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Concentrated Solar Power as a chance for development?

A comparative empirical analysis of capacity aspects in the planning of CSP projects contributing to the sustainable human development of less developed countries in North Africa and the Middle East – the cases of the Desertec Network and CSP in Egypt

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Abstract

The production of fossil fuel based energy production will come to end in the future, but energy demand will continue to rise. In order to secure the energy needs of Europe in the future, sophisticated plans for Super Grids have been laid out. Recent socio-political upheaval in North Africa and the Middle East has increased pressure for Europe to provide support and revise existing neighbourhood policy. In this context the idea of an African-European energy partnership based on CSP projects in the Sahara has been taken up. The idea has been discussed for some years in initiatives such as Transgreen and Desertec and institutions such as the World Bank and the African Development Bank. Due to its particularly technical nature there is a lack of research on associated social issues. In order to pave the way for future implementation of this project, research on the basement of sustainable and human development is essential. This research sets out to analyse the elements that contribute to target countries capacity to maximize sustainable human development benefits. In order to obtain these results the capacity elements such as knowledge and technology transfer and domestic stakeholder involvement are researched in two cases. On the global level the elements will be examined in the context of the Desertec initiative and on the local level the existing CSP project context in the country of Egypt are researched.

"Our challenge is transformation. We need a global clean energy revolution – a revolution that makes energy available and affordable for all." (Ban Ki-moon, 2011)

Table of contents

Annex

List of Abbreviations

CSP – Concentrated Solar Power

CSR – Corporate Social Responsibility

Dii – Desertec Industrial Initiative

DLR – German Aerospace Centre (Deutsches Zentrum für Luft- und Raumfahrt)

IP – Intellectual property

ISCC – Integrated Solar Combined Cycle Power Plant

MENA – Middle East and North Africa

MENA CSP IP – Middle East and North African Concentrated Solar Power Investment Plan

NREA – New and Renewable energy authority

Chapter 1: Introduction

In the context of the EU emergency summit on Libya on the 11.03.2011, High Representative of Foreign Affairs and Security Policy, Catherine Ashton, presented a strategy paper (EU, 2011) on a "partnership for democracy and shared prosperity with the southern Mediterranean" (COM(2011)200) in which, amongst others, institution building for democracy, support of inclusive economic development and the establishment of EU-South Mediterranean Energy Community were proposed. Together with Štefan Füle, Commissioner for Enlargement and Neighbourhood Policy, she suggests: "There is clear potential for building an EU-Mediterranean partnership in the production and management of renewables, in particular solar and wind energy, and in having a joined-up approach to ensuring energy security. Joint renewable energy investments in the Southern Mediterranean in line with the EU's 2050 decarbonisation scenario could offer the possibility of a new partnership provided that the right market perspective is created for electricity imports." (Ibid. 9f.). This proposed cooperation is hinting at large scale solar energy production from the Sahara deserts to secure future European Energy demands.

One proposed concept to tackle several of these issues at once is the concept of "solar energy from the Sahara desert". It proposes the large scale application of renewable energy power generation facilities, in particular of concentrated solar power (CSP), in the desert areas of North Africa and the Middle East, to cover domestic demands, freshwater production through desalination and partially to cover the European energy demand. This concept is the core of the Desertec concept as well as of the MENA CSP Investment Plan (Also Scale up Plan) of the World Bank. Whereas the first is pursued by three entities to promote the concept among European and MENA market parties, societies and political decision makers, the latter sets out to establish concrete CSP projects in the MENA region through financing and assistance.

The setting around the concept and the variety of initiatives addressing it is highly complex due to the large range of issues that are included and affiliated. This thesis sets out to research the opportunities and limitations of capacity aspects (existing and required) to achieve the realization of the concept. The following first part will give an introduction into sustainability challenges in the MENA region and Europe. The successional part will give an overview about the concept "solar energy from the Sahara desert" and will describe the initiatives and programs that consider themselves with the concept or parts of the concept.

1.1 Problem description

As already mentioned above, the core idea of producing CSP based energy in the Sahara for the European export is entailed in several plans. One of them is the Desertec concept. The German-based Desertec Foundation has been officially established in January 2009, but its predecessors date back to 2003. This makes the initiative the most experienced of its kind. Since its formation, it has been successfully engaged in public relations, agenda setting and lobbying for the Desertec concept. This in turn created a wide public discourse, a considerable amount of scientific literature discussing aspects, criticisms and prospects of the concept and a certain degree of public awareness. In his research on the development impact of the Desertec concept Erdle (2010: 4) states: "[…] *almost everything related to DESERTEC is still a matter of debate*". He explicitly refers to questions of feasibility, implementation, participation, calculation of costs, financing and investment, regions of deployment, technology choices, targeted energy mix, beneficiaries and distribution of benefits and profits. This holds not only true for the Desertec concept but for the idea in general. Whereas efforts have been made in particular towards technical and administrative questions, questions of participation, regions of deployment, beneficiaries and distribution of benefits and profits have been largely excluded. This is only partly to be explained with the requirement of having to elaborate these questions for each individual target country.

It is clear that in order for this concept to work and to project sustainable energy collaboration between Europe and MENA, the benefits have to be clear and balanced. Because most of the MENA countries are classified as developing countries, by both IMF and UNDP, this project touches upon the tension between three concepts of development. In development studies the neo-liberal paradigm of development (1) through economic growth has been replaced by a more holistic approach of human development based on Amartya Sen´s capability approach (2) and the reconcilable notion of sustainable development (3) based on the triple bottom line. In human development increased income is not anymore an end but a means to enlarging peoples choices by building human capabilities, "[…] the range of things people can do or be in life" (UNDP, 2011). Here development is measured in three dimensions: Health, Education and Living standard as opposed to only GDP. This is compatible with the concept of sustainable development, in which the core aspects economic security, ecological integrity and social equity set the underlying aim of the development process. This shift towards a new set of objectives in

development thinking effectively breaks with traditional dichotomy of economic and social development in development planning.

If Ashton and Füle suggest the promotion of inclusive economic development, a South Mediterranean – European energy partnership and a key focus on education to modernize national economies in one strategy paper, whereas before "[…] the EU's energy policy vis-à-vis its southern neighbours has so far been focused on two main issues: on the *approximation of the regulatory frameworks*, and on the *inter-connection of the physical infrastructure*." (Erdle, 2010: 16), it appears that, where the European energy policy focused strongly on disintegrated subfields, now they are committed to tackle the big issue of European policy incoherence on the meta level of policy planning. "In fact, no common view exists among EU policy makers with regard to the *interrelation between energy, governance, development, and security."* (Ibid.) It is exemplary for the issue of two competing development paradigms and the general disintegration of economic and social development efforts. This is required to change for future planning. In other words, the planning will have to adhere to the objectives of human and sustainable development.

When taking up the critique on the former European approach as overly technical and somewhat apolitical (cf. Ibid) (for further discussion see Burke, Echagüe & Youngs, 2008), this holds just as true for the Desertec initiative. Not only the appointment of Tunisian dictator Zine El Abidine Ben Ali as patron of the Desertec University network on the occasion of its foundation in October 2010, three months before he had to flee the country due to mass protests, point to the reserved and alienated perspective the initiative holds towards social and political realities in the region. Also the Desertec foundation declares development cooperation along with environment and climate protection as the foundations purpose in their statutes (Desertec, 2009: 2), there is very little activity towards this aspect to observe.

According to the human development paradigm energy production from Sahara deserts could not only rely on predicted benefits from future export revenues to achieve development impacts in the region, but it has to be combined with bigger, country specific tailored, strategies. By applying the concept of capacity to generate sustainable development results, this study sets out to tackle the research problem of the unknown dimension of factors related to CSP projects that develop and enhance national capacities and thereby create positive contribution to the widening of choices for the people of the MENA region. In order to establish a successful energy partnership between Europe and MENA a common vision of the project has to be created, with a clear outline of anticipated benefits for the nations involved. This becomes particularly clear in the

statement by Walid Deghaili, Chief of the Energy Section at the United Nations Economic and Social Commission for Western Asia, on the Occasion of the Webinar: "How will Solar survive in MENA?" on 06.04.2011 "The North shall not regard the South as only a market place. The South does not accept to be treated as a client and a market place only". Given the dominant position of Northern representatives in planning processes up to now, it is necessary to explore demands and opportunities in the South.

1.2 Knowledge gap

After reviewing existing literature on the topic, it became clear that the research field itself is fairly young and allows therefore contributing with new insights.

From a more theoretical angle the issue has been extensively researched from a natural science-based and feasibility perspective. The German Aerospace Centre (DLR) has laid out in three studies technical research for large scale CSP application in the MENA region. MED-CSP assessed the existing energy and water supply structures and projected demand and need scenarios and their provision through CSP (DLR, 2005). Aqua-CSP evaluated the current and projected water scarcity for the region and the potential of CSP for large scale seawater desalination to cover demand (DLR, 2007). Finally TRANS-CSP appraised renewable energy potentials of the EUMENA region under consideration of power on demand provision, energy imports from the South and grid infrastructure (DLR, 2006). The lead authors of the DLR reports have further published a range of scientific articles examining natural resource abundance, assessing different CSP technology options and arguing for their application in order to secure a sustainable energy and water provision to the EUMENA region for coming decades (Trieb & Mueller-Steinhagen, 2007; Vallentin & Viebahn, 2009; Trieb et al., 2009; Lechon et al., 2010). The same line of reasoning is followed in the reports issued by Greenpeace and Estela (Teske et al, 2005; Richter et al, 2008) and by the European Academies Science Advisory Council (EASAC, 2011), both comprising moreover an outlook on market price development and preconditions for an industry scale up.

Another range of articles discusses dimensions of international relations, security issues and risk perception. Focussing on the institutional frameworks in the Middle East, Mason describes window of opportunity to enhance security through regional cooperation in renewable energy (Mason et al, 2009). Taking on the European perspective several authors have assessed the security risks and their perception arising from changing energy

import dependencies from conventional resources to renewable (solar) resources (Lilliestam & Ellenbeck, 2011; Komendantova et al, 2009, Patt, 2010). Similar approaches are taken on with the distinct focus on the impacts of supersmart grids (Battaglini et al., 2008; Battaglini et al., 2009). This issue field overlaps largely with the field of emerging policy challenges (Patt et al., 2011), including the question of financing CSP.

The problem of how to compose viable financing schemes and mechanisms for CSP technology, in order to make it competitive with energy from other renewable and conventional sources has been researched. Main issues here are the evaluation of §9 of the EU energy directive, feed-in tariffs, subsidies for CSP and fossil fuels and tendering schemes such as Build-Own-Operate (BOO) and Engineering-Procurement-Construction (EPC) contracts (Williges et al, 2010; Müller-Steinhagen et al., 2010; ATKearney, 2010). This is directly linked to public administration, permitting process.

Another important field of scientific research considers the potential benefit creation in the dimension of socio-economic research. It ranges from local manufacturing potentials, value chain examination and potential job creation (World Bank, 2010; ATKearney, 2010; PWC, 2010) over critical assessment of development effects (Erdle, 2010; Schüssler, 2008; Werenfels & Westfal, 2009) to strategic assessments of sustainability criteria and the impact on livelihoods, human rights access and sustainable human development (Klawitter, 2010; Klawitter & Schinke, 2010). Regarding the social dimension the PricewaterhouseCoopers report (PWC, 2010: 71) states: “Thus, it is by no means clear-cut whether European efforts to obtain renewable power from North Africa would bring sustainable development.” In a recommendation for further research, it suggests: “To what extent do local stakeholders - not just the government but also a wider range of civil society - have a role in determining the project’s design, placement and operation? It is essential for new projects not to come at the cost of disempowering local people and groups.” (Ibid.). Moreover Klawitter (2010) concludes that experts fear that there could be a lack of participatory processes for local populations (cf.:87) and that the urge for stakeholder involvement from the south is not an “if” but a “must” (cf.:88).

It must be noted that those above mentioned publications have been prepared before the Arab Spring. The implied processes such as inclusion, accountability, transparency and participation bear a somewhat normative notion related to the concept of deliberative democracy. Considering the recent evidence of collective action for political change in the MENA region, these factors gain even more importance in practice just as much as key issues for the concept “solar energy from the Sahara desert”. Hence there is a

need for civil society inclusion and the evaluation of national capacities since they are prerequisite for successful future planning in potentially unfolding forms of democracy in MENA. Moreover the assessment of the development consequences of the Desertec concept in order to explore possible contribution from German development cooperation agencies (Erdle, 2010) shows that it will be necessary to examine each individual national context in depth, since the states differ substantially in socio-economic development and preconditions, and cultural and political heritage and traditions.

Whereas the benefits for European energy security and the European solar energy economy have been discussed in detail, there is a gap of knowledge in elaborate research on the socio-economic benefits for the target countries, required capacities and their development process. In particular in regards to a desired human development impact there is a need for further research, because "[w]ithout addressing the concept's human development dimension, it is likely to offer – next to climate benefits – only a few trickle-down effects and instead bears a high risk to generate numerous adverse impacts particularly on the most vulnerable groups of society" (Schinke & Klawitter, 2010: 6). It is clear that the conditions and settings differ amongst the national and institutional contexts. The scientific knowledge gap presents itself in the exploration of capacities that increase sustainable human development in the target countries.

1.3 Research objective

The research objective of this study will be an assessment of the capacity aspects that contribute to the capacity of the MENA countries to maximize their development benefits in terms of sustainable human development. This conceptualization is chosen because it is consistent with the paradigms of sustainable development and human development. Only if the opportunities and limitations of CSP projects for country specific development will be assessed they can be included in an overall project vision.

The capacity to maximize development benefits exists on three interrelated levels. The enabling environment displays the broader systems context. "Capacities at this level include the policies, legislation, power relations and social norms, all of which govern the mandates, priorities, modes of operation and civic engagement across different parts of society. (UNDP, 2008: 6). This level is also referred to as the "rules of the game". The organisational level represents the level on which frameworks, procedures and policies allow individual capacities to connect and relate. The individual level capacity is found in

the form of skills, experience and knowledge (cf. Ibid.). These three levels are a theoretical construct through which this study examines the possible benefits achievable through CSP projects. From preliminary research the following capacity aspects could be deducted: domestic markets, local supply chains, technology transfer and knowledge transfer, domestic interest, development goals and domestic stakeholder involvement (cf. Erdle, 2010; Klawitter, 2010; World Bank 2010). These aspects are discussed as foundational to the establishment of benefits for the target countries in the context of CSP projects.

The research objective is to elaborate a comprehensive set of these capacity aspects that configurate the regions capacity to maximize sustainable human development benefits from CSP projects by analysing their framing and congruence in two cases, one on the global and one on the local level. This research seeks to generate knowledge on the development process for CSP projects and aims at providing viable input for policy makers and planners. It is a practice-oriented research with a focus on the problem finding stage, by assessing the framing of the hypothetical benefits, the issue becomes more transparent and can be discussed in detail.

1.4 Research question and sub questions

According to the research objective stated above the following research question will be answered in this thesis:

How can sustainable human development be maximized through CSP projects in the Sahara desert?

In order to answer the given, main, research question the following sub questions have been established:

- *Which capacity aspects contribute to the target countries capacity to maximize sustainable human development benefits from CSP projects?*

- *Which capacity aspects constrain the target countries sustainable human development benefit from CSP projects?*

- *How are these aspects framed within a global context and within a local context?*

- *What can we learn from the comparison of the results of analysis of the global and the local level perspectives on these capacity aspects?*

1.5 Societal and Scientific Relevance

The transition from fossil fuel based energy production to renewable based energy production to transit to a decarbonised world economy is of utmost importance in the face of global climate change. Moreover European economy will, due to its predicted rising energy demand, have to reach out to embrace alternative approaches to secure future energy supply.

In order to prepare the facilitation of an African-European energy partnership based on CSP technology it is essential to apply a state of the art scientific framework which will assist the project to avoid well-known pitfalls, such as exclusive planning processes and unidirectional profit distribution.

The transition to a carbon emission free energy production and the according outreach by European and African countries to establish collaboration in the field of solar energy is a relevant issue field to environmental policy and management. This holds true in particular in context of the interdisciplinary focus of the Master programme sustainable development studied at Utrecht University. The elaboration of an interdisciplinary scientific framework for the African-European energy partnership is moreover important in the context of the research program governance for sustainable development at Utrecht University. The interaction of public and private entities requires a unique governance system, which is just about to take form. The planning and implementation of such a project, presents a challenge to interdisciplinary research, due to its complex structure. In particular the development context displays a unique opportunity towards a large scale example of leap frogging for sustainable development.

The purpose of this research is to extend the knowledge base on the social dimension of the idea to produce renewable energy in the Sahara desert for Europe and MENA and if possible to make recommendation based on the established findings to contribute to a code for best practice or a set of sustainability criteria for individual projects.

1.6 Guiding outline

Provided that a thematic access into the research is already given in this first chapter the overall thesis consists of a total of 7 chapters. It starts out in the second chapter by elaborating on the field background and inviting the reader into the contextual setting of the research. It describes the challenges which both regions, MENA and EU will be facing in the next decades. It then proceeds by describing the proposed concept of solar energy production in the Sahara desert, the initiatives that promote the concept and concludes with a discussion on the chosen technology focus of Concentrating Solar Energy (CSP). The third chapter in turn will provide an overview and detailed description of the theoretical concepts applied, followed by research framework and completed by a display of the research strategy and the subsequently elaborated methodological framework. The fourth chapter will present the analysis of the two chosen case studies: the Desertec Network and the case of Egypt, the findings of the second step of analysis: the comprehensive case study analysis will be displayed in chapter 6. The last chapter will summarize the conclusions, give an outlook on further research questions and establish recommendations drawn from the results of analysis.

Chapter 2: Field background information

In order to allow for a better thematic access to this research, this chapter sets out to describe the setting in which the research is embedded and based on. The intrinsic complexity of the context surrounding the vision of "solar energy from the Saharan desert" requires a wider approximation which will be given in this chapter on field background information.

2.1 The MENA region and the European Union: sustainability challenges

The construct "MENA region" describes interconnected regions of North Africa and the Middle East. Whereas there is not one distinct definition but varying ideas as to what countries are comprised by this construct. The main definitions referred to in the context of this research are the World Bank definition[1] and the definition used by the German aerospace centre (DLR)[2]. Main differences in definitions derive from the inclusion of Mediterranean members of the European Union such as Malta, Cyprus, Portugal, Greece and Spain and the inclusion of Sudan in the North African region. Another term which is sometimes used synonymously is the term Arab World, whereas this additionally comprises Somalia, Djibouti, the Comoros, Mauritania and excludes Israel.

The regions population is predicted to grow from currently around 450 million in the next 40 years to around 700 million by 2050 (see Table 1). The demographic structure is characterized by a distinct youth bulge that results from a significant decline in child mortality and a slow decline in the fertility rate, which led to a high birth rate in the 1980s and a drop in the 1990s (PRB, 2007: 15). Hence the youth bulge describes the cohort of young people born in the 1980s and early 1990s and comprised in 2007 around 30% of the overall MENA population (La Cava, 2010: 1). One of the main challenges the markets in the region are currently facing is the absence of employment opportunities for this age cohort, which is moreover marked by high levels of education. This leads on the one hand to the highest youth unemployment rate of 25% for any world region (compared to 14%

[1] The World Bank defines MENA as describing: Algeria, Bahrain, Djibouti, Egypt, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Libya, Malta, Morocco, Oman, Qatar, Saudi Arabia, Syria, Tunisia, United Arab Emirates, West Bank and Gaza, Yemen (World Bank, 2011)
[2] DLR defines MENA as describing: DLR: Algeria, Tunisia, Morocco, Israel, Jordan, Turkey, Iraq, Iran, United Arab Emirates, Oman, Egypt, Lebanon, Saudi-Arabia, Kuwait, Bahrain, Qatar, Syria, Libya, Yemen (DLR, 2005)

global) (cf. Ibid.) and on the other hand it consequently leads to high outmigration flows[3] that result in brain drain, attenuate deterioration of European population structure, but pose a severe risk to the future population structure of MENA.

	Total Population (in thousand)			
Country and Region	**1950**	**2010**	**2030***	**2050***
Middle East and North Africa (MENA)	**103886**	**454109**	**594442**	**692301**
MENA - Western Asia	**51451**	**226456**	**290252**	**332083**
Iran	16913	74276	91155	100174
Iraq	5340	30688	47376	61942
Israel	1258	7272	9160	10527
Jordan	472	6453	8554	10121
Lebanon	1443	4227	4925	5221
Palestinian Territory	1005	4409	7320	10265
Syria	3536	21428	29294	34887
Turkey	21484	77703	92468	98946
Arab Peninsula	**8336**	**63118**	**95159**	**123945**
Bahrain	116	792	1025	1173
Kuwait	152	3051	4273	5240
Oman	456	2767	3865	4639
Qatar	25	885	1161	1333
Saudi Arabia	3201	26416	37314	45030
United Arab Emirates	70	4732	6753	8521
Yemen	4316	24475	40768	58009
Northern Africa	**44099**	**164535**	**209031**	**236273**
Algeria	8753	35423	44726	49610
Egypt	21834	79537	104070	121219
Morocco	8953	32381	39259	42583
Lybia	1029	6530	8447	9683
Tunisia	3530	10664	12529	13178

Table 1 **MENA population** – (data retrieved from http://esa.un.org/unup/; last accessed 25.09.2011) *= estimated

Other severe challenges derive from an expected urban population increase by 65% opposed to an expected rural population increase of 8,5%, whereas 25% of the regions urban population will be concentrated in Cairo, Teheran and Baghdad (Bjerde, 2008). This is projected to lead to an increase in informal housing between 20 - 40% in different areas of the region (cf. Ibid.). These different factors will ultimately lead to increased social and environmental pressures, such as an increased need for physical and economic infrastructure, societal development perspectives and equitable access to basic provisions such as housing and food that need to be addressed in planning efforts.

With increased shares of population seeking higher living standards, the demand for energy and water is also on the rise. The energy demand of the whole MENA region is predicted by DLR to reach around 1700 TWh/a by 2025 and rise up to 3600 TWh/a

[3] 4,5% in 2000, which is a total of 15 million migrants (Marchiori & Docquier, 2010: 5)

(Alnaser et al., 2007: 261). Around 98,3% (World Development Indicators, 2011) of the total energy consumption in the region relies on fossil fuels which will become increasingly scarce within this century. Not only the energy consumption relies heavily on fossil fuels, but also economy and society, either through direct production or remittances of expatriate workers in neighbouring industries. This leads to, what the Arab Human Development Report of 2003 describes as: an "[…] overwhelming dependence on the extraction of raw materials, chiefly oil, in what are often referred to as `rentier´ economies […]" namely Libya, Iraq, Algeria, Egypt, Syria, Sudan and Yemen (UNDP, 2003: 134). A `rentier´ economy is defined by being substantially dependent on rent, that is external to the economy, directly connected to rent-seeking economic behaviour[4] and generated by a small group of society (Yates, 1996: 13). It also leads to high levels of public sector employment, weak taxation systems[5], state largesse public service and subsidy provision and certain autonomy of governments from their societies and subsequent accountability to them (cf. UNIDO, 2008: 298; Spiess, 2008: 247). In literature this was often used to explain "the quasi absence of civil society" (cf. Spiess, 2008: 249). The situation and mandate of civil society and activism in the MENA region has been unclear and debated[6] before the Arab spring and finds itself currently under increased scientific scrutiny.

The water deficit of the region is predicted to grow from 60 billion m^3/y up to 150 billion m^3/y by 2050, which is the most severe water scarcity in the world. This water in turn is sourced from a region where 4/5 of its members are already drawing water below the sustainability threshold of 1000 m^3/p/a (see Table 2), with large impact on groundwater capacities. The water-energy nexus (Siddiqi & Diaz Anadon, 2011) additionally reinforces the interdependencies of both goods and contributes to the decrease of natural resources, the increase in the price for provision and poses significant stress on the natural and social environment.

[4] Rent-seeking was defined by Gordon Tullock in 1974 and describes the pursuit of an economic income (as opposed to A. Smiths wage and profit) generated through low involvement of labour and least risk – for further reading: Tullock (2005)
[5] Taxes account for 17% of GDP in non-oil Arab countries and 5% in oil rich Arab countries
[6] There is no consensual definition on what Arab civil society organisations entail, this is not only a linguistic problem, but mainly a socio-cultural problem pertaining traditional societal structures, religious affiliations (cf. Yom, 2005: 14) and also the need for differentiation between diverse national contexts.

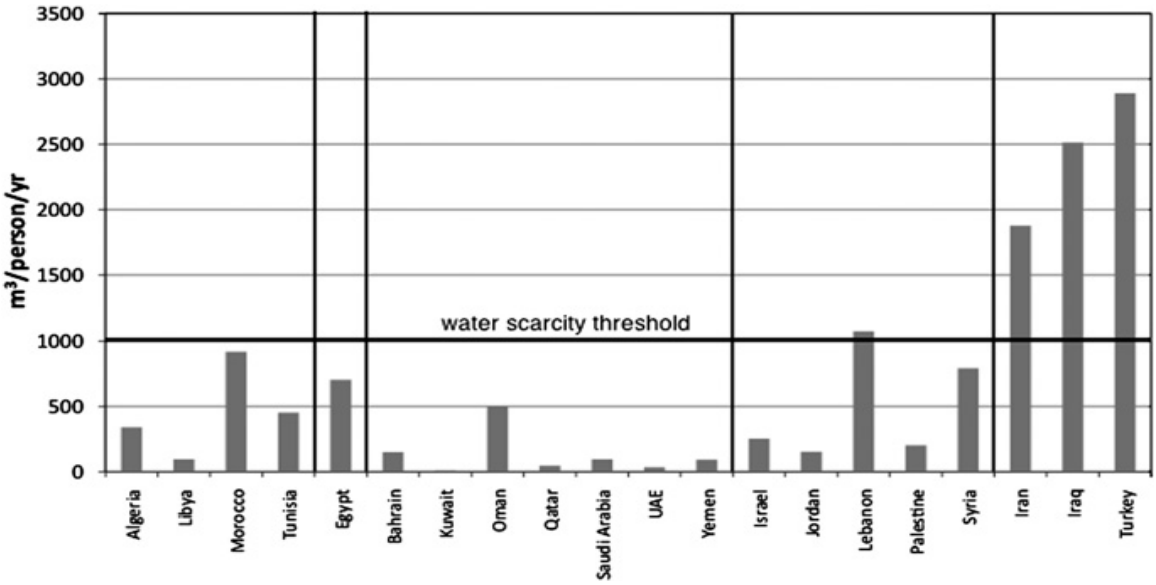

Table 2 **Annual per capita renewable freshwater availability (as of 2010) by MENA countries** (Siddiqi & Diaz Anadon, 2011: 4532)

In terms of human development the region has experienced some improvement in particular the low income countries in the region have increased their Human Development Index (HDI) since the early 1990's twice as fast as their index of GDP per capita (cf. Salehi-Isfahani, 2010:8). The latest UNDP Arab Human Development Report bears the title "Mapping of climate change threats and human development impacts in the Arab region" (cf. Osman Elasha, 2010) and it describes exemplary the extreme climate related vulnerability of the MENA region The Middle East and North Africa (MENA) is considered one of the most vulnerable regions to climate change impacts, on account of its water scarcity (the highest in the world).

On the other side the situation in Europe is much less tense. The current European power demand is around 3000 TWh/a and it is predicted to rise around 400 TWh/a by 2050 due to an increased electricity use for electro mobility (PWC, 2010: 15). This energy production is by 78,7% based on fossil fuel combustion, by 14% on nuclear energy production, by 7,2% on renewable energy sources (Eurostat, 2009: 29). Moreover net energy imports led the group of the EU27 to be energy dependent in their demand by 53,8% (EEP, 2011). So in order for the European Union to achieve their 20/20/20 RES target of 20% CO2 emissions reduction, 20% energy consumption reduction and the realization of sourcing 20% of the European energy needs from renewable sources by 2020 and a desirable higher reduction beyond the date, it is necessary to look for viable options to fuel a low or zero carbon economy for Europe. The possibility to source this potential from the MENA region through CSP plants is given through §9 of the

Renewable Energy Source (RES) Directive 2009/28, on "Joint projects between Member States and third countries". The directive explicitly encourages the member states to collaborate with third party countries on the production of renewable energy in order to reach their own 2020 targets, moreover §9 gives room for every country to decide on their own promotion scheme for renewable energies, which allows for bilateral agreements involving feed-in mechanisms (cf. EC, 2009).

2.2 The vision: "solar energy from the Sahara desert"

The vision of "solar energy from the Sahara desert" describes the core of various policy, research and planning efforts. In its centre stands the realization that renewable energy potentials for solar and wind energy are considerably higher in the Sahara desert region, than in Europe. Rusnok (2004: 289) describes them as 2 – 4 times higher, Knies states that any conceivable energy demand could be covered through solar energy production in the deserts (cf. Desertec (2009) White Book: 19). Trieb and Müller-Steinhagen even suggest that the total economic potential for energy production from concentrated solar energy amounts to 630000 TWh per year[7] (Trieb & Müller-Steinhagen, 2009: 34).

In literature different sources of origin for the concept of "solar energy from the Sahara desert" are cited, one of them can be found in Scheer (2010). He describes that the idea of solar energy production in the Sahara for market provision in Europe is around 60 years old and was first sketched by Marcel Perrot in Algiers (cf. Scheer, 2010:141). Perrot was in 1961 a founding member of the Mediterranean Cooperation for Energy (Coopération Méditerranéenne pour l' énergie - COMPLES), an international association aiming at providing a platform for scientific exchange on solar energy related topics for and with Mediterranean partners. In the following decades the idea has not drawn much public attention. Another source describes the origin of the idea as fairly old but a conceptual framing to be found with in the efforts of the TREC network (Erdle, 2010: 6).

The core of the idea builds upon the aforementioned large potentials for renewable energy production in the deserts in general and projects this upon the geographical setting of Europe, North and Africa and the Middle East. It describes that by means of renewable energy technologies (Wind, PV, CSP, Hydro and to certain extents biomass and geothermal) future energy demands of all regions could be covered with a well organized system of harnessing different local potentials. A focus in the concept has

[7] As opposed to a current world electricity demand of 18000 TWh per year.

been the large-scale application of concentrated solar power, due to its potential to generate baseload power by applying storage solutions and due to its potential for the desalination of water to cover an additional predicted urgent need.

2.3 The initiatives

During the last three years several initiatives were founded in Europe to support the idea of solar energy production in the Sahara desert. The main goals of these efforts aim at securing the future energy supply of Europe and the MENA region (Middle East and North Africa), reducing CO_2 emissions, stabilizing the region and tapping the massive potential of solar radiation in the desert. These shall be achieved by a broad application of Concentrating Solar Power (CSP) technology. The initiatives behind the project are: Union for the Mediterranean with its Mediterranean Solar Plan (MSP) including the French Medgrid initiative, the MENA CSP scale-up Investment Plan (MENA CSP IP) by the Clean Technology Fund (CTF) - supported by the World Bank and the African Development Bank (AfDB), the Global Environment Facility/World Bank Strategy for Market Development of Concentrating Solar Thermal Power and the German Desertec foundation including the Desertec Industrial Initiative (DII). These initiatives may have different foci but they are all involved in pushing forward CSP power generation in the MENA region and thus represent a trend for future energy supply in Europe and MENA. The following sections will give a brief overview on the key initiatives and establishes the wider context of this research.

2.3.1 World Bank MENA CSP IP

Amongst the described initiatives the World Bank MENA CSP scale-up Investment Plan (IP) represents the only initiative that so far supported the construction of actual CSP plants: Kuraymat ISCC, Egypt and Ain Beni Mathar ISCC, Morocco. The investment plan is a cooperative effort between World Bank and African Development Bank endorsed by the Clean Technology Fund (CTF).

On recommendation of the GEF's Scientific and Technical Advisory Panel, in 1996, the cost reduction of high temperature solar thermal power technology became part of the Operational Program 7 (OP 7) aiming at "reducing the long-term costs of low

greenhouse gas-emitting technologies". Under the OP 7 the strategy first set out to support the construction of four Integrated Solar Combined Cycle (ISCC) projects in Egypt (Kuraymat ISCC), Morocco (Ain Beni Mathar ISCC), Mexico (Sonora ISCC) and India (Mathania ISCC) under the umbrella of the WB/GEF solar thermal portfolio. In 2006 the World Bank Global Environmental Facility published an Assessment on its strategy for the market development of concentrating solar thermal power (cf. World Bank, 2006) and states the main objective as the reduction of the price of energy production from high temperature solar thermal technologies[8] for the application in the world's sun belt countries[9] with the eventual goal of reducing greenhouse gas emissions at large (cf. Ibid: 1). The four projects were to make up for around 120 MW solar capacity and comprised an overall commitment from the WB GEF of around $ 200 million (cf. Ibid.: 2). There have been considerable implementation difficulties, which finally resulted in the abandonment of the projects in Mexico and India.

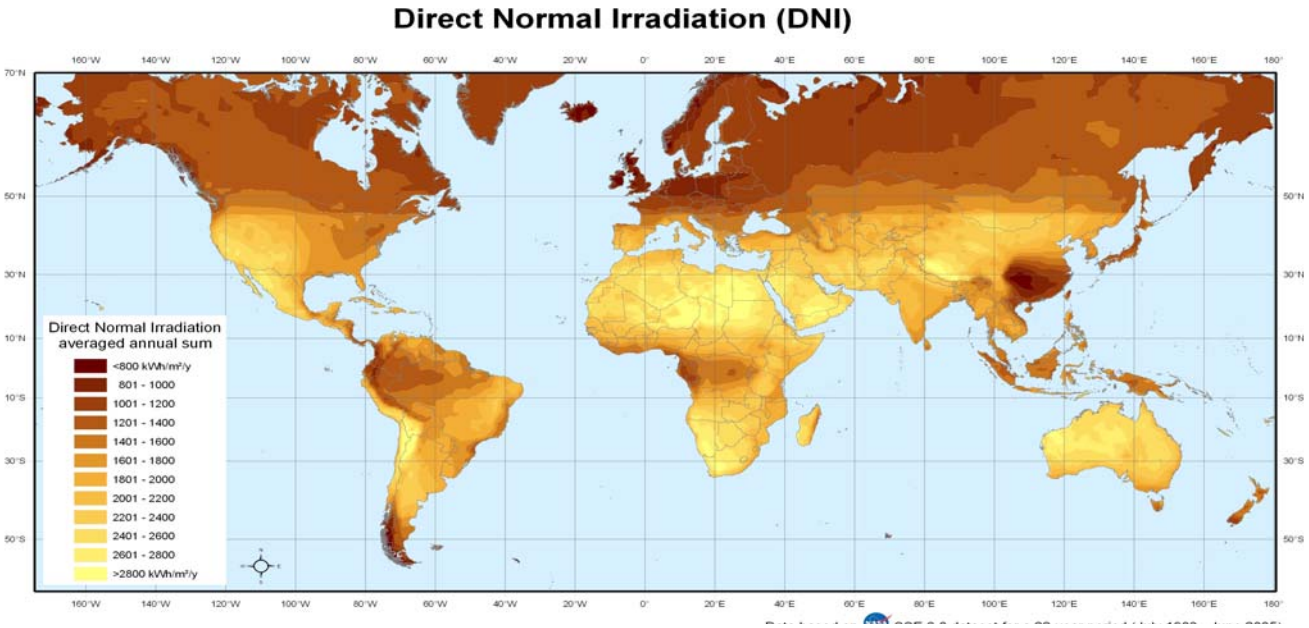

Table 3 **Direct Normal Irradiation**, distribution on world map. July 1983 – June 2005 – NASA SSE 6.0 Dataset (DLR, 2008)

In December 2009 the two remaining projects of the solar thermal portfolio have been subsumed under the newly established MENA CSP IP (ESMAP, 2011: xvii), which has the goal of installing at least 5 GW CSP capacity in the MENA region by 2020. Currently the plan comprises the co-financing of 9 commercial-scale CSP power plant projects, accounting together for around 1,2 GW, that target domestic energy provision as

[8] The concrete target fort the first phase is a levelized energy cost (LEC) of 10-11 US cents/kWh (GEF, 2004: 1)

[9] The Worlds sun belt ranges from the 20th to the 40th line of latitude south and north and is mainly characterized by the occurrence of direct normal radiation (DNI), see Table 3

a first priority. The most recent list entails the following projects[10] (CTF, 2010: 20f) (including projected size and if available the form of contracting to be applied):

Egypt → Kom Ombo (100+ MW)
Algeria → Megahir (80 MW)
→ Naama (70 MW)
→ Hassi R'Me II (70 MW)
Jordan → Ma'an (100 MW - IPP)
Morocco → Quarzazate (500 MW)
→ STEG-CSP (50 MW - EPC)
Tunisia → ELMED-CSP (100+ MW)
→ STEG renouvelables/SITEP (50 MW – IPP)

Apart from those concrete CSP power plant projects the Investment Plan also targets the issue of suitable energy distribution conditions with the Mashreq CSP transmission and Tunisia-Italia transmission projects.

2.3.2 CSP GMI

The Global Market Initiative for Concentrating Solar Power was registered 2002 in Johannesburg as a UNEP Market Facilitation WSSD Type II-Partnership for Concentrating Solar Energy Technologies. As a joint effort of UNEP, GEF, German federal Ministry for the Environment (BMU), the KfW group (Reconstruction Credit Institute), the European Solar Thermal Power Industry Association (ESTIA) and the American Solar Industries Association the initiative set out to tackle the issue of decreasing the market price for CSP in order to be able to make wider use of the technology. The main objective is "[…] to facilitate and expedite the building of 5000 MWe of CSP worldwide over the next ten years." (GMI, 2004a). The initiative is based on the Palms Springs Protocol for a Concentrating Solar Power Global Market Initiative and defines three regions for the collaborative effort. Region I embraces the southwest of the US, southern Europe and Israel, Region II entails Algeria, Morocco and Mexico and Region III covers Brazil, Egypt, India, Iran, Jordan, Yemen and South Africa. In order to reach the objective, the initiative aims at assisting and establishing in terms of policy frameworks, financing schemes and connecting the different member countries in their

[10] a complete overview on numbers of CSP projects in the MENA region see footnote 22

effort. The aforementioned protocol states amongst others the ambitious expectations towards the effects of CSP technology at the expected cost: “CSP addresses many of the Worlds most pressing issues, such as economic development, energy security, energy independence, rural grid expansion, socialization, air and water quality and long-term price stability.” (GMI, 2004b: 14). Moreover the initiative set out to ensure that all member countries will meet the Kyoto goals through the combined effort in the activities and the pursuit of the 5000 MWe target. The Initiative has been laid off in 2004 due to lack of financial resources.

2.3.3 The Mediterranean Solar Plan

The Mediterranean Solar Plan is one of six concrete projects of the Union for the Mediterranean (UfM), which was found in 2008 in the context of the European Neighbourhood Policy (ENP) to make the effort more tangible and visible. In the framework of the Euro-Mediterranean partnership, directly integrated in the Euro-Mediterranean Energy Partnership, the UfM represents a multilateral partnership between 43 countries including the EU 27, countries from MENA and the Balkans. The Euro-Mediterranean partnership is the result of the Bologna Process and was launched 1995 in Barcelona.

The UfM is largely financed through the European Neighbourhood and Partnership Instrument of the European Commission and receives additional funding for individual projects from the European Investment Bank (EIB) and the InfraMED Infrastructure Fund. The initiative of the Mediterranean Solar Plan is closely connected with the following regional and sub-regional projects of the European Union: MED-EMIP, MED-ENEC, MEDREG, FEMIP and others. The Euro-Mediterranean Energy Market Integration Project (MED-EMIP) is considered with support for enhanced integration and the improved security of the energy market of the countries neighbouring the Mediterranean Sea and it pursues this mandate by providing a platform for dialogue and knowledge transfer, and stimulating developing markets towards green technologies and management solutions. The project on energy efficiency in the construction sector (MED-ENEC) is focussed on awareness raising, providing information on climate-oriented building and construction and pursues concrete undertakings in the partner countries. After MED-ENEC I has been concluded successfully (2005 -2009), a second round: MED-ENEC II was launched to perpetuate the project. The same holds for the

Association of Mediterranean Regulators for Electricity and Gas, which was established by the EU-project MEDREG I and continued with MEDREG II. Another important project that supports the Mediterranean Solar Plan is the Facility for Euro-Mediterranean Investment and Partnership (FEMIP) which is concerned with the promotion of sustainable economic growth in the partner countries through the particular stimulation of private sector and infrastructure investments (cf. EMIP, 2011).

The Mediterranean Solar Plan (MSP) aims at installing 20 GW of solar energy production capacity by 2020 and achieving significant energy savings through energy efficiency measures (ENPI, 2010: 1). It is stated that the MSP aims at meeting the major climate and energy challenges of both regions. The strategy paper (MSP, 2010) describes as an intermediate target, on the way to the above mentioned complementary goals, the creation of favourable framework conditions. This is to include regulatory frameworks, technology and knowledge transfer and the enhancement electricity infrastructure (cf. Ibid.). Based on the strategy paper two implementation phases were set up. The first is the Action Plan 2010-2011, aiming at identifying a first set of projects and executing detailed research on the situation of the electricity interconnection. The second is the deployment phase 2011-2020 which is supposed to enact a Master Plan that will be elaborated within the timeframe of the Action Plan and is to be presented by the end of 2011.

2.3.4 Trec and Desertec

With growing public awareness of global climate change and energy security at risk due to impending “peak oil”, it finally has been taken up again in 2003 by the Trans-Mediterranean Renewable Energy Cooperation (TREC) for development, climate stabilisation and good neighbourhood. TREC was found in October 2003 by the German Association for the Club of Rome and the Hamburg Climate Protection Foundation under involvement of the Jordan Centre for Energy Research. The key publication of the initiative was prepared as a paper for the “Arab thought forum and Club of Rome” in Amman 2003. The TREC concept was planned to be elaborated in a master plan for its implementation which was supposed to be presented at the 2004 International Conference on Renewable Energies in Bonn. The development of the concept developed by the TREC network really gained momentum in the last 6 years when the German Aerospace Centre (DLR) took on the idea and conducted, commissioned by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, three interrelated

studies. The first study, MED-CSP (DLR, 2005), was concentrated on demand evaluation and resource availability, the second study, TRANS-CSP (DLR, 2006), researched the requirements for an integrated grid between Europe and MENA and finally the third study, AQUA-CSP (DLR, 2007), examined the threat of water scarcity in MENA and the possibility of generating fresh water through desalination.

On the foundation of these three detailed studies, in 2009 the DESERTEC foundation was created. A distinct group of scientists and engineers gathered to push forward their vision of renewable energy production in the desert, or rather on the surrounding steppes and woodlands and in the coastal areas. In 2009 the foundation released two key publications that describe the position of the Desertec Foundation, the RedPaper (Desertec, 2009a) and the WhiteBook (Desertec, 2009b). The project dimensions are unique, on the basis of an interconnected electricity grid renewable energy, mostly from wind and concentrated solar energy facilities, shall be provided to MENA and EU (see Table 5) In order to satisfy up to 2050 around 15% of Europe's demand, an estimated 400 billion € investment is necessary (cf. Trieb & Mueller-Steinhagen, 2007; Vallentin & Viebahn, 2009).

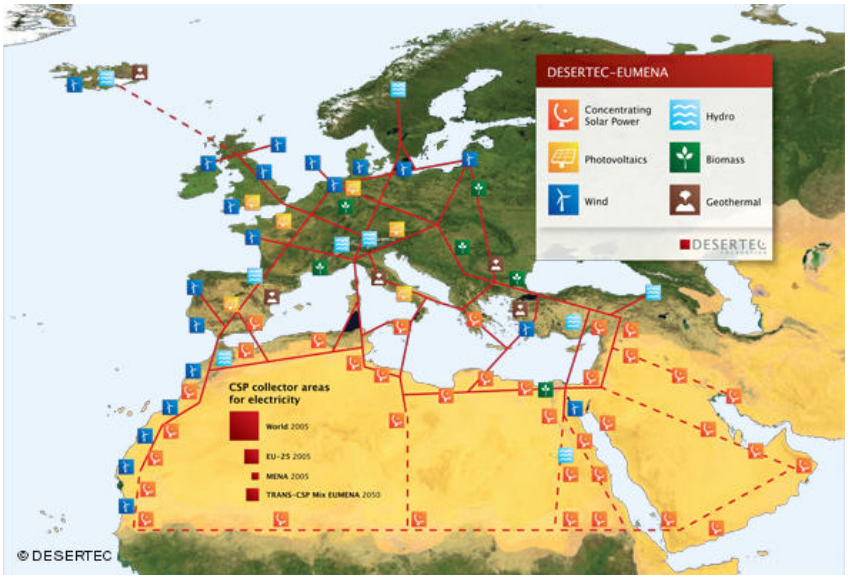

Table 4 **The Desertec Concept** (Desertec, 2008)

The Desertec foundation is a non-profit organisation and has been the sole promoter for its concept for some time. Nowadays it is embedded in a network with the Desertec Industrial Initiative GmbH, which was found in 2009 by several European countries and the foundation, and the Desertec University Network, which was found in 2010 and represents Universities from Europe and the MENA region. The Desertec

Industrial Initiative (DII) is a private sector partnership, which is committed "[…] to developing the markets for large-scale sustainable energy production and transmission." (Dii, 2010). The Desertec University Network (DUN) was established to facilitate transnational research and widen acceptance in academia. "From our intense contacts with activists and experts in the desert countries we have learnt that the local education of qualified specialists is a critical success factor for the implementation and the acceptance of our DESERTEC Concept." (Desertec, 03.11.2010).

2.4 Why Concentrated Solar Power?

The focus of this research evolves around concentrated solar power technology. In order to elaborate why this focus was chosen the following section sets out to give a quick overview on the technology, reason for the chosen research focus and finally give the working definition for this research.

The term concentrating solar power[11] describes an energy conversion technology that bundles direct solar radiation with mirrors and creates heat between 400°C and 1000°C (cf. Richter et al., 2009: 7). This heat is concentrated and directed at an absorber or receiver which in turn allows for powering a conventional gas or steam turbine or a sterling engine to produce electricity. The additional application of a heat storage system[12] extends the original operation phase and can provide up to a 24 hour power generation or a "power on demand mode" (cf. Lechon et al., 2010: 4421). In general there are four types of this technology available: Linear Fresnel, Central Receiver (also Solar Tower), Parabolic Dish and Parabolic Trough (see Table 6). A comparison of the technologies is biased, to date, toward parabolic trough, due to its technological maturity, it dominates in nearly 100% of the existing CSP plant capacity and 75% in the planned projects (cf. Ibid.). There have been various studies on CSP technology and its application in the MENA region, among them are the above mentioned studies of the DLR (DLR, 2005/2006/2007; Lechon et al., 2010; Richter et al., 2009).

[11] Also: Solar Thermal Power (STP), Solar Thermal Energy (STE)
[12] Liquid or solid storage media are molten salts, ceramics, concrete or phase-changing salt mixtures (cf. Richter, 2009: 7)

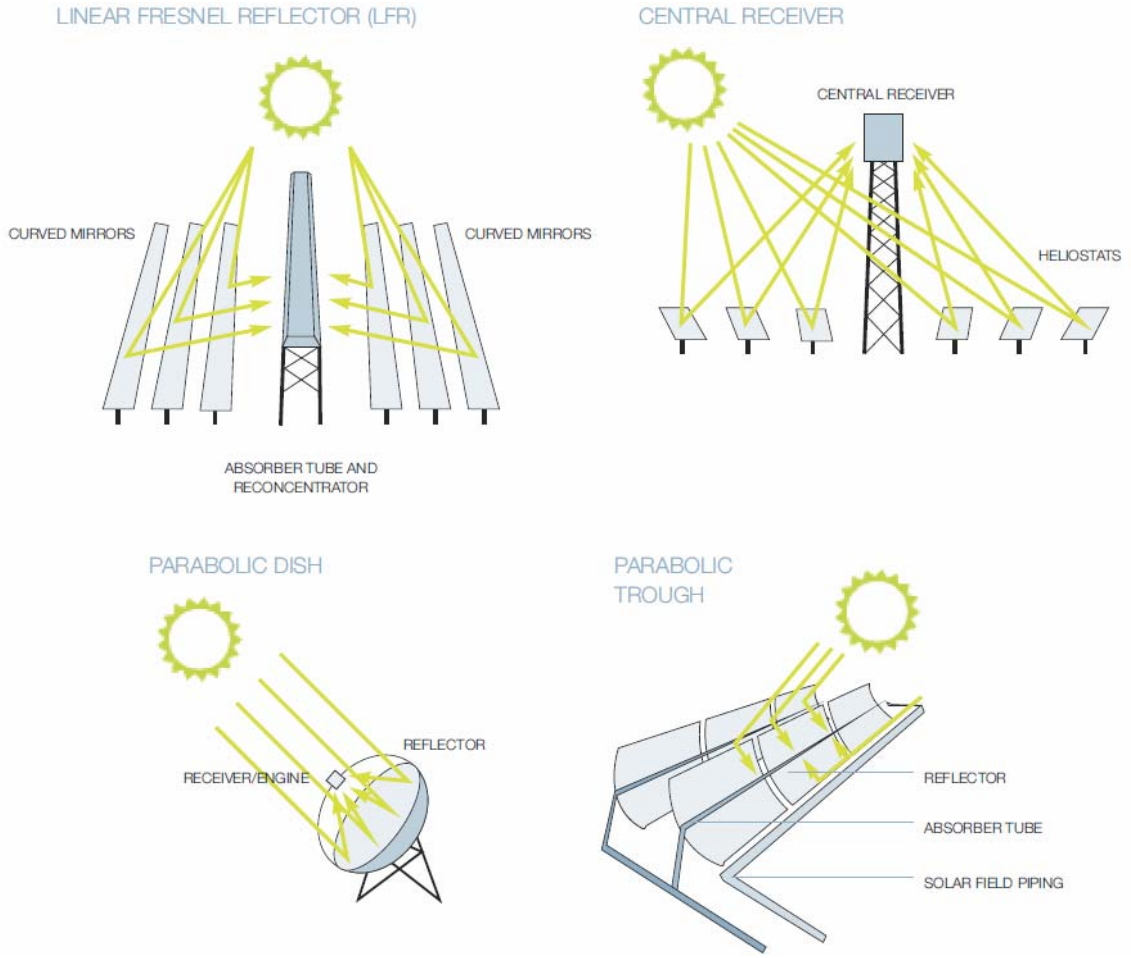

Table 5 **Concentrating Solar Power technologies** (Richter et al., 2009: 18)

While approximating the research topic, it was discovered that in literature arguments can be found for supporting the specific technology choice for CSP just as well as arguments can be found dismissing that very same choice.

There is a range of renewable energy technologies that provide the possibility of generating low carbon electricity through harvesting the renewable natural resources in the MENA region. Regarding the fact that on the grounds of the acceptance of climate change and the inherent responsibility to mitigate or reverse it, the sole choice for renewable energy itself is to a large part a moral decision. The next step, the choice for a specific technology to produce low carbon electricity is mostly based on the research on that technology, evaluated risks, opportunities and limitations. There are diverse ways of transforming an energy system, but most large scale plans have both flaws and advantages. Depending on the criteria applied to such a large scale energy transition, many different options are available.

In order to understand why Concentrated Solar Power has become the focus or part of the focus of the above mentioned initiatives one needs to look at characteristics and the attributed opportunities of the technology. Concentrated Solar Energy is largely attractive as a panacea-like package solution, which can potentially solve climate, energy, water and development problems all at once, with the precondition of a market scale-up. First there is the climate change argument which is well presented by the following statement: "The main benefit of CSP systems is in replacing the power generated by fossil fuels, and therefore reducing the greenhouse gas emissions, the cause of climate change." (Richter et al., 2009: 13). In terms of future energy supply security a main advantage results from the fact that the system can remain unchanged because CSP delivers dispatchable energy supply. "Just like conventional power stations, concentrating solar power plants can deliver base-load or balancing power, directly using sunshine during the day, making use of thermal energy storage facilities during the night and in case there is a longer period without sunshine, using fossil or biomass fuel as backup heat source." (Desertec, 2008: 31). The base load characteristic in turn is of utmost importance in regards to the coupling with a desalination plant, since it is not possible to run those on fluctuating energy input (cf. Lechon, 2010: 4421). Additionally there are high expectations towards the scale-up of CSP technology, in particular under an EU-MENA energy partnership. "Considering that the industrialised countries in Europe will spend money in equipment production creating jobs in their own countries instead of spending it for burning fossil fuels, and that the developing countries in MENA will accelerate their development due to income from selling clean electricity, this will lead to prosperity for all peoples involved. " (Desertec, 2008: 54). Richter et al. (2009: 8) estimate that a scale-up could create €11.1 billion investment in 2010, developing up to €92.5 billion in 2050 and they expect that there will be 200,000 new jobs in the industry by 2020 and even around 1,2 million jobs overall created by 2050[13]. For the MENA region in particular the World Bank predicts a possible added value for the regional production of up to 60% share of the value chain and an added economic impact of 14,3 billion US $ is calculated, which also would result in 64,000 to 79,000 new permanent jobs (World Bank, 2010: 10). The main obstacle towards the scale-up is the cost and related policy and financing frameworks: "While the deployment of CSP plants to supply base load power could result in a much larger application of CSP technology, this also requires not only the deployment of long-lasting thermal storage but, in order to produce electricity at a

[13] Moderate scenario worldwide, figures referring to "sun-rich countries" (see Richter et al., 2008)

competitive price this also will require significant reductions in capital costs" (Zhang et al., 2010: 7894).

The focus on CSP for this research is chosen on one hand on the grounds of practicability and on the other hand because the technology provides the basis to shift the existing energy infrastructure to a different source. If a scale-up, with significant technology cost reduction, is possible it will provide an efficient tool for new means of climate adapting cooperation. Moreover the field of research on socio-economic aspects of CSP is fairly young and still allows for contributing to it with new insights.

For the purpose of this study concentrated solar power (CSP) is defined as power produced by solar plants that "[…] bundle solar radiation using concentrating mirrors. The concentrated radiation is then transformed into thermal energy used to power conventional steam and gas turbines or stirling engines." (Vallentin & Viebahn, 2010: 4467).

Chapter 3: Theoretical concepts and research framework

This chapter sets out to elaborate on the theoretical concepts (3.1) utilized in the framework of this research, display the synthesized operationalization of capacity aspects and research perspective (3.2) and to elucidate the applied research framework (3.3). In the first section the following theoretical concepts will be described: sustainable human development, capacities, capabilities. In the next subsection this will be concluded by the description of capacity aspects and their subsequent operationalization. Afterwards the research perspective synthesized from the aforementioned concepts will be introduced. Finally this will be followed by the explanation of the research framework, the research strategy and the applied methodologies. This will contain an elaboration on the case selection, desk research, expert interviews, semi structured interviews and an overview on the research material.

3.1 Theoretical concepts

The theoretical basis of this research will be illustrated in the following. This will be achieved by firstly explaining the ultimate aim for current development efforts: the concept of sustainable human development.

All initiatives promoting the concept of "solar energy from the Sahara desert" either explicitly (cf. Desertec, 2009: 2) or implicitly (cf. Teske et al. 2005: 44) have development of the MENA region as a long-term goal. In particular for the chosen cases Desertec and Egypt it is important to note that: "DII and the World Bank Group share the vision that the development of CSP in the Middle East and North Africa region will have positive benefits worldwide because of the cost reduction achieved with CSP technology through economies of scale." (CTF, 2010: 35). Therefore it is necessary to specify the development definition, the concept of capacity building and the range of targeted benefits itself. Those will be discussed in detail in chapter 3.2.1. In order to approach the subject of the anticipated benefits it is necessary to roll out the background of sustainable human development, the capability approach and the concept of capacity to the have a basis to examine the anticipated benefits and its constituting concepts and processes in the following.

3.1.1 Sustainable human development

When approaching the idea of development, it is necessary to define development closer. Bellù describes that there are generally two parallel existing definitions, whereas the first describes an event as a new stage in a changing situation, the second describes the process of change per se (cf. Bellù, 2011: 2). Further he notes that when exerted on socio-economic systems it means the improvement either of the overall system or of its constituting parts. The concept of sustainable human development is a development paradigm which in turn is defined as "[…] a defined modality or path to follow to achieve development, based on a codified set of activities and/or based on a vision regarding the functioning and evolution of a socio-economic system." (Ibid.: 5f).

The evolution of development paradigms

These above mentioned codified sets of activities and/or visions regarding the evolution are tied to the wide range of development paradigms which are mainly to distinguish by their focus on what to develop and how to develop. The dominating dimensions are the economic development, the social or human development and a sustainable development with a primary focus on sustainable resource management. These foci already indicate the underlying issues of a certain normative constraint towards development theory. Many arguments have been made for one or the other, yet it is incontestable that all three forms of development are vital. The evolution of development paradigms and its underlying assumptions is inherent to the discipline of development studies and could be elaborated here extensively, yet is not the focus of this research and therefore only touched upon briefly. It is important to note that the theories described in the following, occurred in overlapping phases and didn't substitute each other entirely.

The early stages of development theory were heavily influenced by colonialism, the idea of a fundamental dualism between colonialists and colonies and the idea to adjust development by imposing "occidental" systems, in turn this paradigm is termed Orientalism[14]. Modernization and `developmentalist´ theories followed step and understanding development as a uniliniear process, that can be repeated anywhere under certain circumstances. Then there is a whole different school of thought, the political

[14] For further reading see: Said (1978); Young (1990)

economy, which concentrates on unequal exchange relations in the international economy originating in political power structures and dependencies[15]. Yet another body of literature places an emphasis on the contrast between structure and agency centred development approaches[16]. Neo-liberal theories turn towards a structural perspective focussing on market potential and represent the theoretical response to political economy theory. The introduction of neo-liberal assumptions had and still has far reaching consequences in development cooperation, the prevailing tangible policy outcomes are deregulation, liberalization and conservative macro-economic adjustments. The idea behind it is to shift power from the state to the market in order to allow for a successful integration into the world market[17]. This approach corresponds strongly with globalization and the `roll-back of the state´ and has been criticized for being predominantly beneficial to large corporations in the global North. Another related theoretical approach is introduced by North, who emphasizes the role of the state for economic development: Institutionalism[18]. The underlying rationale of all the above described theoretical approaches to development has been "economic growth = development". This rationale has been challenged with the introduction of the capability approach by Amartya Sen (see 3.1.2) and the affiliated concept of human development.

This approach constitutes the core of the human development concept as defined by the Human development report series introduced in 1990. "Human development is a process of enlarging people's choices. The most critical ones are to lead a long and healthy life, to be educated and to enjoy a decent standard of living. Additional choices include political freedom, guaranteed human rights and selfrespect – what Adam Smith called the ability to smix with other without being "ashamed to appear in publick". (UNDP, 1990: 10)

Three years earlier, in the face of rising awareness on global environmental degradation, the Brundtland commission defined the concept of sustainable development in our common future. "Our Common Future firmly established SD[19] as a component of international development thinking and practice. It also helped set in motion what many now argue are the three mutually reinforcing and critical aims of sustainable development: the improvement of human well-being; more equitable distribution of

[15] For further reading see: Cypher & Dietz (2009): 158-188
[16] For further reading see: Long & van der Ploeg (1994)
[17] For further reading see: Rapley (2007)
[18] For further reading see: North (1989)
[19] Sustainable Development = SD

resource use benefits across and within societies; and development that ensures ecological integrity over intergenerational timescales" (Sneddon et al., 2006: 255f.).

The result of amalgamating both concepts into one is given in sustainable human development (SHD). A first definition was given by Speth, UNDP Administrator, and described "sustainable human development is development that not only generates economic growth but distributes its benefits equitably; that regenerates the environment rather than destroying it; that empowers people rather than marginalizing them. It gives priority to the poor, enlarging their choices and opportunities and providing for their participation in decisions affecting them. It is development that is pro-poor, pro-nature, pro-jobs, pro-women and pro-children." (UNDP, 1994: iii). The latest definition given by the UNDP ties up directly to Sen´s capability approach: "[s]ustainable human development is the expansion of the substantive freedoms of people today while making reasonable efforts to avoid seriously compromising those of future generations" (UNDP, 2011c: 2)

In the context of this research this definition is crucial since it substantially questions the mere impact of economic growth: "[…] selective examples from developing nations show that economic growth alone does not guarantee sustainable human development" (Spiess, 2008: 245). Rather the holistic concept of sustainable human development is strongly linked with the global adoption of human rights, "[…] because human rights, along with democracy, peace, and justice, have been thus defined as subsets of development." (Bhargava, 2003: 38). It is possible to criticize this approach due to the political ideology employed. Yet current political developments in the MENA region leave the question for future governing structures unanswered. Moreover the argumentation laid out by Klawitter and Schinke (2010: 17ff) for the application of a human rights-based approach to Desertec, holds true for the more general concept of "solar energy from the Sahara desert". An integrated and holistic planning approach to the concept adds value due to (cf. Ibid: 17-18):

- Attention to the poor and marginalized people
- Inter-dependence of human rights and sustainable human development
- Assistance in the achievement of the Millennium Development Goals
- Addressing conflicting rights and interests
- Preventing Elite capture
- Effectiveness through increased acceptance
- Social and Environmental Sustainability

The above mentioned factors are a theoretical argument for applying research with the higher aim for sustainable human development. Upon reflection it seems viable to enclose the practical dimension of this higher aim by elaborating on the most prominent approach implementing this aim: the capability approach.

3.1.2 Capability approach

In order to gain a better understanding of the sustainable human development approach it is necessary to look into Amartya Sen´s capability approach, because it shines an exemplary light on the line of reasoning and the actual implementation on the local level of this idea. The capability approach has a major influence on current development practice of international organizations such as UNDP and UNEP. In this section a brief overview will be given on Amartya Sen's approach of tackling poverty and development issues. His definition of development as freedom has changed the face of development cooperation and therefore builds an important building stone to comprehending this new strategy towards a holistic development.

Sen builds on the rights-based approach tying the access to freedom to an individual's 'capabilities set,' i.e. range of life-options that people have (Gasper, 2000: 992). One of his main arguments is that freedom is of paramount importance and it should be included in policy programs that favour members of a disadvantaged community. Indifferently of whether these 'capabilities' get fulfilled and become 'functionings,' i.e. the actual things people achieve and do, the simple availability will tend to promote positive development in troubled areas (Sen, 1999; Gasper, 2000). This can be considered a better measurement than the classical income measure, economic choices (if someone chooses an item/service then it must make them happy), or declared state of general satisfaction, all of which can be somehow misleading (Gasper, 2000: 992). His interdisciplinary synthesis of the `capability approach´ overarches both macro economic and individual measurements resulting in a holistic and practical framework. It is important to note that Sen does not provide a theory but an approach and thus "allows for significant flexibility in interpretation and use and in doing so [...] often provides a way of re-framing many of the problematics of the social sciences" (Deneulin & McGregor, 2009: 4). Subsequently, this is permitted by a definition of assets entirely different from the one that is mainly provided in economics. The core of this is freedom (and democracy

as the best way of achieving the highest possible freedom), which maintains three major roles: direct importance, instrumental importance, and constructive importance. Hence, Sen looks at development as "a process of expanding the real freedoms that people enjoy´, [and] `a process of removing unfreedoms and of extending the substantive freedoms of different types that people have reasons to value" (Sen, 1999). In regards to substantial material values poverty can be understood as deprivation from capabilities. Substantive freedoms, as represented by functional capabilities, include options such as living a long life, engaging in economic transactions or becoming active in the political arena. In relation to practical implication, income is more of a means than an end in itself, which sets this approach apart from initially described income focussed development approaches. Moreover this is closely related to the idea of strengthening human rights simultaneously. In the context of foreign direct investment and large scale solar energy projects this can be mainly executed through enhancing workers rights and enabling capacity building. In doing so the approach theoretically gives room to more relevant decisions and choices. Sen described what have been the ethical assumptions typically made in economics and promoted richer thinking about ethical choices by showing many relevant types of information besides those considered in previous welfare economics (Sen, 1970).

3.1.3 Capacities

One of the most effective ways of fostering sustainable human development and enlarging peoples capability sets is capacity development (cf. UNDP, 2008: 24), which is "[…] the process through which individuals, organisations and societies obtain, strengthen and maintain the capabilities to set and achieve their own development objectives over time"(Ibid.: 4). Defining capacity is a complicated endeavour, as Morgan (2006: 2) notes: "There is no broadly-accepted definition. Different disciplines and bodies of knowledge such as organizational development or institutional economics or political economy see capacity issues quite differently".

For the purpose of this study capacity will be defined as "[…] the ability of individuals, institutions and societies to perform functions, solve problems, and set and achieve objectives in a sustainable manner" (UNDP, 2006: 3). Further the UNDP Practice Note on Capacity Development (2008: 5f) explains that capacity resides within three levels: 1. enabling environment (also referred to as institutional or societal level); 2.

organisational level; 3. individual level, which will be elaborated upon below. In order to specify capacity the literature suggests asking "capacity for whom?" and "capacity for what?" (cf. UNDP, 2008) – in this case it will be capacity for the target region MENA to maximize development benefits from large scale concentrated solar energy projects, in terms of sustainable human development. The factors to achieve this capacity will be referred to as capacity aspects.

The capacity to maximize development benefits exists on three interrelated levels (see Table 6). The enabling environment displays the broader systems context. "Capacities at this level include the policies, legislation, power relations and social norms, all of which govern the mandates, priorities, modes of operation and civic engagement across different parts of society. (UNDP, 2008: 6). This level is also referred to as the "rules of the game". The organisational level represents the level on which frameworks, procedures and policies allow individual capacities to connect and relate. The individual level capacity is found in the form of technical skills, experience and knowledge (cf. Ibid.).

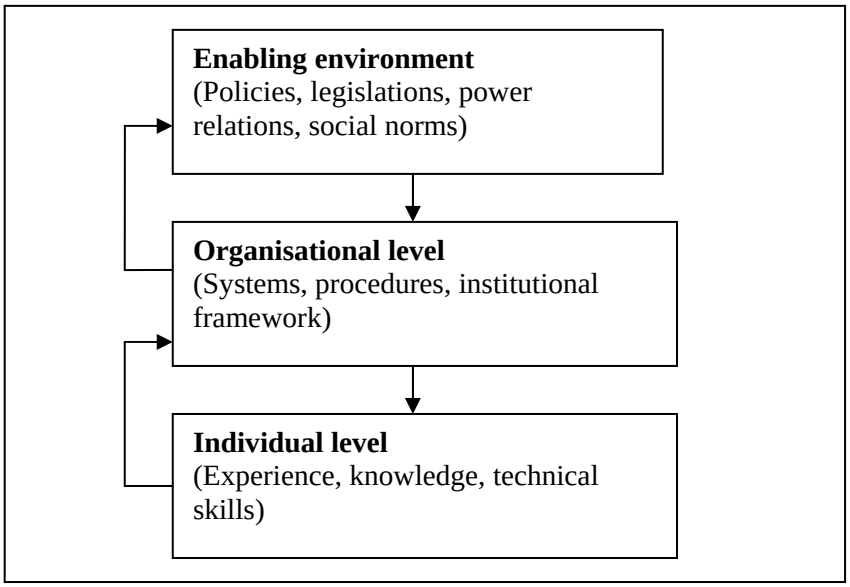

Table 6 **Levels of Capacity: a systemic Approach** (UNDP, 2008: 6)

As is the case with the concept of capacity, the term capacity development is used rather inconsistently – it seems to refer to anything from providing training to institution building. However, what most literature has in common is the use of the term development to describe external capacity development interventions. Yet some authors stress that capacity development shall be understood as a process of change, which can be driven both internally and externally (Baser & Morgan 2008). From this perspective, capacity development support has to be potentially provided by all institutional entities

involved in the concept of “solar energy from the Sahara desert”. Yet it is already suggested that it is only one of the factors influencing the development of capacity within a system. It should be noted that endogenous efforts at capacity development are not entirely autonomous or self-contained rather they are influenced by the context.

Following Baser and Morgan (2008), in this research, the term capacity development will be used to refer to any improvements in renewable energy planning and implementation system capacities (i.e. institutional, organizational, human, scientific, technical and resource capacity) – be they internally or externally induced.

3.2 Synthesis

The following section sets out to describe how the conceptual model was translated into practice in order to answer the research question of this thesis: *How can sustainable human development be maximized through CSP projects in the Sahara desert?*

3.2.1 Operationalization

The three capacity levels, discussed under 3.1.3, are a theoretical construct through which this study examines the possible benefits achievable through CSP projects. The range of benefits is approximated in two steps. In a first step the detailed description of Schinke and Klawitter (2010: 9) (Table 6) was consulted and in a second step a goal tree of anticipated benefits was established on the basis of selected publications.

This overview already depicts very well a range of anticipated benefits not only for Desertec but also for the concept “solar energy from the Sahara desert” more general. As the authors state further the anticipated benefits of the MENA CSP IP and Desertec are very similar (cf. Ibid: 28). On the side of the target countries technology and knowledge transfer, capital investment and the outlook to export renewable energy to Europe are anticipated to create development political stability and economic growth.

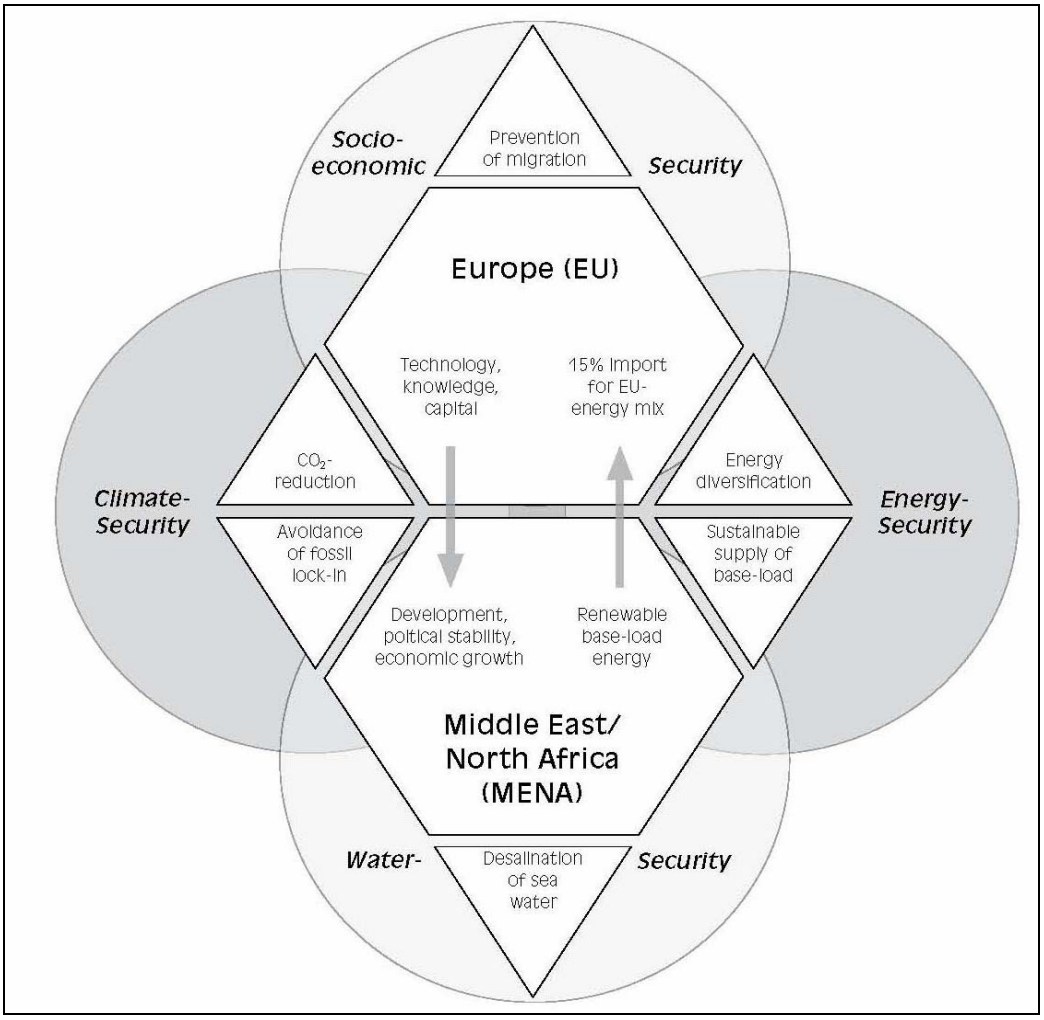

Table 7 **Benefits** (Schinke & Klawitter, 2010:9)

Moreover the diversification of the energy supply in the region will create a more sustainable trajectory of development by avoiding the region to be locked into a fossil fuel-based energy system and at the same time generating a stream of base-load energy supply resulting from the strategic harvest of solar resources. This range of benefits rather is a flexible set, with cores frequently referred to and associated satellites, than a determined range of consolidated expectations.

Since this portrayal of anticipated benefits was based on only one source there was a need to expand that source base to account for different research perspectives. In order to clarify what so far has been discussed in the bulk of literature in terms of anticipated beneficial impacts for the target region, it has been resorted to a structuring method of policy analysis. Since the concept “solar energy from the Sahara desert” is a prescription for multi- or bilateral implementation, it can be considered as an early stage policy construct and hence can be structured and analysed with a tool of reconstructive policy theory. This aims at identifying underlying assumptions and cause-effect

relationships, in order to structure the research field. Upon reflection regarding the required capacity to have a large degree of beneficial impact in the target region, it has been chosen to apply a “Reflection of Final Relations in a Goal Tree” (Hoogewerf, 1990: 287).

The volume of literature directly related to the initiatives is by far exceeded by the volume of secondary literature. Since representatives of the former are also very active in the public promotion of their initiatives there is a lot of additional sources that have to be taken into account, such as radio interviews, public speeches, presentations, Newspaper articles, personal communication etc. Accounting for this particular difficulty a set of 8 publications (see Annex 1), comprising research and reports on CSP MENA IP, Desertec and MSP, with different approaches has been established to conduct this preliminary structuring. These 8 publications were chosen due to their exemplary character for the larger range of literature on the topic. Derived from this larger set, the selection reflects well the variety of forms in which information and knowledge is provided and the different fields that produce this information and knowledge. These fields are mainly represented as International Governmental Organizations (IGO), Non Governmental Organizations (NGO) and independent scientific researchers. By covering the range of those different sources of knowledge production it is aimed at preventing a one dimensional research perspective. Moreover a serious effort is made towards approximating the practical realities of the concept in order to produce tangible and applicable results.

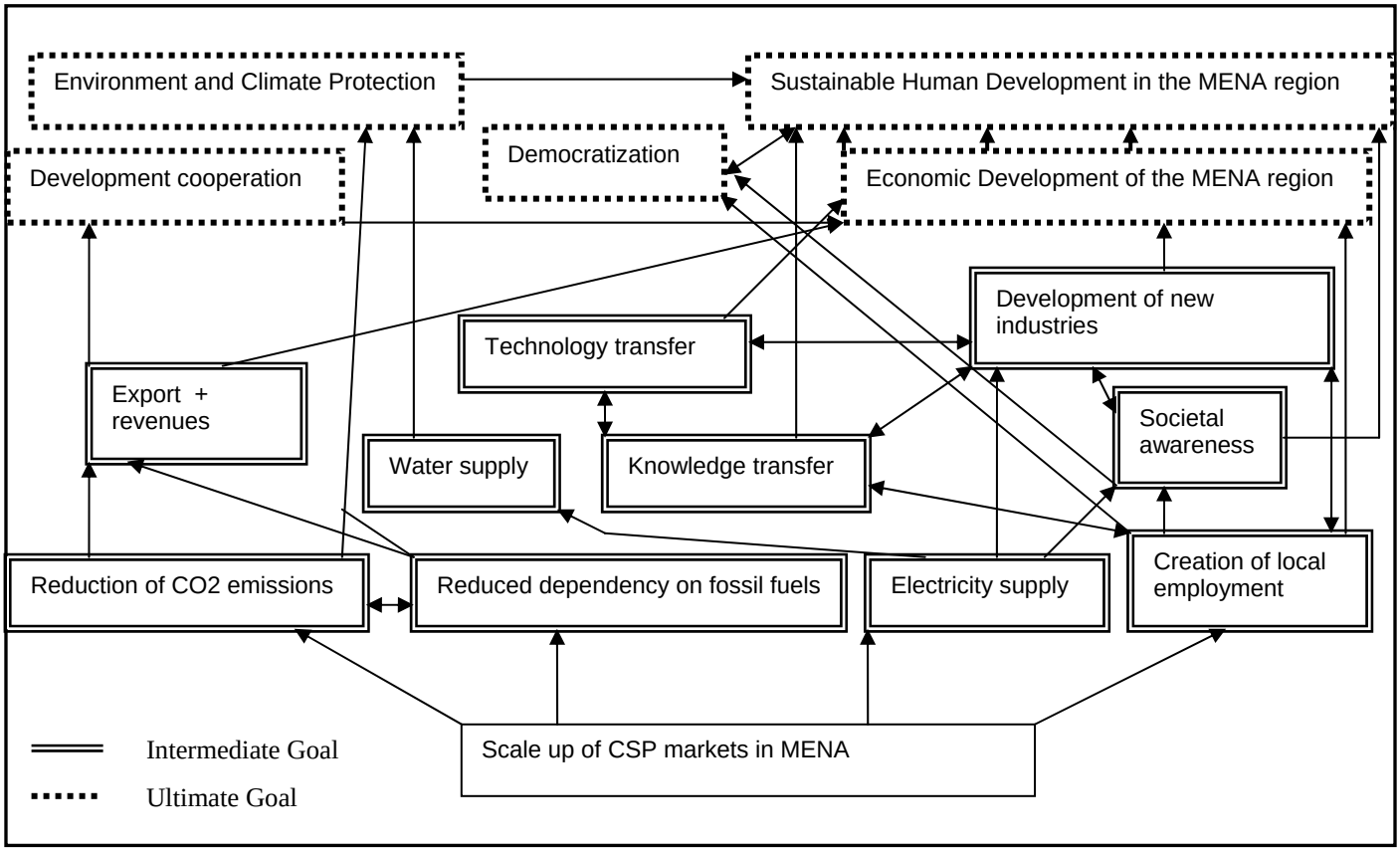

Table 8 **Goal Tree – „Solar energy from the Sahara desert“**

As Hoogewerf (1990: 287) describes “The goal-means relations can be represented schematically in a goal tree […]. This goal tree can, without much effort, be translated into causal hypotheses”. In this case there are intermediate and ultimate goals. The results of the examination as displayed above (Table 7) is by no means exhaustive or complete, it rather gives an extensive overview of major anticipated benefits. It shows that the scale-up of CSP in the MENA region has a wide range of anticipated benefits of various types. On the one hand there are the ultimate goals which comprise economic development, development cooperation, environment and climate protection, democratization and sustainable human development. On the other hand there are intermediate goals such as reduction of CO2 emissions, reduced dependency on fossil fuels, renewable water and electricity supply, creation of local employment, development of new industries, technology and knowledge transfer and the creation of an energy export market and subsequent revenue generation. The anticipated synergies are depicted as displayed in the literature and again are neither exhaustive nor complete. They rather represent indicated anticipated causal relationships. In order to operationalize the given arguments, those were chosen that are expected to impact on sustainable human development. Based on these arguments operational capacity aspects (constituting the interview themes) were

established. The scale up of CSP in the MENA region itself, as one capacity aspect, and the interrelation between approaching water/fossil fuel scarcity and solar energy, as another, are likely to influence on the general agenda on changing to renewable energy systems and hence alter the theme of domestic interests and development goals. The capacity aspects of electricity supply, local employment creation and the development of new industries are summarized under the theme domestic markets. The capacity aspects of knowledge and technology transfer displayed such a massive overlap that they are merged into one big theme. This theme comprises different forms of knowledge, as well as the technological knowledge CSP in theory and practice. Finally the underlying capacity aspects of empowerment through inclusion in planning and decision making, the set of anticipated local stakeholders and the overall expected increased societal awareness through increased shares of renewable energy and increased revenues are subsumed under the theme of local stakeholders.

Since the deducted capacity aspects are still broadly sketched the identification of the three interrelated capacity levels will be applied in chapter 5 to lay the ground for more tangible recommendations. The application of the established themes which are constituted from different capacity aspects is further displayed in the following research perspective.

3.2.2 Research perspective

The research perspective is based upon the preliminary conceptual model depicted below (Table 8). It shows the relationship between capacity aspects, capacity and sustainable human development. The spotted frame highlights the focus area of this research, whereas the capacity aspects constitute the core of the investigation and the capacity levels are reference points for conclusive structuring.

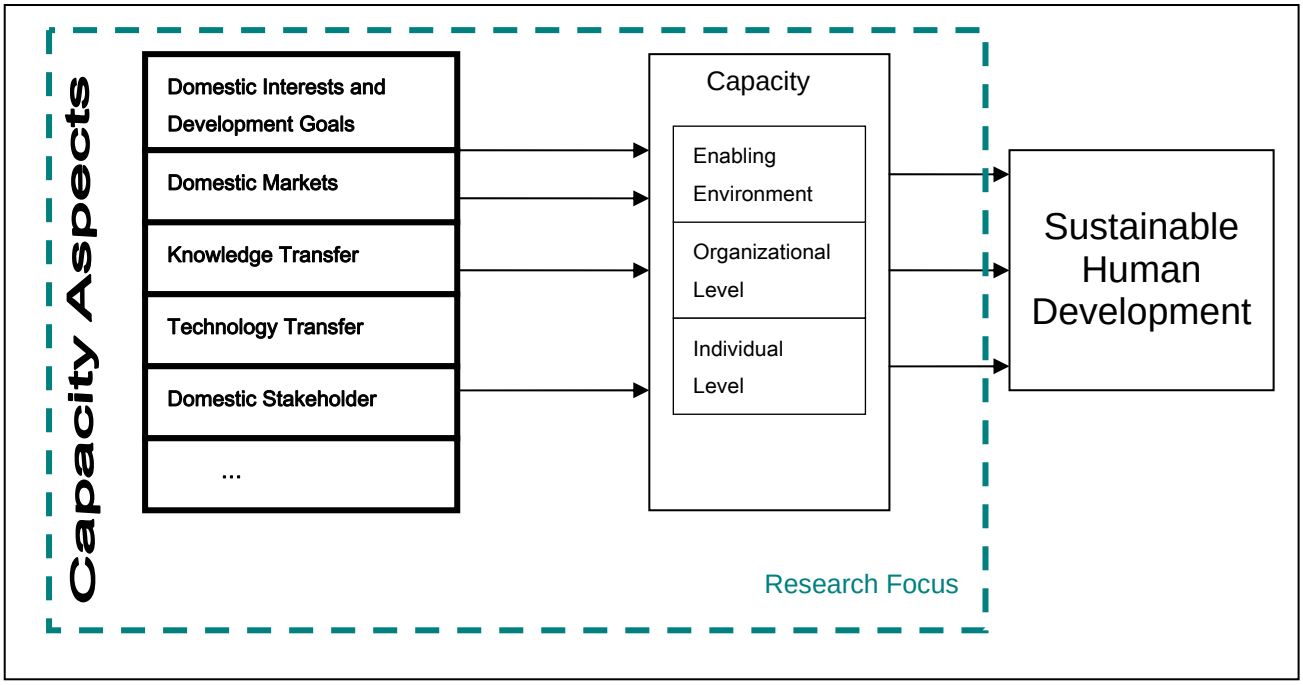

Table 9 **Preliminary conceptual model**

In its content the preliminary conceptual model brings together the benefits which constitute capacity aspects that are anticipated to contribute through increased capacity on three levels. There is a range of uncertainties regarding those capacity aspects which are to be illuminated through the research framework described in the following.

3.3 Research framework

The research framework (Table 9) suggested for this study is designed to assess the possible contributing capacity aspects to sustainable human development in the context of existing and planned CSP projects in the Sahara.

In a first step (a) theories from 5 different research fields will be used to verify, falsify and extend the elaborated set of capacity aspects, as presented in the preliminary conceptual model. At the same time these will be contextualized within the three levels of the capacity approach and then subsequently be related to their anticipated contribution to sustainable human development goals. In a second step (b) this triad will be taken on the ground to be tested against two cases, whereas the first will depict the global level and the second will depict the local level. This application may prove, falsify and extend the established set of capacity aspects. In the next step (c) the results of each case study will be examined individually, to build the basis for a comparative analysis and synthesis (d)

in the following. Deriving from this and building upon the findings in a last step (e) recommendations for further planning will be made.

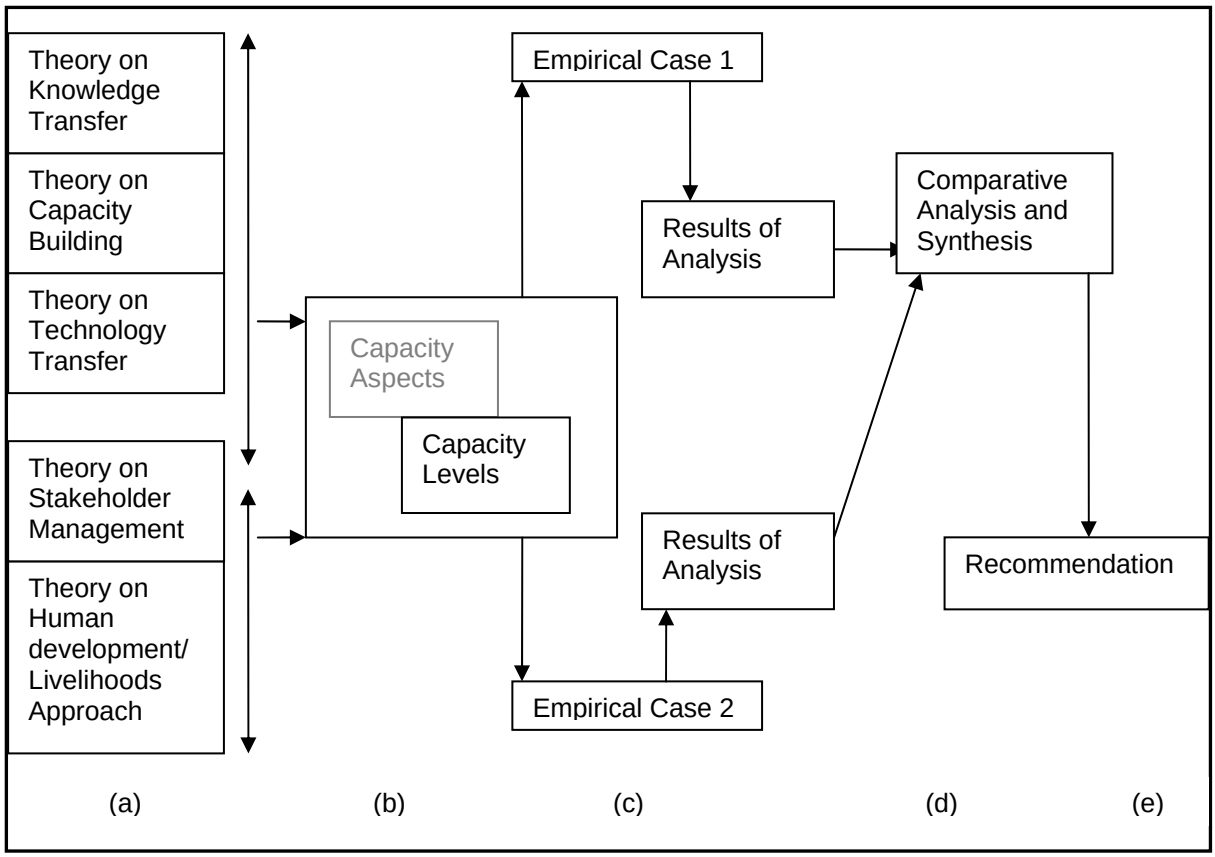

Table 10 **Research Framework**

3.2.1 Research strategy

According to Verschuren and Doorewaard (2005) the technical research design comprises the three elements of research material, research strategy and research planning (Table 10). Since the research planning is explained beyond in the research framework and the research material is describes under 3.3.6, this subsection sets out to enclose the methodological path taken in between. The established research strategy for this research design consists of a comparative case study of two cases, an extensive desk research and expert interviews based on semi-structured outline interviews.

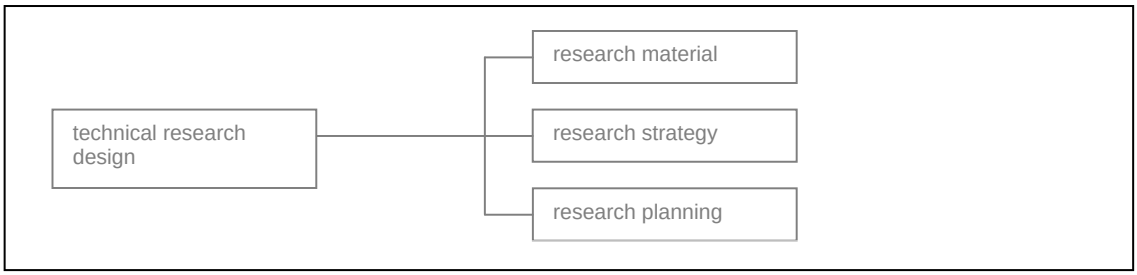

Table 11 **Structure of technical research design,** (cf. Verschuren & Doorewaard, 2005:17)

3.2.2 Explaining the research strategy: hierarchic comparative case study - Desertec Network and Egypt

In order to examine opportunities and limitations to maximize sustainable human development benefits from CSP projects in the Sahara desert it has been chosen to apply the hierarchic comparative case study method as described by Verschuren and Doorewaard (2005). They describe this as one amongst three most important variants of the case study, which is characterized by a two step approach: (1) the individual study of each case, followed by (2) the comparative analysis of the coherent case study body. This procedure enables a highly efficient use of collected data material (see 3.3.6). According to Thomas (2011: 513) "[c]ase studies are analyses of persons, events, decisions, periods, projects, policies, institutions, or other systems that are studied holistically by one or more methods. The case that is the subject of the inquiry will be an instance of a class of phenomena that provides an analytical frame - an object - within which the study is conducted and which the case illuminates and explicates". Adhering to this distinction the research at hand has the capacity aspects required for the concept "solar energy from the Sahara desert" contributing to sustainable human development in the MENA region as an object and analyses them through the subjects[20] of the Desertec Network and Egypt. In order to specify the cases it is necessary to define the nature and the boundaries of the subjects (cf. Ibid. 516f.). Firstly there was a time limitation. Cases have been studied through interviews between the 17.06.2011 and the 21.09.2011, in a parallel fashion. Secondly there were boundary considerations made regarding the nature or shape of the cases. Whereas the first case evolves in its core around the three institutional bodies of the Desertec Network, the second case evolves around the planning and implementation of

[20] subject and case are used synonymous in the following

CSP in Egypt as a (MENA) country[21]. In both cases it is directly worked with fleshing out the practicalities of the aforementioned concept, which results in a large overlap of knowledge which is not only relevant for this research, but essential. The analytical frame given within the object will eventually illuminate the given research question: "*How can sustainable human development be maximized through CSP projects in the Sahara desert?"* and the four sub questions: *1. "Which capacity aspects contribute to the target countries capacity to maximize sustainable human development benefits from CSP projects?" 2. "Which capacity aspects constrain the target countries sustainable human development benefit from CSP projects?" 3. "How are these aspects framed within a global context and within a local context?"4. "What can we learn from the comparison of the results of analysis of the global and the local level perspectives on these capacity aspects?" in both cases.*

Additionally the selection of cases was subordinated to practical considerations, such as time constraints, practical and financial feasibility. Both cases resemble what Thomas (2011: 514) describes as "local knowledge cases" – part of the field research I spend at Hamburg University, Germany, as a guest researcher and active member of the Desertec discussion group and another period of time I spend as a guest researcher at the Regional Centre for Renewable Energy and Energy Efficiency (RCREEE) in Cairo, Egypt.

The selected case studies are derived from the international CSP project planning context, narrowed down by the affiliation with the concept "solar energy from the Sahara desert". The context of the Desertec network is chosen because, among comparable initiatives, it is fairly advanced, explicitly committed to development cooperation and it represents a wide range of international actors from state, market and civil society. For the second case study it is chosen to operationalize the local level through the analysis of the CSP projects in Egypt. Currently there are two CSP plants planned in Kom Ombo and Borg El Arab, and one combined cycle plant is already in operation in Kuraymat. This gives the country a typical, compared to other MENA countries[22], project pipeline and subsequently a range of planning processes and process related stakeholders. Moreover

[21] It is important to note that general reference to the case Egypt in this research is always to be understood in this rather complex, but distinct meaning.

[22] (Including Data presented in chapter 2.3.1)
Algeria: 1 plant operational, 3 plants in planning stage
Iran: 2 plants operational
Israel: 2 plants in planning stage
Jordan: 1 plant in planning stage
Morocco: 1 plant operational, 1 plant under construction, 2 plants in planning stage
Tunisia: 2 plants in planning stage
United Arab Emirates: 1 plant under construction (CSP Today, 2011; personal communication)

the Egyptian context is chosen on the basis of acknowledging the need for country specific evaluation (cf. Erdle, 2010; World Bank, 2010; Klawitter, 2010) and the establishment of a series of such for all MENA countries. Due to lack of resources it is only possible to research one country case. Egypt is particularly suitable, because it already pursues a pro-active renewable energy policy, the transitional state of society deriving from the revolution earlier this year creates development space in terms of participation and voice and the estimated population growth and rise in energy demand for the whole region is even more pressing in Egypt due to its large population. Moreover the assessment of the three mentioned projects highlights another important cluster of actors around the World Bank group. The research strategy presented yields at producing deep qualitative and empirical knowledge. It is designed in order to answer the main research question "*How can sustainable human development be maximized through CSP projects in the Sahara desert?"*.

3.3.3 Explaining the research strategy: desk research

The basis of this research is found upon desk research. In order to gain insight into the topic academic literature, dossiers issued by working groups, think tanks and authorities, annual industry reports and CSP related journals have been analysed. Accordingly existing research approaches considering the socio-economic and environmental impact of CSP, the specific application in the EUMENA region and anticipated benefits, opportunities and limitations have been approximated.

Building on those findings another desk research has been done to examine existing research in regards to capacities required for and related to large scale CSP application in the Sahara desert that concomitantly positively impact sustainable human development in the target countries. The results were employed in partially answering the 1st sub-question: "Which capacity aspects contribute to the target countries capacity to maximize sustainable human development benefits from CSP projects?" and instigating the point of departure for the conceptual model applied.

3.3.4 Explaining the research strategy: expert interviews

In this section the applied method of expert interviews will be explained. In the following, the selection of the chosen experts and the realization of the interviews will be elaborated upon.

Due to the explorative nature of this research and the practical challenge to generate or draw from meaningful statistical data to answer the complex research question, it was resorted to the methodology of expert interviews. Moreover this methodology is particularly valuable when the field of research has not as yet been studied extensively.

This method is rather heterogenic than clearly defined. As suggested by Bogner and Menz (2005), it evolves between quantitative and qualitative traditions of research. Therefore an explanation on how expert interviews are defined in the context of this research and how they are utilized is required.

As Littig (2007) notes the expert interview is a concept predominant in German-speaking literature and it corresponds with the concept of elite interviews predominant in English-speaking literature. In consideration of the delicate political context, a rather neutral approach seems to be more suitable and hence the former concept is preferred. Firstly expert interviews aim generally at reconstructing exclusive, detailed and comprehensive knowledge (cf. Pfadenhauer, 2005: 113). There are various types of knowledge, but this research aims specifically at the contextual knowledge (cf. Meuser & Nagel, 2002: 76) of the interviewees. Accessing this in-depth knowledge will assist in gaining systematic information about aspects of capacity for “solar energy from the Sahara desert”. According to Bogner and Menz (2005: 7) experts can be seen as “Focal points for practical insider knowledge and considered being interviewed representative for a variety of actors”.

Accordingly there is an urge to define the concept of the expert. In this context the term expert has a highly relational status in regards to the field of research (Meuser & Nagel, 2005: 75). As described by Näf and Mieg (2006: 6-7) the role of the expert is constructed by factors such as societal function and involvement in decision-making processes. This is usually based on factors such as a certain specific education granting access to a specific field, a certain position in an institution (corporation, research institute or ministry), competence and field experience. In the context of this thesis research this can be translated to the field of realization of the concept “solar energy from the Sahara desert”. It comprises expertise related to planning, research and implementation of

concentrated solar energy projects in the context of Desertec and Egypt. As a working definition an expert is "someone who possesses field specific knowledge/skills, acquired through long-standing experience" (Näf & Mieg, 2006: 7). In this particular context the definition of long-standing must be seen relational to the development of the overall idea, which has been only around since 2003. Therefore as Klawitter (2010: 11) already notes experts are more likely to gain their specific knowledge rather through their occupation than through their education. Hence the occupational context was prioritized in establishing the first sub-set of experts.

Since the interviewee in the interview situation is not only present as a professional, but also always as a person with certain character traits, experiences and normative values (cf. Kassner & Wassermann, 2005: 107), special attention has to be paid to those externalities. This requires, in particular under consideration of the intercultural context, a high degree of reflection pertaining to the objectivity of the assembled data. Therefore the choice of expert interviews for the research at hand can not be understood as supplement for a comprehensive quantitative data collection. Rather it is used, in particular in regards to the explorative character of the research, as an entry point for comprehending interrelations and gaining clear and meaningful indications for further planning efforts.

Finally the selection of experts has followed an open snowballing sample strategy, which is a type of nonprobability sampling. As Babbie describes snowball sampling is a method in which "[...] the researcher collects data on the few members of the target population he or she can locate [and] then asks those individuals to provide the information needed to locate other members of that population whom they happen to know." (Babbie, 2010: 208). This technique seemed particularly suitable due to the encountered disintegration of the research field and the difficulty to establish contact with some high-ranking international experts and representatives. After preliminary research and the establishment of a first sub-set of interviewees, a second sub-set was build upon recommendation of the first interviewed experts and this process was repeated in a third round. So as a result the generated iterative process was an exploration of knowledge holders rather than an enclosed predefined list. This way one of the main flaws, namely the sampling bias, is addressed

The interviews have all been audio recorded to account for externalities such as the interview context, disturbances and overall impression (cf. Ullrich, 2006: 103). Further they have been fully transcribed following the steps elaborated by Ullrich (cf. Ibid: 104), including the steps of condensation in which the interviews are reduced by

word redundancies, disjointed phrases, repetitions, noises and by to the research questions irrelevant excursus. The interviews have been conducted largely face-to-face, yet in 6 cases it had to be resorted to virtual interviews, conducted via the Voice over IP software Skype.

3.3.5 Explaining the research strategy: semi-structured interviews

For the realization of the expert interviews the method of semi-structured or outline oriented interviews has been applied. As described by Liebold and Trinczek (2002: 39) this represents the predominant approach to expert interviews. They describe outline oriented interviews as a good combination of "content focussing" and "self-contained narration" (cf. Ibid.). Since it allows on the one hand the interviewer to address the topics of research interest and at the same time provides a certain degree of openness on the other hand to encourage the interviewee to elaborate on his perspective. This is particularly important in the face of the critique of bias originating in the interview setting, which refers to the risk of producing results that are dominated by the researchers own perspective . The outline oriented interview enables the researcher to assume the role of a "co-expert", with who the expert shares a common ground of knowledge and assumptions and hence does not require a specific legitimation (cf. Pfadenhauer, 2007: 50). This has the concrete advantage of minimizing the interview typical asymmetric communication structure, by leading towards a more horizontal situation of speech. In turn the involvement on eye-sight level produces an "autonomous dynamic" (Ibid.: 51) that brings the interviewee to share specific information and knowledge. This role is substantiated by a body of in-depth knowledge acquired in the preparation of the outline through desk research and literature review. The very same body of knowledge is the basis for creating the interview outline (see also 3.2.1), which is handled in a flexible manner to give room for open answers. The outline is a combination of an open set of issue fields and pre-formulated questions that are not bound to be asked in a predetermined sequence. The initial outline (see Annex 2) has undergone a few changes after concluding the first sub-set of respondents due to practical reasons (time restrictions) and certain content-related insights. Those adaptations correspond with the insight from Gläser and Laudel (2004: 146) who state that "[…] the work on the outline is never entirely concluded, but rather continue until the last interview". Those changes included especially the terminology of capacity aspects derived from theory which had not been

clear enough to the respondents (see Annex 3). Also a few questions turned out to be irrelevant to the field and hence have been deleted from the second version of the outline.

3.3.6 Explaining the research strategy: interview analysis

The interview process has been conducted as follows: In a first step a range of anticipated experts has been identified through desk research and literature review. Then they have been contacted via email and telephone (depending on the results of an internet research on their contact details[23]) and been provided with an email outlining the research and requesting an interview appointment (see Annex 3 and 4). In the following an interview appointment has been scheduled. Following the set of the first 10 respondents two further sets according to the snowball procedure described under 3.3.4 have been elaborated. Due to practical and time-related considerations a limit of 30 respondents was set, under consideration of an equal distribution for both cases. An overview of the chosen respondents is depicted in table 11 below. Interviews were mostly held within the work space of the respondents or in public spaces. The duration ranged from 30 minutes to 2 hours, with an average of around one hour.

Case					Total
Desertec	Desertec Industrial Initiative	Desertec University Network	Desertec Foundation	International Institutions	
	3	3	6	3	15
Egypt	National Institution	International/ foreign Institutions	Civil Society/ NGO	Industry	
	4	5	2	4	15
					30

Table 12 **Respondent overview**

A major constraint that has been encountered during the course of the research was the cultural dimension of the co-expert role (see chapter 3.3.5). Upon reflection it has become clear that to a certain group of respondents my gender and age has lead to reservation, due to conflicting views on the equality of women and men. In cases where this idea was implicitly opposed, it was not possible to establish an eye-sight level communication situation. This is well explained taking into account the most common

[23] During the research it became evident that respondents in the Egyptian context had preferred the initial contact via telephone, hence the response rate in those cases was close to 100%.

constraints to outline oriented interviews: linguistic or (sub-) cultural differences (Meuser & Nagel, 2005: 487) and the problem of an asymmetrical social relation between researcher and interviewee (Kromrey, 2002: 352).

The analysis of the generated results was conducted based on the 5-step model introduced by Meuser and Nagel (2005: 71ff) and the text analysis software MAXQDA 10. According to Schmidt (2004: 449) the choice of method for the analysis depends on the research objective, the research question, the overall methodological approach and resources respectively constraints (time, personnel and finances). Considering those factors it was resorted to the theory grounded model of analysis mentioned above. Main aims are to work out commonalities, differences, typical elements and to reduce the volume of the acquired data. Categories are not to be established beforehand but are to be generated during the process of analysis. Therefore the operational sub-sets generated under 3.2.1 have to be understood as preliminary fields of investigation. Adhering to the criterion of openness immanent to outline oriented expert interviews, the interviews have been evaluated in a way that allows for insights from previously not anticipated lines of reasoning.

The first step of analysis is the paraphrasing of the generated transcriptions. In a second step the paraphrased passages of the interviews are assigned to themes (preliminary anticipated and new) and groups of terminology are built. The third step is the thematic comparison of interview segments. Whereas here there was firstly a comparison made in between the range of each case and secondly a comparison made in overarching both cases. Here a certain degree of abstraction is applied, to allow for contextualizing the findings with existing research. The last two steps of analysis described by Meuser and Nagel have not been applied, since the first three steps allow for creating a comprehensive body of results. Moreover the nature of this research does not require the establishment of an additional set of final categories.

During the course of research it transpired that the initially targeted set of themes covered an extremely wide field. Due to time constraints it was decided to focus in the analysis, next to opportunities and limitations, on the themes local stakeholders and knowledge and technology transfer. Those themes were chosen on account of the already existing body of literature on the remaining established themes and the lack thereof for the chosen themes.

3.3.5 Research material

The required research material for this research has been derived from different resources. First of all the data needed for the first step of analysis has been obtained from different academic literature, in order to be able to render the units of analysis more precisely. For the next step these units have been compared with units found in a document analysis of the two given cases: Desertec and Egypt. These documents are largely available online and have been acquired from key institutions. In order to test this set of capacity aspects in both cases overall 30 semi-structured expert interviews have been conducted.

The interviews were rendered anonymous in a code (see Table 12), since the interview data contains some information about sensitive market processes and about sensitive public administration procedures.

Case	Respondents	Quotes
Case 1 = C1	R1 – R3, R16, R18, R19, R21 -R27, R29 – R30	Q1 – Q9
Case 2 = C2	R4 – R15, R17, R20, R28	Q1 – Q12

Table 13 **Interview coding**

In order to at least allow for a contextualization of the background of the interviewed experts, the following will describe the range of backgrounds of the experts. In the case of Desertec these are representatives from the foundation, the Desertec University Network (DUN) and the Desertec Industrial Initiative (Dii). Moreover there have been interviews with experts from international institutions such as the League of Arab States, UNESCO and an independent scientific research institute in Cairo. In the context of Egypt interviews have been conducted with experts of the planning process from national government authorities such as the New and Renewable Energy Authority of Egypt (NREA), the Egyptian Electric Utility and Consumer Protection Regulatory Agency (EGYPTERA) and the Industrial Modernization Centre (IMC). Moreover interviews were held with representatives of international institutions such as the World Bank, in particular planners involved with MENA CSP IP in Egypt, MED-EMEP (see 2.3.3) and a regional research institute, as well as interviews were held with industry representatives from market parties from Europe and Egypt involved in the Kuraymat and in the Kom Ombo project. Additionally an interview was held at a University in the vicinity of the Kuraymat plant, and at a local Egyptian NGO.

4. Results

In this chapter the results of the thesis research conducted, according to the strategy laid out in 3.3.2, 3.3.4 and 3.3.5 and analysed according to the methodology described in 3.3.6, will be presented. This chapter is divided in three sections. The first section (4.1) sets out to approximate the experts understanding of capacity building and its constituting elements (capacity aspects) in the context of the concept "solar energy from the Sahara desert". This is done to verify the findings on which the operationalization (3.2.1) is based. The second section (4.2) and the third section (4.3) will then proceed displaying the interview results by themes for case 1 (4.2) and case 2 (4.3). The first subsection respectively seeks to answer the first two research sub questions: "*Which capacity aspects contribute to the target countries capacity to maximize sustainable human development benefits from CSP projects?" and "Which capacity aspects constrain the target countries sustainable human development benefit from CSP projects?"*. The second subsection seeks to answer the third research sub question: "*How are these aspects framed within a global context and within a local context"?* in regards to two the themes: local stakeholder and knowledge and technology transfer.

4.1 Capacity

In this chapter the research findings on capacity (see Table 13) will be presented. Additionally the original quotes building the basis for the paraphrases are displayed in Annex 6.

Capacity building as a theoretical construct did not only pose some challenges of this thesis, but respectively turned out to be a rather cumbersome concept to the interviewed experts. A remarkable degree of uncertainty was observed among the interviewees encountering the terms capacity and capacity building. On the one hand the above described blurring boundaries of the definition (3.1.3) are likely to contribute to this and on the other hand indicate the varying professional backgrounds a simple unfamiliarity with the concept.

Despite of this practical impediment, there is a wide range of anticipated constituents of the capacity to create sustainable human development benefits from the large scale application of CSP in the Sahara desert.

Generally capacity building is seen by the experts as learning processes and the acquisition of knowledge in general and CSP technology expertise in particular

(C1R26Q1, C1R27Q1, C2R28Q1). In order to create long term beneficial impacts it is necessary to establish expertise on the base of education and vocational training (C1R23Q1, C2R14Q1, C2R17Q1). Education has to target various areas such as: processes, manufacturing, integration and organisation of supply chains, project management, public management, policy making and technology transfer. The fields of application are not only the CSP and its components industries (C1R25Q1), but also public administration (C1R16Q1, C1R23Q1, C1R17Q1), political parties (C2R20Q1), epistemic community as represented in universities and research institutes (C1R25Q1) and the MENA public. The issues addressed comprise matters of technical knowledge, such as quality assessment, process optimization, project design, planning, operation and maintenance (C2R28Q1). Other issues addressed comprise matters of societal acceptance (C1R3Q1) through information dissemination and awareness raising (C1R26Q1, C1R30Q1, C2R13Q1, C2R20Q1).

Moreover main constituents to a solid capacity enabling the target countries to benefit from large scale CSP application are stronger domestic markets (C1R19Q1), local component production and assembly, a regional CSP industry, the adaptation of the technology to desert conditions (C1R3Q1, C1R19Q1, C2R13Q1, C2R15Q1), suitable financing schemes and policy frameworks (C1R27Q1, C2R14Q1), a long standing project pipeline (C1R19Q1, C2R14Q1) and the increased investment of domestic industry in research and development (C2R17Q1).

Capacity		
Code	Paraphrase	Generalization
C1R3Q1	In order to gain acceptance it is necessary to produce components locally. This requires training, R&D and investment and it will bring technology advancement and price decrease.	acceptance, local production
C1R16Q1	We need institutional adaptation to those projects.	Knowledge transfer for public administration
C1R19Q1	A certain market volume and a long project pipeline are the preconditions for investments in local production.	market, project pipeline, local production
C1R23Q1	We require vocational training and receive knowledge on project development, best practices and institutional capacity development.	Knowledge transfer for public administration, vocational training
C1R25Q1	We need a change in work ethics. We need institutional capacity building to produce efficient institutions and prevent favouritism.	Knowledge transfer for industry and epistemic community
C1R26Q1	It is necessary to spread the knowledge on CSP technology and to communicate the larger concept. Training is needed for the industry and for institutions regarding policymaking and project management.	Knowledge transfer, awareness
C1R27Q1	We need an educational strategy for academics and vocational training for operations and maintenance. The technology has to be adapted to the desert and we need policies to attract investment.	Knowledge transfer, technology transfer, policy framework
C1R30Q1	We need to create awareness about the project and the	Awareness

	opportunities it holds for the region among state civil society and market parties.	
C2R13Q1	We need awareness of the technology and increased shares of local manufacturing.	Awareness, local production
C2R14Q1	We need more engineers and more technicians through education and applied research. Long pipelines create know how, attract investments and jobs.	Academic and vocational training, financial support, project pipeline
C2R15Q1	We need to enhance the market for component production.	Local supply chains
C2R17Q1	We need R & D and practical training for maintenance and planning. The institutional level needs training to supervise the projects.	R & D, vocational and academic knowledge transfer, knowledge transfer for public administration
C2R20Q1	We need the political will and train decision makers. We need awareness about renewable energy.	Knowledge transfer for political sector, awareness
C2R28Q1	We need knowledge and technology transfer for design, storage, operation, maintenance, quality assessment, components, CSP project management and overall process quality.	Knowledge and technology transfer

Table 14 **Capacity Aspects**

The following sections set out to illuminate the opportunities and limitations, to maximize sustainable human development benefits from large scale CSP application, perceived by the experts of the two given cases. Moreover they will lay out the framing of the themes: local stakeholder and knowledge and technology transfer.

4.2 Case 1: The Desertec Network

The Desertec network, as already explained in 2.3.5, consists of the Desertec Foundation, the Desertec Industrial Initiative (Dii) and the Desertec University Network (DUN). It represents currently 28 research institutions and universities from MENA and Europe in DUN, 21 international shareholding companies and 35 associated partners in Dii and unites a network of international country representatives in 14 locations in the foundation. The network is the biggest and most active initiative amongst those described under 2.3. It diversity of members and groups makes it the largest congregation of stakeholders from civil society and global markets.

Opportunities

When approaching the interviewees with the question about opportunities to maximize sustainable human development benefits for the target countries there was a wide range of answers. According to the perceptions of the capacity concept (for original quotes see Annex 7) discussed above the establishment of assets such as technology and project

expertise, industrial production facilities, revenues, empowerment, employment and additional spill over effects were pointed out.

The respondents of the Desertec network pinpointed that by applying large scale CSP facilities in North Africa and the Middle East an energy transition (C1R1Q1; C1R19Q2) will be initiated, which will decrease carbon emissions (C1R1Q1; C1R19Q2). On the one hand this benefits the region through mitigating climate change (C1R1Q1) and subsequent impacts and on the other hand it allows the countries of the region to gain revenues from carbon credit trading (C1R22Q1), taxes (C1R27Q2) energy and possibly technology export (C1R29Q1; C1R22Q1). It is thought to contribute to overall development (C1R1Q2; C1R22Q1; C1R22Q1), to reduce `brain-drain´ through decreasing out migration (C1R22Q1) and establish a new perspective for the regions socio-economic future (C1R27Q2). In the face of recent political upheaval this will support recent democratization efforts (C1R3Q2) through increased incomes (C1R1Q2) resulting in improved living standards, empowerment of local communities through participation and the establishment of learning processes for societal engagement (C1R18Q1). A similar anticipated opportunity that was mentioned by a vast majority of this set of respondents was the creation of employment (C1R1Q2; C1R16Q2; C1R19Q2¸ C1R22Q1; C1R27Q2) which will also directly impact on increased incomes and living standards.

This is connected to the notion that a large scale application of CSP will create an increased awareness (C1R3Q3; C1R30Q2) of environmental protection and resource depletion in the target countries. Further it is mentioned that CSP technology holds additional opportunities for industrial cooling processes, to reclaim degraded land for agriculture (C1R2Q1) and to tackle the regions increasing water scarcity through fresh water production from desalination (C1R16Q2; C1R21Q1). At the same time the regions rising demand for electricity (C1R21Q1; C1R29Q1) partly deriving from the growing demographic pressure, could be satisfied and the regional markets (C1R16Q2; C1R21Q1) would be integrally supported. This is based, on the one hand, on the argument that base load power provision (C1R27Q2; C1R30Q2) generated by CSP facilities will be conducive to the fragile and small electricity grids in MENA and moreover provide energy security (C1R30Q2). On the other hand it is based on the idea that through extensive CSP application, knowledge and technology will be transferred to the region (C1R23Q2; C1R27Q2; C1R29Q1; C1R30Q2), components will be produced locally in a newly developing industry (C1R1Q2; C1R3Q2; C1R16Q2; C1R29Q1) and CSP

technology will be adapted to desert conditions (C1R21Q1). These processes will create new impulses for MENA economies (C1R3Q2) and stimulate industrialization (C1R1Q2).

The profits for foreign technology providers (C1R21Q1; C1R19Q2) are likely to attract further foreign direct investment which will support future market developments in MENA.

Theme: Opportunities		
Code	Paraphrase	Generalization
C1R1Q1	The opportunity lies in starting an energy transition and replace fossil fuels and its emissions. In turn this can be transferred to the rest of the world.	Decarbonisation, energy transition, climate change mitigation
C1R1Q2	Developing industries in the region will create employment, accelerate industrialization and increase incomes. In the long run this will create development.	Industry development in MENA, job creation, industrialization, increased income, development
C1R2Q1	There is the chance to enhance Fresnel technology, which allows for new forms of agriculture and cooling processes.	Opportunity for agriculture and cooling processes
C1R3Q2	Local production will create local employment, which in turn will establish higher living standards. Those are favourable conditions for democracy.	MENA industry development, new impulse for MENA economies, democratization
C1R3Q3	It will change the perception of energy and environment issues.	Awareness
C1R16Q2	Desalination and jobs through domestic industry development will be beneficial. Through collaborating with European companies the market could be fostered.	Desalination, job creation, MENA industry development, MENA market development
C1R18Q1	Engaging local communities in participation will lead to jobs and economic participation. Another impact could be an iterative participation process, to train societal learning and decision making.	Empowerment of local communities through participation, learning processes for societal engagement
C1R19Q2	The end of fossil resources requires an energy transition. Carbon pollution will be reduced. Foreign companies will make profits and create vocational employment.	Energy transition, profits for foreign companies, job creation, reduction of co2 emissions
C1R21Q1	The customer will be provided energy and electricity and the technology producer can suit conditions. Export will benefit the local markets.	Water and energy supply, profits for technology provider, adaptation of technology, local markets
C1R22Q1	MENA could export energy and technology and foster development through job creation. Europe could get carbon credits, import energy and mitigate migration pressure.	MENA: export energy and technology , employment, development, Europe: carbon credits, decreased migration flow
C1R23Q2	Specialized knowledge will benefit certain people in the region.	Knowledge transfer
C1R27Q2	We can produce base load power, which matches the requirements of fragile/small grids in MENA. Spill over effects will be job creation, knowledge transfer and increased tax revenues. Another opportunity is the creation of hope through a new perspective for the future.	Base load provision, job creation, spill over effects: knowledge transfer, establishment of future vision, increased tax revenue
C1R29Q1	Export is the basis for industrial development, education and local off take.	Industry development, knowledge transfer, export, electricity supply
C1R30Q2	There are benefits in education and vocational training. It would create new perspectives for those countries, through generating export options. This could change the overall consciousness. Baseload power plants mean a significant improvement of the energy supply that is already suffering from supply shortages.	Knowledge and technology transfer, base load provision, future vision, awareness, improved electricity grids, energy security

Table 15 **Case 1 Opportunities**

Limitations

According to the respondents of the first case study the set of factors limiting the benefit from large scale CSP application is quite large and ranges from socio-cultural limitations, over missing technological break throughs to policy and political problems (for original quotes see Annex 8).

One major impediment to positive impacts was described in a lack of educational training (C1R27Q3), the quality thereof (C1R23Q3; C1R25Q2) and the lack of technology transfer (C1R26Q3; C1R26Q2). This is mainly related to two further limitations: overprotective approaches to intellectual property rights slow down industry development (C2R19Q3) and decelerate the market price decrease for CSP (C1R29Q2; C1R26Q2; C1R26Q3). At the same time storage and dry cooling technologies require some further improvement (C1R27Q3; C1R27Q4) and the declining price of other renewables (C1R27Q4) such as photovoltaics and wind reduce anticipated beneficial impacts. The created financial risk repels investment which might even be deteriorated by the overall lack policy and financing frameworks and resources (C1R16Q3; C1R18Q2; C1R25Q2; C1R27Q3; C1R29Q2; C1R30Q3). Other limitations derive from the political situation which depicts constraints in the lack of political will, security problems, political and social instability (C1R16Q3; C1R29Q2; C1R30Q3) and corruption (C1R1Q4). Some respondents voiced concern that the currently diffused European efforts could limit the beneficial impacts further. The existing grid infrastructure is described as insufficient for the large scale CSP application (C1R25Q2) and the envisioned North-South energy supply bears the potential to create a disadvantageous power dependency (C1R1Q3). This again has the potential to prevent transnational political agreements and scare off investors. Other respondents pointed out on the one hand cultural differences are a hurdle already in existing regional project work (C1R19Q4; C1R26Q3) and on the other hand respondents noted that the intention with which foreign parties enter the region for collaboration is another one (C1R25Q3). Further one respondent laid out that the rather traditional cooperation approach in which `European´ solutions and processes are imposed on developing countries is dangerous and would potentially limit anticipated benefits (C1R18Q3).

Theme: Limitations		
Code	Paraphrase	Generalization
C1R1Q3	The risk is Europe becoming dependent on power supply from	Power dependency: North-South

	North Africa.	
C1R1Q4	Corruption is the only obstacle. Putting money into some pockets will prevent development.	Corruption
C1R16Q3	The main threat is prevailing political instability. This will increase the financial risk and increase the lending rates. The social stability is important.	Political instability, financial risk, social stability,
C1R18Q2	The main limitation is the absence of feasible economic models for CSP plants.	Lack of operational economic models
C1R18Q3	The main obstacle is the trust in the people. They have to develop their own participative processes and dialogue and we can not assert ours on them.	Ignorance of peoples autonomy and voice
C1R19Q3	IP protection is a big obstacle for the development of the whole CSP industry.	IP protection slows down industry development
C1R19Q4	Cultural differences are a major obstacle in the daily work they seem to prevent the implementation of a certain accuracy.	Cultural differences to generate lack of accuracy
C1R23Q3	The quality of education for engineers in MENA is an impediment.	Lack of specialized knowledge
C1R25Q2	I observe a lack of coordination between the different initiatives this will result in isolated pockets of activity. Another point is the poor infrastructure in the MENA region. Europeans are not ready to invest there. Also the graduates are not up to the challenge.	Diffused European efforts, insufficient infrastructure, lack of financing, insufficient training level
C1R25Q3	The intention of the people from Europe is a real obstacle.	Intention
C1R26Q2	The technology is currently too expensive and we still do not know how to localize component production.	High technology cost, lack of technology transfer
C1R26Q3	Technology transfer and costs are major obstacles. A disregard of intercultural differences is another hurdle, since we are facing significantly different understandings of work, efficiency and awareness. There is not much understanding of the potential of economic gain through this option.	Lack of technology transfer, costs, intercultural differences
C1R27Q3	If educational efforts are not made it will slow down the overall process and if regulatory frameworks will not be developed, the investments will not be made.	Lack of educational training, policy and financing frameworks
C1R27Q4	The price decrease of other renewables could impact the developments severely. One factor here is the improvement of storage technologies.	Technology: Storage, price of other renewables
C1R27Q5	Regarding the water scarcity in the region, it is crucial to improve the dry cooling technology.	Technology: Dry cooling
C1R29Q2	I think financing and political stability are limitations, just as well as the development of CSP price decrease and the establishment of regulatory frameworks.	Financing, political stability, price reduction, policy frameworks
C1R30Q3	I agree with the three risks described in literature: financing issues, security issues and the current lack of political will.	Lack of financing, security, political will

Table 16 **Case 1 Limitations**

Local stakeholder

The theme local stakeholder covers two main perceptions of experts: firstly it displays who is perceived as a local stakeholder and secondly it reveals how those stakeholders are believed to be benefited (for original quotes see Annex 9).

The stakeholders that were perceived the most relevant by the interviewees came from all three spheres: market, state and civil society. The actually established counts are

of little significance, since the nature of the research is qualitative and sample size does not provide quantitative validity.

Within the market the stakeholders are seen mainly in companies providing engineering services for project planning and implementation, and for companies being directly involved with the production of CSP and desalination components. On a more general level, electricity suppliers, grid dispatching managers and trade chambers in the MENA region are regarded as relevant stakeholders. It was found that respondents found it difficult to differentiate market parties considered important. This accounted in large parts for a vague knowledge on actual projects and their implementation practicalities.

In the sphere of the state various stakeholders on different levels are identified. On an international level European and MENA governments, especially those being dependent on fossil fuel imports, were found to be significant. Respondents pointed out, on the one hand (new) political powers have to be addressed and on the other hand certain ministries of the target countries have to be involved. Those ministries were namely those considered with water, population development, urban development and regional development. Additionally the German Aerospace Centre (DLR) and governerates of oasis communities were named as stakeholders.

In the realm of civil society, the civil societies themselves at large, neighbouring local communities, NGOs and academic institutions such as universities and research institutes are regarded as significant stakeholders. About the involvement of local communities respondents expressed conflicting ideas. Some found the average resident of neighbouring desert communities had a right to be informed, but could not be included in decision making processes due to a lack of resources. Other voiced that it was crucial to have those stakeholders as an integral part of the decision making processes to gain acceptance and safeguard the projects.

	State	Civil Society	Market
R1	Government, population development department, urban development department, regional development department	Academic sector, Institutes of technology, engineering departments at universities, high schools	Engineering offices, engineers, financing experts
R2	Politics, European governments, MENA governments	Right to the neighbouring communities of information, not decision making process	MENA trade chambers
R3	Governerates of oasis, governmental organisations	Water consumer, universities, social communities, small communities, regional communities, oasis centres, NGOs	CSP producer, producer (desalination components)
R18	People who are not affiliated with old system, fossil fuel importing countries	Younger people, affiliated with the Arab spring	
R19			Companies

R21		Community, informal leaders	Business
R22	Clients, ministries, DLR, regional governments, regulatory bodies, water ministries (desalination)		Supplier, transmission line manager, contractors
R23	Governments	Civil society	Companies
R24	Ministries		Industry
R25			Local industries
R26	Ministries	Regional centres for research, local communities	Relevant industries
R27	Governments	Local communities	Local business, international companies
R29	Political entities	Non-political stakeholders, NGOs such as the DESERTEC foundation	Businesses
R30	State	"community energy manager", civil society, grass root movements	Market
Total	11	10	13

Table 17 **Case 1 Stakeholder**

When researching the theme of local stakeholder interviewees found that through applying a large scale CSP system to the MENA region overall awareness in target countries for climate change, arising environmental issues and more efficient resource management will be increased (C1R24Q1; C1R26Q1[24]; C1R30Q1[25]). Also it is thought that the complex interplay of market development, local production and employment that is anticipated to follow suit will assist in filling the gaps left by decades of autocratic regimes and state economies in the region through providing a new socio-economic perspective and vision for the future (C1R1Q5; C1R21Q2). The responsibility for promoting this is seen to be on NGOs (C1R3Q5) and the academic sector (C1R1Q5). This is a key process since the acceptance (C1R18Q6; C1R27Q6; C1R3Q1[26]) of the concept and the individual reference projects by civil society is the precondition for establishing beneficial impacts. This promotion is viewed controversial by the respondents. On the one hand it is argued that, on the state level the nature of the energy projects and the general level of education in societies do not allow for participative decision making processes (C1R2Q2) for the project planning and implementation. On the other hand it is described that due to their role towards feasibility, ownership and security of projects it is essential to engage civil society stakeholders in an inclusive participation process (C1R25Q4; C18Q4; C1R26Q4). This is likely in turn to be negatively influenced by the repeatedly expressed notion of an empty and uninhabited Sahara desert (C1R23Q4; C2R22Q2) that coincides with the realization that local community development is of low priority among MENA countries (C1R22Q3). Moreover the preconditions for project

[24] See Table 13
[25] See Table 13
[26] See Table 13

employment, the actual numbers of created jobs and their time frames and the absence of those required skills in rural communities (C1R19Q5) minimize positive impacts further and leave neighbouring communities with the benefit of grid connection (C1R3Q4). Moreover some respondents uttered that the construction of infrastructure (C1R16Q4) and new community establishment, subsequent relocation and the awareness thereof will also be particularly beneficial to urban populations in MENA (C1R24Q2). One respondent pointed out that according to the above described imbalance it is necessary to evaluate possibilities of creating further beneficial impacts for neighbouring communities (C1R26Q5). Possible fields to be targeted should comprise topics related to the Millennium Development Goals established be the UN: illiteracy and empowerment of women (C1R30Q4). Further aspects to be considered are named as the need to avoid collaboration with old elites of autocratic regimes and instead the support of newly emerging actors (C1R18Q5) and the application of successful governance concepts elaborated in the North such as the German "community energy manager" (C1R30Q5).

Theme: Local stakeholder		
Code	Paraphrase	Generalization
C1R1Q5	In North African countries there is a lack of real visions. The academic sector should promote visions for the development of the countries	No visions, academic sector
C1R2Q2	People should be informed, but they are not able to take part in decision making processes yet.	People not able to participate
C1R3Q4	Universities and industries should be involved to engage in research and communities should be involved too. They will not have a direct benefit, but an indirect one through grid connection.	Stakeholder, indirect benefit: grid connection
C1R3Q5	NGOs have good local bases and can convince people about the concept.	NGOs to promote concept
C1R16Q4	The benefits to the local community are jobs. Also you establish roads, provide power for them.	Indirect benefit: infrastructure
C1R18Q4	Increased revenues will not provide ownership. Inclusive processes need to be installed.	Ownership through participation
C1R18Q5	Currently people in power come from the old political systems. I think we should look at people who were less successful in them, maybe approach the young people from the Arab spring.	Collaboration with old elites
C1R18Q6	We need the local acceptance to save the cost of additional security measures.	Acceptance
C1R19Q5	During construction (Andasol: 400 – 500) you create more jobs, than during operation and maintenance (Andasol: 40). The labour needs to be receptive, disciplined, literate and speak English. You will not find the necessary skilled labour in the vicinity of the plant. They are located in the big cities.	Project employment, requirements, skilled labour in cities
C1R21Q2	It is necessary to create new visions for the countries in the region.	Vision
C1R22Q2	There are no neighbouring communities to the plants because it is in the desert.	No people in the desert
C1R22Q3	Local community development has a very low priority right now.	Prioritization
C1R23Q4	CSP plants are constructed in unpopulated areas.	No people in the desert
C1R24Q1	The majority of people are unaware of climate change. NGOs	Awareness climate change

	should change this.	
C1R24Q2	We need to study the possible relocation of people to more remote areas and create awareness about this option.	Awareness, relocation
C1R25Q4	Ownership should be created through consulting communities and combining projects with catering their needs.	Inclusion, ownership
C1R26Q4	It is important to consult with local communities and ensure the integration of the projects.	Inclusion
C1R26Q5	We should seek out to establish additional benefits on the sidelines of the projects.	Additional benefits
C1R27Q6	There needs to be communication on benefits as well as on disadvantages such as water and land use issues. Recent turmoil in California point out the need for acceptance.	Acceptance
C1R30Q4	We need to work towards eradicating illiteracy and the empowerment of women. We need to encourage pupils to go with their education in the field of renewable energy.	Illiteracy and empowerment of women
C1R30Q5	We need to install structures for engagement we could install the German "community energy manager".	Community energy manager

Table 18 **Case 1 Local Stakeholder**

Knowledge transfer – Technology transfer

The analysis of the respondents understanding on capacity development in chapter 4.1 already indicated that knowledge and technology transfer (C1R26Q1[27]; C1R27Q1[28]) are regarded as integral to the target countries capacity to maximize sustainable human development benefits. In the following the interview results from the context of the Desertec network will be discussed (for original quotes see Annex 10). The structure can be roughly broken down into: preconditions of knowledge/technology transfer, entities considered with knowledge and technology transfer, Knowledge directly related to CSP technology and Knowledge indirectly related or independent from CSP technology.

As an important precondition for successful knowledge and technology transfer the regulation of intellectual property rights was identified. The respondents pointed out that a protective approach to intellectual property rights (C1R1Q8) possibly reinforced through the infant industry character of the CSP market is inappropriate in the face of a globalized economy. Further it was expressed that it would be beneficial to establish special intellectual property agreements (C1R16Q5).

Various views on which entities should or must be involved in the process of knowledge and technology transfer are held amongst interviewees. This large set comprised in the public sphere schools and universities for the provision of basic education and creation of awareness (C1R1Q6). Vocational training systems have to be in place to prepare labour force for projects prior to implementation (C1R1Q7). In the

[27] See Table 13
[28] See Table 13

industrial sector experts conveyed that joint ventures (C1R23Q5) are the preferable structure in to transfer knowledge through exchanging staff (C1R21Q3). The physical exchange of individuals and the beneficial side effects of increased intercultural understanding were also mentioned as a key component for transferring knowledge to students and the overall epistemic community (C1R2Q3; C1R25Q1[29]). Moreover it is believed that trade chambers, industry associations, retired field professionals could support the gain of knowledge for the industry more general (C1R2Q4). Another set of answers pointed at the importance of aiming particular efforts at transferring knowledge to public administration (C1R16Q1[30], C1R23Q1[31]). Only one respondent held the view that the erection of the first component factories will automatically create a process of knowledge (C1R3Q6).

When reflecting on the content and nature of required knowledge most experts remained vague in their answers. The currently existing research base was rendered insufficient (C1R27Q8; C1R1Q7) and was said to require further combined action, not at least to illuminate the adaptation of CSP technology to desert conditions (C1R27Q7) and further investigate the localization of supply chains (C1R26Q8). Moreover the project development (C1R23Q5) itself seems to comprise a very distinct body of knowledge that is necessary to be installed in the MENA region in order to gain the crucial competence to make transferred knowledge operative (C1R1Q9).

Another topic discussed is the transfer of knowledge that is indirectly or very loosely connected to the application of CSP technology. Such knowledge was found in more procedural cognisance on teaching methods, imparting and extending absorptive capacities (`learning how to learn´) (C1R1Q9) and conveying management skills (C1R1Q7). Additionally some respondents laid out that considering the negative impacts of neglecting intercultural differences (C1R26Q7), the promotion and strategic academic knowledge on intercultural understanding (C1R2Q3; C1R16Q6).

Theme: Knowledge and technology transfer		
Code	Paraphrase	Generalization
C1R1Q6	Knowledge transfer requires the ability to understand knowledge on the basis of general education, from primary school to university. The educational level is still low, illiteracy rates are too high.	Basic education, school/ university system
C1R1Q7	The target countries have to install vocational, scientific and research capacities, to be receptive to this knowledge transfer. Moreover we will management skill transfer.	Vocational training, research, management skills
C1R1Q8	Knowledge and technology disclosure has to be liberalized, as protectionism is increasingly hard to enforce and bears the risk	IP protectionism

[29] See Table 13
[30] See Table 13
[31] See Table 13

	of alienate MENA partners.	
C1R1Q9	It is of utmost importance to make knowledge beneficial to the target countries. Therefore it is necessary that institutes of technology, engineering departments at universities and high schools have the ability to teach, to absorb the knowledge and the competence to make it applicable.	Teaching and absorptive capacities, competence, operative knowledge
C1R2Q3	Experts and students need to be exchanged to promote the understanding. Practitioners need to have local knowledge, which is different for each country of the region.	Interregional exchange, intercultural understanding
C1R2Q4	Trade chambers and industrial organizations should be involved in knowledge transfer. Retired experts could support this process.	Trade chambers, industry association, retired
C1R3Q6	We don't need special structures, building a factory for component production will cause the knowledge transfer.	Factory = knowledge transfer
C1R16Q5	It is important to safeguard intellectual property in technology transfer or joint ventures. In the past the Egyptian government has refused to allocate additional financial resources to IP rights for wind technology and it prevented local component production.	Technology transfer requires IP agreements
C1R16Q6	Since there are different cultures regarding regulations and contracts, intercultural understanding is necessary to achieve agreements.	Intercultural understanding
C1R21Q3	Knowledge transfer happens through training exchanging experts from the South to the North. The value added derives from having professionals from the South receive training from their partners in the North.	Knowledge transfer = exchange
C1R23Q5	Preferable would be the interconnection between governments and private parties. Foreign companies should partner with local companies in joint ventures this will lead to knowledge transfer or at least to gains in project development.	Joint ventures, project development
C1R26Q6	The technology transfer is a problem because lack of local manufacturing and the knowledge thereof.	Lack of localization
C1R26Q7	Since there are differing understandings of work, efficiency and awareness, the disregard of intercultural differences represents an obstacle.	Disregard of intercultural differences
C1R27Q7	Acquiring intellectual property rights would not make a big difference, because MENA will not have cutting edge technology for the next 5-10 years. Rather the role of the local research and development will be adjusting the technology to local conditions.	Adaptation of technology to desert conditions
C1R27Q8	There are not many experts on the socioeconomic impacts because this research approach to the concept is new.	Insufficient research base

Table 19 **Case 1 Knowledge and technology transfer**

4.3 Case 2: Egypt

As one of the oldest nations in the world, Egypt went through various different developments at different times. Today the country occupies the 123rd rank on the Human Development Index and it aims at going up as fast as possible. The country is located at a geographical key position between the Middle East and Northern Africa and finds itself close to Sub-Saharan Africa. Despite its favourable position and its implication for economy, Egypt faces some serious issues. Food production is increasingly unsustainable,

water scarcity impacts agricultural and economic developments, energy demand is on a steady rise and financial resource allocation hardly sustain the demands of the educational requirements. The adult literacy rate ranges at 66.4% and places Egypt behind Angola and Congo (UNDP, 2009: Fig.1). One of the crucial fields for economic development is education, as “Egyptian labour does not fulfill the market requirements” and “[l]abour is a critical impediment to private sector´s growth and competitiveness” (UNDP, 2010: 2).

The current Egyptian energy policy was introduced in 2007 by the former ruling National Democratic Party. It contains a renewable energy target of 20% (8% wind, 12% hydro) by 2020, a restructuring of fossil fuel subsidies, the construction of 4 nuclear power plants and a grid interconnection with neighbouring countries (Suding, 2011: 4432). The energy strategy paper does only exist in an unauthorized English translation and does not contain any specific solar energy target. The whole section considered with renewable energy targets is currently under revision and is expected to be concluded by December 2012. This revised and newly structured policy will be presented as “Combined Renewable Energy Master Plan for Egypt” (CREMP) and will be addressing CSP projects explicitly (KfW, 2010).

Opportunities

In the case of Egypt the respondents also depicted a wide range of anticipated opportunities to benefit their sustainable human development from large scale CSP application (for original quotes see Annex 11). The range of contributions in this case evolved around increased income, employment, industrial production, enlarging habitable areas and security of supply.

The reduction of carbon emissions (C2R6Q1; C2RQ3) and the opportunity to cover regional energy demand (C2R6Q1) are referred to as being major benefits to the country. In particular in the face of rapidly depleting gas resources in Egypt an increased energy supply from renewable sources is described as creating a situation of energy security (C2R7Q1; C2R12Q1; C2R28Q2) that is not provided through the current energy system and potentially triggering a transition (C2R7Q2) to a whole new energy production system, free of nuclear and fossil sources. Moreover a large scale CSP application will improve the infrastructure of local rural communities (C2R20Q2; C2R28Q3) and offers the opportunity to reclaim degraded desert areas for habitation (C2R7Q2) and therefore mitigating the population pressure on the Nile delta (C2R7Q2).

It was expressed that infrastructure would be enhanced through electricity grid connection and supply, water provision through desalination (C2R10Q1; C2R17Q2) and through job creation in rural and remote parts of the country (C2R8Q1; C2R13Q2). The application of the technology to the needs of the people will create a process of involvement (C2R17Q2) and increase the awareness for environmental problems (C2R7Q3; C2R14Q2). It was also mentioned that the overall concept if implemented promptly will create a frontrunner advantage (C2R14Q2) in the CSP market. Through technology transfer a domestic industry (C2R4Q1; C2R6Q2; C2R28Q2) will be created that will benefit the country not only through revenues from energy export (C2R6Q2; C2R7Q1; C2R28Q2) and through increased local income through employment (C2R6Q2; C2R10Q1; C2R13Q2; C2R28Q2). A long standing project pipeline is thought to have sustainable employment effects (C2R13Q2) and promote the future vision of a green Egyptian economy (C2R6Q2).

Theme: Opportunities		
Code	Paraphrase	Generalization
C2R4Q1	A domestic CSP industry will have positive impacts, but only for a small number of people.	Domestic industry
C2R6Q1	The need for diversification of energy sources for Europe and the increasing regional demand for energy can be satisfied.	Decarbonisation, regional energy supply
C2R6Q2	The electricity industry and supply sectors will grow and create employment. The export option allows looking towards a future vision of a green economy.	Industry, employment, export, vision
C2R7Q1	Solar energy is a valid alternative to replace nuclear energy. The German energy policy requires the import of new alternative sourced supply.	Energy security, transition, export
C2R7Q2	I believe that generating electricity in the desert with the option for supplying infrastructure will be a way to establish new communities and mitigate the current stress on the ecosphere of the Nile delta.	Reclaim of desert areas, mitigating population pressure on Nile delta
C2R7Q3	Emission reduction will benefit the local communities. The existence and promotion of pilot projects will promote awareness.	Emission/pollution reduction, awareness
C2R8Q1	Some jobs will be established for low skilled labour in rural areas.	Employment in rural areas
C2R10Q1	Job creation is a major benefit to the region. Desalination could assist in catering the regional water demand.	Employment, water supply through desalination option
C2R12Q1	Egypt faces an increase of energy demand that can not be satisfied by their gas resources.	Energy security
C2R13Q2	Projects will create local employment and generate increased income to neighbouring communities. A long project pipeline increases those benefits.	Rural job creation, increased local income, project pipeline
C2R14Q2	Since electricity is heavily subsidized, so there is no awareness yet, this would change. Then we have the opportunity to become exporters of the technology that we apply here to satisfy our own demand.	Awareness, frontrunner advantage
C2R17Q2	Successful pilot projects will attract investors. Applying technology to the needs of the people means involving them. Therefore desalination is very important here.	Involvement, desalination
C2R20Q2	Grid connection will improve the living standard for remote villages, many lacking connection.	Improved infrastructure for local communities

C2R28Q2	Pending energy shortages can be approached and overhead can be exported as a commodity. The created employment will trigger technology transfer and gives the outlook to create a new industry.	Energy security, export, employment, technology transfer, industry
C2R28Q3	The benefit to local communities is the employment, energy supply and the overall development of the community.	Improved infrastructure for local communities

Table 20 **Case 2 Opportunities**

Limitations

In the case of Egypt the limitations displayed by the respondents were largely of an actual and instantaneous nature. In particular the respondents directly involved with the integrated solar combined cycle power plant in Kuraymat contributed recently encountered experiences of limitations to benefits (for original quotes see Annex 12). Thus this knowledge pertains in large parts the practicalities of knowledge and technology transfer, it led to the notion that failures and omission in reference projects have a deterrent effect on successive projects (C2R12Q3). Moreover practitioners pointed out that there is a substantial lack of absorptive capacity (C2R7Q4), involvement and ownership (C2R9Q1). It was expressed that the absence of those factors are observed to be highly detrimental to the knowledge and technology transfer.

Further the concern was voiced that individual projects, when not embedded in a longer project pipeline (C2R12Q2) spoil beneficial employment and industry impacts. A general lack of awareness (C2R5Q2) due to the socio-economic developments and an electricity price that is artificially kept low through subsidies (C2R14Q4) are noted also. It is argued that the lack of ownership does not only occur on project level, but also on the more general level regarding the concept “solar energy from the Sahara desert” and when prevailing, will have very limiting impact on benefits (C2R5Q1). Other limitations are named as the absence of political decision makers (C2R14Q3), policy frameworks (C2R12Q2), lack of investments for production and reference projects (C2R11Q1). Moreover one respondent commented that, by targeting the necessary market price decrease for CSP technology and hence overcoming the infant industry stage (C2R28Q4) the automated production of components is likely to spoil the beneficial effects of additional employment (C2R11Q1). Additionally respondents pinpointed that recent experience in an Egyptian infrastructure project that has been lacking a participative dialogue process with community stakeholders have led to protest and rejection (C2R17Q4) and that in order to produce viable benefits the intention has to be a true win-win situation including acknowledgement of human rights for desert populations. Two

other limitations were found in the unfavourable position of Egypt for a trans-Mediterranean electricity grid interconnection (C2R12Q4) and the unwieldy character of multilateral agreements for energy trade (C2R20Q3).

Theme: Limitations		
Code	Paraphrase	Generalization
C2R5Q1	The concept can not be asserted but has to come from within the country to be successful. This is not the case.	Domestification of the concept
C2R5Q2	Whether it is on renewable energy or on energy efficiency, the amount of awareness is very poor.	Lack of awareness
C2R7Q4	We do not have people here that can absorb the technology knowledge from our foreign cooperation partner.	Lack of absorptive capacity
C2R9Q1	Egyptian cooperation partners are not eager to acquire knowledge and they are not aware of the opportunity or of their ownership.	Lack of domestic involvement, ownership
C2R11Q1	The problem is that there are just very few projects coming out. This leads to an absence of investments in component production. Automation threatens employment creation.	lack of reference projects, investment for production, automation takes jobs
C2R12Q2	Without a certain volume of projects coming up there is no investment, projects can only come up under suitable policy frameworks.	Short project pipeline, lack of policy framework
C2R12Q3	Failing technology and knowledge transfer in reference projects gives bad signals to follow ups.	Reference projects deterrent examples
C2R12Q4	The export opportunities will depend on geographic accessibility for grid connection. Egypt is not suitable for a direct connection with Europe.	Lack of grid connection
C2R14Q3	Due to recent political turmoil it is hard to find reliable and decisive political decision makers. Particularly large projects require a lot of governmental involvement.	Absence of political decision makers
C2R14Q4	One of the main detriments in the overall context is the subsidy on the electricity because it results in ignorance regarding energy topics.	Lack of awareness due to electricity subsidies
C2R17Q3	If the projects do not aim at benefit for the whole country but only for a few, than this is a problem. Ignoring people in the deserts and their rights is a limitation to having any benefits from this.	Intention, disregard of desert populations and civil rights
C2R17Q4	Recent example show that people in Egypt need to be involved in critical infrastructure projects, otherwise one will risk protest and rejection.	Lack of participation
C2R20Q3	Practical solution are unlikely to come through multilateral agreements, but rather through agreements between two partners.	Multilateral agreements too unwieldy
C2R28Q4	A major limitation is the cost for CSP. This is strongly related to the size of the CSP market, which is an infant industry (around only 70 reference projects).	Market price of CSP, infant industry

Table 21 Case 2 Limitations

Local stakeholder

The discussion of the theme local stakeholder will display on the one hand the range of perceived stakeholder groups and on the other hand the understanding of benefits to different local stakeholders and their dynamic will be described.

The respondents considered stakeholders of all three spheres: state, market and civil society important. Generally it can be stated that interviewees reflected a lot of uncertainty about who to name as stakeholders and who would have a right to be involved. About half of the respondents answered the questions pertaining to stakeholders. Within the realm of the state ministries of environment and electricity were regarded significant stakeholders. The new and renewable energy authority, as a specialized subdivision was named, just as well as international development banks, inter-governmental research centres, Egyptian Electric Utility & Consumer Protection Regulatory Agency (EGYPTERA) and the Industry Modernization Centre (IMC).

Within civil society local communities and academic research entities in universities and research institutes are described as significant stakeholders. Moreover interviewees pointed out the need to include NGOs, which is described as difficult due to a lack of regional NGOs considered with energy and environment topics. One respondent voiced that Desertec and similar entities working on super grid concepts should be addressed too. Among market parties, banks, industrial unions and supplying companies are pointed out as important stakeholders. Whereas engineering services have to be equally addressed as trade services. It was observed that respondents largely have difficulties to name different market parties that have a stake.

	State	Civil Society	Market
R4	NREA	Neighbourhood, Academic scientific research	Companies, industrial unions, big private sector companies (AOI, Orascom, Al Sewedy)
R5	NREA	Local community, level NGOs interested in renewable energy, NGO (no clear NGO), academics	Industry, future industries, Engineering, technicians
R7		Local communities	EHC (Egyptian holding company)
R8	Government	Desertec initiative, super grid people	Companies, banks
R9	The owner (Ministry of electricity)		
R10	World Bank, IBRD, BIB, African Development Bank		Commercial parties
R13	NREA, RCREEE, regulator, IMC	Local communities (planning through public hearing processes), newly established social populations, Universities, research institutions	
R15	NREA		Market
R17		Universities, research institutions and energy NGOs who are really connected with local communities, the local communities themselves	
R20	Ministry of electricity	Scientists, local communities	All businessmen
R28	Environmental authority agency	Local stakeholders, NGOs in Egypt	
Total	9	8	7

Table 22 **Case 2 Stakeholder**

The research on the theme local stakeholders in the context of Egypt shows that the interviewees answers strongly evolved around issues of power imbalances, lack of trust and detrimental shortcomings of the institutional and societal systems (for original quotes see Annex 13).

Generally it is pointed out by the experts that establishing a future socio-economic vision on the basis of the concept of "solar energy from the Sahara desert" will benefit the current societal transition process by providing a goal (C2R13Q3) and potentially support political structures (C2R20Q5) by indicating an economic strategy. The current public opinion suffers at this stage severely from unawareness of problems and solutions equally. It is mainly constrained through a weak to non existent public awareness (C2R5Q4; C2R20Q1[32]) on the concept itself, which is well reflected in the fact that by June 2011 the lot of Egyptian newspapers published in English[33] had published together only a handful of articles on the topic.

Additionally the increasing threat of water scarcity (C2R7Q6) is not widely anticipated and therefore the solution to an unknown problem does not meet much interest in the public discourse. This is believed to have negative effects since awareness is needed to gain acceptance which in turn is a key success factor for CSP project development and associated benefits (C2R6Q3). Further local stakeholder engagement is confined by a decentralized governance system that does not allocate any responsibility on the community level (C2R7Q7), 30 years of development agenda strategically neglecting research and development capacities and creating a void thereof (C2R7Q5) and a list of problems, burdening civil society, that appear far more immediate and pressing than the large scale application of CSP (C2R7Q8; C2R12Q5). The latter might also explain why the small Egyptian NGO landscape pays little attention to the topic (C2R20Q4) and the former indicates another detriment to be found in the disintegration of expert cluster (C2R5Q3). Through the lack of experience and specialized knowledge governmental, research and other public institutions find themselves in a situation that inevitably requires iterative learning processes and collaboration (C2R17Q1[34]). Any approach towards this solely focussed on the technical side of the project (C2R17Q7) is bound to limit the desired capacities. Moreover the specific Egyptian sensitivity

[32] See Table 13
[33] For this purpose a desk research was conducted in the archives of the following papers: Al Ahram, Al Masry Al Youm, Business Today, Cairo Times, The Daily News Egypt, Egypt Today, The Daily Star Egypt and Egypt Daily News
[34] See Table 13

pertaining to foreign interference and foreign agenda setting (C2R5Q4) conflicts on one hand with the notion of co-development in bilateral tandems (C2R17Q6) and the urge for `real partnership´ (C2R8Q2) and on the other hand strengthens the plea for establishing ownership (C2R9Q2). This ownership is partially supposed to be established through public agencies implementing donor standards in their projects and consulting with neighbouring communities in public hearings on the project implementation (C2R4Q2). These processes are theoretically appointed to ensure empowerment and inclusion. In the case of the Kuraymat project the official position claimed the implementation of public hearings according to the specifications of the World Bank and the Japanese Bank for International Cooperation (JBIC). However it was found that the report of the public hearing in Kuraymat was not accessible during the period of this research to the researcher and it was not possible to disclose the process or dynamic in which the results from this hearing have been integrated in the project planning. Moreover it was found that experts at a neighbouring (public) university learned with surprise about the existence of the close by CSP reference plant and have not been included in the public hearing process.

Further the project is described to have failed in transferring knowledge and thereby also in empowering Egyptians (C2R15Q2). It is indicated in addition that one possibility to prevent this in the future could be the ante-project implementation of training schemes within the vicinity of the proposed projects (C2R28Q5).

Theme: Local stakeholder		
Code	Paraphrase	Generalization
C2R4Q2	We held consultations with the community in Kuraymat and we will do that in Kom Ombo. We follow the donor standards and implement EIAs.	Donor standards and EIA/public hearing
C2R5Q3	There is a wide range of experts in different agencies and institutions, but they are currently disintegrated. We need to bring efforts together to have a specialized community promoting the concept.	Disintegration of expert cluster
C2R5Q4	The awareness on RE in general and the concept in particular is weak. There is an issue in the collaboration of civil society organisations and donor agencies. Foreign influence raises suspicion of forwarding political agendas. Though the civil society would need this input and support, international involvement raises suspicion.	Weak awareness, foreign interference
C2R6Q3	In order to take the concept forward it is necessary to get acceptance from civil society and to form some consensus on it.	Acceptance
C2R7Q5	Under the former government there has not been a focus on research and development, there was no emphasis on its role for the economy.	Former government neglected research and development
C2R7Q6	Thus water issues are pressing, the majority is unaware of this. No related demands were made in the Kuraymat project.	Unawareness of water scarcity
C2R7Q7	The decentralized system disconnects the local community from projects. Though we do have public consultation, an	Decentralization

	involvement of NGOs does not seem feasible because there is no financial provision for this collaboration.	
C2R7Q8	Poverty is the most important problem here green energy is not our problem.	RE no priority
C2R8Q2	It is important to create real partnership and a win-win situation. Power imbalance towards Europe will spoil the benefits.	Real partnership
C2R9Q2	The government does not feel or enact ownership for the Kuraymat project.	Lack of ownership
C2R12Q5	The common man does not care about the energy supply it has not been a problem so far. So he and civil society does not have to be addressed on this topic.	Civil society not a direct stakeholder
C2R13Q3	The concept, when including a FiT from North to South present a valid future perspective for Egypt.	Future vision with export option
C2R17Q5	The project in Kuraymat did not result in knowledge transfer and has not empowered Egyptians. It is just a reference project for foreigners. We need a process where Egyptians learn from Egyptians.	Lack of empowerment, domestic development
C2R17Q6	Desertec has refused the notion of co-development towards me. But I believe we need to work on the local community level and engage civil society.	Co-development
C2R17Q7	When the projects are approached technocratically they might not generate benefits for Egypt.	Technocratic approach
C2R20Q4	Local communities and NGOs have to be engaged, but the field of RE is not really covered by local NGOs yet.	NGOs not covering RE
C2R20Q5	The government is responsible for creating a vision for the next 100 years.	Government needs to give a vision
C2R28Q5	Labour has to be sourced locally and trained in time to be available at the respective project stage.	Ante-implementation training

Table 23 Case 2 Local Stakeholder

Knowledge transfer – Technology transfer

As already described earlier the input of field practitioners gave valuable insight to this research and to the range of answers on what knowledge for whom and how.

According to the range of answers the following discussion can be subdivided into types of knowledge and technology transfer, preconditions and knowledge content (for original quotes see Annex 14). The majority of experts agreed on the fact that there is a elementary necessity for both specialized academic and vocational training (C2R14Q1[35]; C2R17Q1[36]), additionally knowledge to public administration and political decision makers were referred to (C2R17Q1; C2R20Q1[37]). Despite this realization field practitioners also agreed that in the Kuraymat project currently there is at least a lack of, if not no knowledge transfer (C2R7Q9; C2R11Q3).

[35] See Table 13
[36] See Table 13
[37] See Table 13

In parts it can be explained through disadvantageous contracting structures (C2R11Q2) deriving from the commercial tendering process (C2R12Q6). In addition it is found that in the budget plan, of this commercially tendered project, there is a substantial lack of resources for training and performance monitoring purposes (C2R12Q6). The experts are further substantially divided on the question whether or not intellectual property rights are the root of some problems (C2R4Q3; C2R5Q5; C2R6Q4; C2R11Q4). Those interviewees sketching out an overprotective approach to intellectual property rights as a hurdle for knowledge transfer suggested approaching the issue either through bilateral agreements (C2R7Q12) or through contractually determined technology transfer targets (C2R6Q4).

One respondent defined successful knowledge transfer through arriving at a situation where an Egyptian consultancy on its own is able to project and construct a CSP facility (C2R7Q12). This would require the acquisition of the necessary design engineering expertise (C2R7Q9; C2R7Q10), the needed proficiency on quality testing and assurance (C2R9Q3) and the prerequisite knowledge on operations and maintenance (C2R7Q10; C2R9Q4) of a CSP plant. Moreover the knowledge on the production of different components such as parabolic mirrors and receiver tubes is thought to be highly relevant (C2R7Q10). Knowledge transfer resides on the one hand in academic structures (C2R5Q6), but in particular with this not fully mature technology, it resides in the accumulation of practical experience (C2R10Q2). The major hurdle of knowledge transfer is to be found in the confession of an Egyptian field practitioner who declared openly that cooperation partners are delivering and the problem is found within the fact that there are no employees who are able to absorb the knowledge (C2R7Q11; C2R7Q4[38]).

Theme: Knowledge and technology transfer		
Code	Paraphrase	Generalization
C2R4Q3	No I don't think intellectual property is a problem, for Kuraymat it is written in contract. There are no cases in Egyptian industry where intellectual property was stolen.	IP
C2R5Q5	We want to create business and keep our secrets.	IP
C2R5Q6	Involve academics and then do the knowledge transfer to them.	Academia
C2R6Q4	We have experience with IP problems, maybe technology transfer targets are a solution. The current difficulty derives from the market being very small and immature.	IP, technology transfer targets, infant industry
C2R7Q9	I can not see any knowledge transfer in Kuraymat. Knowledge transfer or technology transfer means that I am capable as an Egyptian to design this power plant in Egypt.	No knowledge transfer, design
C2R7Q10	In knowledge transfer there is an academic level and vocational training for renewable energy level. We need to	Design engineering, production, O& M

[38] See Table 19

	train engineers to design solar power plants. Once we have these capabilities, they can train other Egyptians, for manufacturing, operations and maintenance.	
C2R7Q11	Egyptian employees in Kuraymat not receptive of receiving subcontractors knowledge.	Lack of absorptive capacity
C2R7Q12	The goal of knowledge and technology transfer would be an Egyptian consultancy design a power plant from A to Z. This can only work through bilateral agreements.	Goal, bilateral agreements
C2R9Q3	The quality testing and assurance needs to be improved.	Quality testing, assurance
C2R9Q4	Currently there is no knowledge transfer to Egypt. The owner does not put much effort in overtaking the operation and maintenance of the Kuraymat project.	O & M
C2R10Q2	Knowledge transfer comes from project experience.	Practical experience
C2R11Q2	Technology transfer will not happen if domestic companies will stay with the construction and foreign companies design. Technology is a black box then.	Contracting structure
C2R11Q3	Knowledge transfer is not happening right now.	No knowledge transfer
C2R11Q4	Intellectual property is a problem.	IP
C2R12Q6	Technology transfer suffers from a lack of qualified engineers, budget and strategy to improve performance and optimize technology. When commercially tendering a project there are no incentives to the technology holder for further improvement or monitoring.	Lack of training budget for projects: performance, commercial tender

Table 24 **Case 2 Knowledge and technology transfer**

5. Comparative analysis and theoretical reflection

The following chapter sets out to answer the 4. research sub-question: "*What can we learn from the comparison of the results of analysis of the global and the local level perspectives on these capacity aspects?"*. This will be achieved by comparing the major findings from both cases in a first step and relating those back to the three capacity levels in a second step.

Opportunities

The range of anticipated capacity aspects is much larger than reflected in literature. Thus touched upon the varying impacts of direct and indirect employment capacity, are very vague due to their extremely speculative nature. As for example the job opportunities in supply industry are differing extremely between different technology options. Most respondents from the target region see a big opportunity in establishing their own domestic CSP industry development and hence increase their share of value chain profits dramatically.

Overall most experts agreed that in the global context it will be highly beneficial to all regions with high DNI values and the world energy demand if the market price for CSP technology will be decreased over time.

Basically all respondents see the main arising benefit in the anticipated economic growth and a subsequent increase in overall welfare for the participating countries. There have been expressed several concerns for the equity of the profit distribution, which are discussed in the next sub-section. Another main argument derived from literature deals with the rising energy demand in the region and the approaching water scarcity. Whereas the former could be largely substantiated by the experts, the latter met a divided response. The case 1 respondents all agreed on the issue and also a certain amount of experts of case 2 held similar views, but there was a third group that did not recognize the argument. Interestingly some experts were convinced that there is no water shortage to expect in Egypt. Upon reflection it was found that many field practitioners held this particular view. One reason for this line of reasoning could be that Kuraymat as well as Kom Ombo are built close to water connections and this commodity (as also bread, gas, oil etc.) is currently heavily subsidized, directly from one ministerial body to another and does not show up as a real cost factor. Another reason is the general lack of awareness regarding the critical situation of water scarcity. Similar observations were made in the past in Spain

and Australia and have been tackled with targeted campaigns and educational programs (reference).

Some experts indicated that due to the population structure and the political climate it would be of renewed importance to create an energy infrastructure that has truly sustainable characteristics in terms of capacity and emissions. This rising demand could be satisfied and simultaneously fulfil the criterion of sustainability with the large scale application of CSP.

One novelty argument was introduced by a range of the experts in Egypt. It regarded the issue of population pressure in the Nile Valley. The idea was expressed that CSP could not only be used to increase the standard of living for rural desert communities, but rather it could be used to open up new habitats. Apparently there is a strong need for the densely populated to alleviate the stressed region and migration effects would allow for remedy. Experts went further and explained the idea of creating self-sustained agricultural communities in areas that are currently rather hostile human living conditions.

Limitations

One main concern for most experts was the limitation currently presented in changing political conditions. Whereas experts in the Desertec context are mainly arguing that political turmoil is changing the face of domestic development agendas, case 2 experts supported the same line of reasoning by stating that Egypt is currently lacking a development vision. Also there is apprehension expressed about the lack of political decisiveness due to the transition processes ongoing in the region an even larger threat would be posed if newly elected governments would lack political will to support the large scale application of CSP.

Another broad topic that crystallizes from the interviews is closely related to the political climate. Starting out with the overall perception of corruption expressed in favouritism, elitism and nepotism. This impediment of public administration and regional market transactions was already found according to literature to be the major obstacle for investment. My research shows that moreover it is a serious pitfall for human resources. Interviewees stated that competence was usually not the main priority in recruitment processes, which damaged the output of projects, ministries and research institutions.

Moreover a lack of institutional independence and agency of key institutions was found to diffuse efforts further.

A lack of expertise on the side of the target countries institutional context in concentrated solar power plant planning, assessment and deployment, observed in procedural forthcomings, which shows a heavy reliance on foreign expertise - points out clearly that there is a substantial lack of field grounded expertise and hence related mechanisms to install those on public administration level in Egypt. The problem of installing such capacities within a context representing about a 1/10 (and less) of the average wage of a professional holding aforementioned expertise on the current market juxtaposes the issue of market valued expertise and technocratically imposed knowledge transfer programs typically for autocratic regimes. Realistic market values have to be introduced to institutional interventions and expert consultancy subsequently has to be regarded in relation to its “real” market value and subsequently taken up in an appropriate manner meaning a carefully designed training process.

Additionally the experts were found to be substantially divided on the issue of civil society and local community inclusion. Despite implemented public consultations, many Egyptian decision makers admitted that they did not regard them as useful or beneficial. From their more traditional point of view the efforts and costs outweigh the generated benefits. It has to be kept in mind that those decision makers are used to very effective top down policies that seemed not to require general acceptance or stakeholder involvement. In parts this derives from the former repressive system and the considerably small civil society engagement.

The recurring argument of an uninhabited desert (see additional observations) was used to justify a merely technocratic approach to project implementation. Thus regulatory framework prescribes certain procedures and public availability for processes and documents, these jurisdictions are not translated into practice. The general lack of public accountability and transparency is a main object of recent political unrest. On the project level this object poses a main threat towards the equal distribution of benefits and the risk to marginalize certain groups of society even further. In a large scale application of CSP this effect is likely to extrapolate and exclude even more vulnerable groups. The obverse argument was also given in experts voicing fear to be exposed to foreign influences imposing “their” development ideals on the region. In turn this general practice refers to the normative choice discussed in 3.1.1. In the same issue field experts also demurred that through the lens of favouritism or elite capture a conflict could arise from prioritising energy export before satisfying domestic energy demand.

Another set of raised concerns arises from the degree of uncertainty included in current research on socio-economic impacts, interviewees voiced that there is a large potential for overestimating the anticipated profits and benefits and subsequently fuel false hopes and expectations. This was strongly correlated with the absence of clear regulatory frameworks for stable investment conditions. This was on one hand substantiated with a majority of the respondents agreeing that a general Feed in Tariff (FiT) according to the European model would collide with income structure in the region.

Also limitations were seen on the one hand through a sagging decrease of the CSP market price and on the other hand through an absence of export opportunities in the long term. This was particularly a sensitive issue in case 2 due to the lack of possibilities to connect the Egyptian grid directly to the European grid. Moreover the estimated costs for a EUMENA grid require a big trans-regional financing effort which would in turn require complete new agreements. The comparison was made with Europe where the integration of renewable energy capacity into existing net structures currently ignited a discussion about responsibilities for financing, which yet stands to be concluded.

Local stakeholder

When comparing the results of the themes local stakeholder from both sets of interviews, it is found that in the case of Egypt respondents were rather unsure about who are stakeholders to the concept. Whereas interviewees in the case Desertec seemed confident about defining stakeholder groups on a more general level. Both groups reproduced similar standpoints on the role and responsibilities of the academic sector.

They put a strong emphasis on local community and NGO involvement. Thus one respondent pointed at the essential different structure of the NGO landscape in the MENA region, the majority was unaware of this. In the same context the importance of public acceptance was highlighted repeatedly. This is particularly interesting when compared to the case of Egypt, since the argument was voiced but with a much lower priority. Egypt before the 2011 revolution has not had a big tradition of civil disobedience or protest against controversial infrastructure projects, accordingly the experts did not regard this as a pressing obligation. Further most respondents considered it a challenging task to create effective public participation processes in the rural areas suitable for plant allocation. The main reason for this was described by poverty related problems outweighing environmental interests. Within the Desertec context many respondents pointed out job

creation and subsequent incomes as major benefits, referring to locally created jobs. When looking at the ISCC in Kuraymat most employees are sourced from either Alexandria or Cairo. The benefit creation for local communities then is reduced to grid connection and accordingly their stake in those projects becomes less evident. The respondents who were aware of this dynamic suggested to take additional efforts for neighbouring local communities through CSR projects by involved market parties.

Within the context of Egypt two major perspectives on state involvement were identified. Most Egyptian respondents pointed without hesitation at NREA and similar ministerial institutions to address the state interest within the projects. In contrast those respondents who were directly involved with the ISCC in Kuraymat (mostly foreign experts) agreed that the current government involvement has a negative impact on the projects proceedings and that efforts should be made towards loosening the ministerial grip on projects.

Moreover in the Egyptian context many concerns were voiced about intentions and foreign agenda setting. The prevailing assumption that the concept “solar energy from the Sahara desert” fulfils the European demand for renewable energy fuelled the concern that national interests could be sacrificed. This has been vaguely described by respondents from the Desertec context as well. Underneath this concern lies the juxtaposition of a top-down country-to-country approach versus a bottom up trans-regional civil society-to-civil society initiative. According to this the selection of stakeholders can be viewed through these two perspectives.

Knowledge transfer and technology transfer

The answers of the respondents regarding the theme knowledge transfer and technology transfer reflected in large parts very similar viewpoints. Whereas in the Desertec context experts repeatedly pointed out the necessity for vocational training and importance of intercultural training. Respondents in the case of Egypt voiced an urged for training for governmental staff involved in project development and implementation. The case of Kuraymat was described unsuccessful in terms of knowledge transfer, which is largely due to a lack of absorptive capacity. This lack of absorptive capacity is also described in other fields of industrial collaboration and was partially be derived from a lack of resource allocation for training in the project planning. The tension arising from commercially tendered projects and poorly funded governmental project owner creates a

vacuum of extending and proliferating the given project technology and is accompanied by a perceived absence of ownership.

Due to the presence of the ISCC Kuraymat respondents in the Egyptian context could distinguish particular fields of missing knowledge such as quality testing and assurance, performance monitoring, operations and maintenance and optimization. One respondent suggested the installation of technology transfer targets in contractual agreements and some other respondents agreed that the lack of knowledge and technology transfer partially derives from the difficulties accompanying an infant industry such as the CSP industry. In this regard interviewees uttered that despite of recent publications on local manufacturing potential there is still a lack of in depth research, particularly pertaining to the localization of production.

It becomes apparent that the expectation of what knowledge and technology transfer should bring varies enormously with the interpretation of the concept “solar energy from the Sahara desert”. The concept is currently in no initiative elaborated extensively sufficiently to make final claims about what is needed for what. One respondent defined successful knowledge transfer in having a wholly Egyptian team being able to plan and construct a CSP facility. Another respondent defined knowledge transfer through having a regional component production factory and yet another respondent voiced that experts need to be exchanged between companies of both regions for successful knowledge transfer. Different goals imply different paths of achieving them.

Theoretical reflection

The research shows that capacity building is necessary on all three capacity levels as stated by UNDP.

On the level of an enabling environment the case of Egypt shows that recent political transformations are in an early stage and social norms currently undergo a massive transition process. The implementation of the concept “solar energy from the Sahara desert” requires societal embedding on a scale that is new to the region. Societal awareness and acceptance point at a new configuration of inter-societal power relations. Power relations and policies are also integral aspects of the international relations amongst North and South. In Egypt there is a cautious approach towards international assistance to be observed, due to a fear of impairing foreign interference and hidden

agendas. Thus the experts from the Desertec context discussed the issue, little concrete action or confrontation with practicalities emerged.

On an organisational level it became apparent that neither the Egyptian system and its according procedures, nor the institutional framework are prepared to increase positive impacts on sustainable human development. Most experts agreed that knowledge transfer and capacity building are required on this level in order to assist the maximizing of benefits. Whereas experts in Egypt voiced this requirement more frequently than experts in the Desertec context.

On an individual level it was found that the core of required knowledge is found in practical experience. This experience is rare due to the fact that compared to conventional and some other renewable energy technologies, the amount of existing CSP projects is small. More generally experts found that the transfer of CSP specific knowledge and technical skills is a major aspect of creating benefits for the target region. The interviewees in the Egyptian context stated that currently in the existing project of Kuraymat this transfer is not successful. In context of Desertec the respondents were unaware of the detailed proceedings in the project and hence did not make any suggestions towards improving this shortfall.

6. Conclusions and recommendations

In the following chapter I will give some conclusions which are established on the basis of the discussion of results in chapter 4 and 5 and on the overall research process.

The way in which CSP projects can positively affect sustainable human development process in the target countries has been explored in this thesis research. Improvements could be made according to the conceptual model applied, could be achieved on all three levels: enabling environment, organizational level and individual level. The capacity aspects chosen initially to approximate those levels comprise a very wide range of issues. Of those only two could be researched in more detail due to time and financial limitations. It became clear that further investigation of the interplay between anticipated benefits and the existing structure in individual target countries requires further research. The dimensions of capacity aspects and accordingly the levels of sustainable human development are directly dependent on the framework conditions and can not be generalized for neighbouring countries.

Moreover there is a range of topics addressed in this research which display staring points for further investigation due to their controversial and uncertain nature. Upon reflection certain issues evoked absolutely opposing responses. One of them being the views and perceptions on the handling of IP rights in CSP projects. Whereas one group would describe the topic as negligible and redundant, another group would describe it as one of the major problems to be solved for CSP projects in the MENA region.

Another similar observation made was pertaining to the above mentioned issue of the rights of local communities. This was directly related to the respondents more general views on development, human rights and the relationship between public administration and civil society. Those opposing views turned out to be one factor contributing to a disintegrated cluster of experts in the MENA region. It was observed that the most severe disintegration of views are to be found between experts from technological planning units on the one hand and from developmental planning on the other hand. Some critical experts were singled out, did not participate in certain concept related events and reflected an overall hostile environment. This in turn seems to have caused certain damage so far to the discourse on the concept “solar energy from the Sahara desert”. It also makes the collaboration amongst some agencies very difficult, which in turn is a loss for the regional discourse. In order to assist further collaboration this structure should be investigated and underlying power dynamics be revealed. It seems that an orientation in this complicated structure has become increasingly intricate since the revolution.

Moreover the research hub planned in Kom Ombo under collaboration of Italy, domestic Egyptian industry and several Egyptian universities, is an expression of this effort. The University of Cairo is currently involved in a research project developing a mirror surface suited to the particular demands of the desert climate. This adaptation to North African conditions reflects an engaged initiative that is likely to operate more efficiently with sufficient research funding. Both these networks give important new insight for the support of organizational capacity, as junior professionals get trained here and will be likely to enrich the labour market in the aftermath. It should be researched to what extent it is possible for other countries, interested in such collaboration, to support comparable indigenous initiatives.

More generally experts agreed that the FiT scheme was not a realistic option under given conditions and that despite experiences with Kuraymat and Kom Ombo the intermediate future will rather hold more EPC and/or BOO/PPA financed projects. For further planning it would be very valuable to enclose which contracting structure delivers more beneficial conditions.

The research shows the crucial significance of balancing beneficial effects for sustainable human development from the concept of “solar energy from the Sahara desert” on the micro (community) and macro (society) levels of target countries. It was found that currently a detrimental approach is followed by state agencies within the state context of Egypt, that are likely to negatively effect the overall generation benefits.

It is very clear that for large scale CSP to create sustainable human development impacts the project pipeline has to be prolonged. The vast majority of jobs created are during the construction phase (1 or 2 years), which is expected to shrink with a scale up of the industry. This time frame does not express sustainability of employment in itself. It represents a major disadvantage compared to wind farms, such as the Zafarana wind farm in Ain Sukhna (Egypt), which was built during several years in different project stages. This procedure subsequently impacts on the income earning opportunities. In order to achieve similar impacts from CSP it is necessary on the one hand to put a stronger focus on long standing project pipelines, investigate further into the transformative refurbishment of existing fossil fuel burning power plants and on the other hand to explore additional dimensions, next to employment and participation, of creating capacity to benefit the sustainable human development of the projects. In order to increase the sustainability of the welfare impact of a project, there is a need to address corporate social responsibility (CSR) of involved companies. The competitive advantage of the CSP

industry is currently artificially established by means of FiTs or financing schemes of development banks. This could be considerably enriched by a pro active approach to CSR accompanying the implementation of projects and subsequent promotion of CSP technology (add recommendations).

On the side of public administration there is an intense need for restructuring the institutional context. As was already established in a report by Mosterd (2008) the current capacity collides strongly with the stated scope of responsibilities. Embedded in a renewed system there is a requirement to flesh out a new regulatory framework for local communities, stakeholder involvement and dialogue and the establishment of reliable transparency and accountability protocols. This would require in a first instance the acknowledgement of the existence of local communities (e.g. Beni Suef governerate, 2006: 2,3 mil inhabitants) in the Sahara desert and their entitlement within society.

On a more practical level it would advance current efforts considerably to establish a tri-lingual (Arabic, English, French) database of policies and project documents. Also it seems very viable to adopt the current South African practice of ante-implementation of training schemes which already are included in the tender to ensure the feasibility of sourcing employees locally.

The efforts of the Desertec network could be substantially empowered if there would be more project knowledge embedded within the network. Profound expertise on required knowledge and project aspects could be an integral part of the promotion of the concept on a larger scale.

7. Literature

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8. Annex

Benefit / Literature	World Bank (2010)	Erdle (2010)	Desertec (2009b)	Klawitter (2010)	MSP (2010)	Schinke & Klawitter (2010)	CTF (2010)	Richter et al. (2008)
Reduction of CO2 emissions		✔			✔	✔	✔	✔
Reduced dependency on fossil fuels		✔	✔		✔	✔	✔	
Electricity supply	✔	✔	✔	✔	✔	✔	✔	✔
Creation of local employment	✔	✔				✔	✔	✔
Societal awareness				✔	✔	✔		
Development of new industries	✔	✔				✔	✔	✔
Knowledge transfer				✔	✔	✔		✔
Technology transfer	✔	✔		✔	✔	✔	✔	✔
Water supply			✔	✔		✔		✔
Export + revenues					✔	✔	✔	
Democratization				✔		✔		
Economic Development of the MENA region	✔	✔		✔		✔	✔	✔
Development cooperation		✔						
Environment and Climate Protection		✔	✔		✔	✔	✔	✔
Sustainable Human Development in the MENA region						✔		

Annex 1 **Overview Benefits – Desk Research**

Guideline 1 - X

Introduction:

Please introduce yourself and state briefly in which context you are occupied with CSP projects in the MENA region.

1. The concept: energy from the desert:

a. Please describe your position in regards to the concept „solar energy from the Sahara desert“?
b. Which projects do you know that promote the idea of “solar energy from the Sahara desert”?
c. Which advantages result from the extensive application of CSP facilities in the MENA region?
d. Which risks and dangers could arise from the extensive application of CSP facilities in the MENA region?

2.Capacity aspects:

a. How important is the promotion of these benefits, in your eyes, to the feasibility of a large scale application of CSP?
b. What socio-economic processes are required to achieve these advantages?
c. Where do you see the responsibility for this tasks allocated?
d. Which international agreements could form the basis for assuming this obligation?
e. What are possible obstacles in the process of achieving benefits for the target countries?
f. How could the local markets be fostered?
g. How could the capacity of local supply chains be enlarged?
h. Which stakeholders should be involved in the planning of CSP projects?

3.Knowledge transfer:

a. What is the aim of knowledge transfer for “solar energy from the Sahara desert” from your point of view?
b. What structures are necessary to facilitate knowledge transfer?
c. Which layers for knowledge transfer can you identify?
d. What role does your institution play in the concluded and current planning of facilities in Kuraymat, Kom Ombo, Marsa Alam and Borg ElArab City?
e. Do you see a possible conflict between the paradigm of intellectual property for the market parties and knowledge transfer for regional development?
f. How do you view the relation between existing subcontracting structures, non-disclosure clauses, `on-the-job training´ and the aim of technology and knowledge transfer?
g. What kind of incentives could be installed in order to ensure successful knowledge transfer?

4.Stakeholder:

a. Which actors/institutions/organisations could initiate/propel those processes?
b. Which actors/institutions/organisations do you perceive as crucial for this process?
c. Which actors/institutions/organisations do you know or have worked with, personally, already?
d. Who do you think would be important actors/institutions/organisations for this research to include and why?
e. Do you think that some countries in MENA are more favourable than others for the large-scale application of CSP?

6.Conclusion:

a. Is there anything would you like to add?
b. Is there anything you think we have not discussed sufficiently yet?

(Annex 2 **Guideline 1 – X**

Guideline 2 - Y

Introduction:

Respondent name/organization – role in projects Kuraymat, Kom Ombo, Borg el Arab

1.The concept: energy from the desert:

a. Please describe your position regarding the concept „solar energy from the Sahara desert“ and the initiatives that promote the idea?
b. Do you think that some countries in MENA are more favourable than others for the large-scale application of CSP?
c. What possible benefits result from the extensive application of CSP facilities in the MENA region?
d. Which possible limitations could prevent the extensive application of CSP facilities in the MENA region from becoming reality?

2.Capacity aspects:

a. What does capacity building in this context mean and what should it include?
b. What socio-economic processes are needed to achieve the above mentioned benefits?
c. Who is responsible for curbing these processes?
d. Which international agreements could form the basis for assuming this obligation?
e. What are possible obstacles in the process of achieving benefits for the MENA countries?

3.Markets & Knowledge Transfer

a. What is the ultimate goal of knowledge and technology transfer for “solar energy from the Sahara desert” from your point of view?
b. How could the local markets be fostered and the capacity of local supply chains be enlarged?
c. Which parts of the value chain could be Egyptian?
d. Do you see a possible conflict between the paradigm of intellectual property for the market parties and knowledge transfer for regional development?

4.Stakeholder:

a. Who should be involved in the planning of a CSP power plant?
b. What is the benefit to the local communities if a CSP plant is constructed in their neighbourhood?
c. What measures could improve the generation of benefits to the communities?

5.Network:

a. Which actors could initiate/propel those processes?
b. Which actors/institutions/organisations do you have worked with already?
c. Who do you think would be important actors/institutions/organisations for this research to include and why?

6.Conclusion:

a. Is there anything would you like to add or you think we have not discussed sufficiently yet?

Annex 3 **Guideline 2 – Y**

Dear Mr./Ms. X,

(I received your contact through Y.)
I am currently researching for my thesis on capacity building and knowledge transfer for CSP facilities. I study at Utrecht University in the program sustainable development/environmental policy and management. I am currently researching at CLISEC in Hamburg and examine the case of Desertec.
In this context I would like to conduct an interview with you.

I am aware that you are very busy. Still it would be very nice if you could spare an hour in the coming weeks to be part of my research.
Attached you find my research proposal to gain some deeper insight into my study.

Kind Regards,
Jana Platau-Wagner

Annex 4 **Interview Request I**

Dear Mr./Ms. X,

(I received your contact through Y.)
I am currently researching for my thesis on capacity building and knowledge transfer for CSP facilities. I study at Utrecht University in the program sustainable development/environmental policy and management. I have already been researching at CLISEC in Hamburg and looked at the case of Desertec. Now I am at RCREEE as a visiting scientist to look at the case of Egypt. In this context I would like to conduct an interview with you pertaining to the scale-up plan and the projects in Kuraymat and Kom Ombo.

I am aware that you are very busy. Still it would be very nice if you could spare an hour in the coming weeks to be part of my research. Attached you find my research proposal to gain some deeper insight into my study.

Kind Regards,
Jana Platau-Wagner

Annex 5 **Interview Request II**

Capacity	
Code	Quote
C1R3Q1	The countries shall not buy just equipment and install it there. (…) They will get more acceptance for the industry of Europe and other countries, to say okay we can invest there, there is a long term investment possibility and it is much cheaper and effective if we bring not complete equipment but we bring in some structure for producing equipment and then train some people locally to work on it and manufacture products and then we can work with them together on improving this equipment, making local research on the spot, increase quality and decrease price.
C1R16Q1	institutional capacity building – NREAs problem is that it has many heads. It is a planner, a developer, doing maintenance, operation, research and capacity building. They can not fulfil all of these functions. This is too much. They can be debundled for a maintenance company, a development company, capacity building and so on. Trying to do all this functions and they don't have the time or the capacity to do all that. There has been a consultancy for many years, involved in that, there has been the same recommendation: to debundle NREA.
C1R19Q1	Capacity building is a certain market volume that is achievable for the industry. Only if you have a certain market capacity you are able to think about the industrial manufacturing of certain components. (…)It is also about having a project pipeline that allows you to invest in production lines with reasonable returns. At the end of the development you will have a ready mounted product.
C1R23Q1	Capacity building is many things. We have to create vocational training. We have to create knowledge on project development we have to create experience and develop ideas on best practices, including institutional capacity development.
C1R25Q1	We need a cultural change in how to do things. What is it that we are missing? This is why I want to teach student and we need to inject that into them. There is nothing good that you can base this industry on today in the MENA region. Change the culture. Even punctuality, you can not go to a conference opening in MENA without it starting 30 or 40 minutes late, because the officials opening are coming late. I know now with this societal attempt to change, they want to change for the better. They look up to Europe and the US and they wonder why life is better there, but it really is because there are certain concept and people stick with it. Even policy making, people here do not know how to sit down and elaborate proper policies that work. So we do need capacity building on that level as well. Institutional capacity building in the region created a monster, in terms of inefficiency and wasting money for conferences and meeting that do not lead to anything. Creating institutions with a good will only, is a waste of time
C1R26Q1	Capacity building is a very important issue. Capacity should definitely entail the dissemination of information about the CSP technology and the communication of the larger concept of "solar

	energy from the desert". Also it must include training of experts from government and industry. Further institutional capacity building is necessary regarding policymaking and project management.
C1R27Q1	I think human capital development is a core of capacity building. It should contain an educational strategy to foster renewable energy professionals. It has to enhance the capacity and training of labour for operations and maintenance and needs to build the basis for adapting the technology to the harsh local conditions. In terms of local industries, there need to be incentives for foreign direct investment to be set. Also I think it is necessary to stimulate local construction capacities.
C1R30Q1	I see that people in the region do not perceive the opportunity yet. So capacity building has to aim at creating awareness for the project and the opportunities it holds for the region. We need to communicate the concept on various levels NGOs, governorates, Industry and local communities.
C2R13Q1	We have to make the awareness of the technology by capacity building. We need to increase the share of local manufacturing.
C2R14Q1	You need more engineers and more technicians. I mean probably more is needed, like a connection to the international research community and we need more doctoral candidates. You need running plants produce electricity and give work to engineers and technicians and also plants that show the demand for investments for further capacity building. You need medium sized projects for a future perspective.
C2R15Q1	The base is there: glass, construction, steelworks, controls. We need additional capacity in that and expand that. We need more players in that.
C2R17Q1	We have to establish Research and Development in this country. We have to create this capacity here in the country this will be a very good guarantee of the success of the program in the long run. (…) They will make everything, not only maintenance, but also development of these projects. Of course we need capacity building on institutional level as well, for example for the public administration to convey that it is not only a technical issue.
C2R20Q1	You really need the political will. You need to focus capacity building on political decision making, on how to create a public opinion about the importance of renewable energy.
C2R28Q1	I think capacity building should include knowledge and technology transfer. Capacity building should aim at creating capacity for design, storage and operation and maintenance. (…) We really need to establish capacity for quality assessment, for components just as well as for assessing the overall process quality. It is necessary to get fundamental guidance for CSP project management, in order to gain independence.

Annex 6 **Quotes: Capacity**

Theme: Opportunities	
Code	Quote
C1R1Q1	I think in general mankind will benefit, because it would be the beginning of a large scale transition. It would make a very important contribution from fossil fuels to clean fuels. Coal and carbon fuels and nuclear fuels have to be replaced. It would allow to replace that. It could be the initiating project. In this region (EU-MENA) for the supply of Europe but also for the domestic demand. The volume is so big, that the expected cost reduction of the technology would be so big, that the cost would become lower or competitive with costs from fossil fuels. Then we have a global tool for the transition.
C1R1Q2	This is not the cheapest but this additional money is not lost somewhere in the sand, it is spend for creating jobs and developing an industry in these countries. The industry in the country is what will give them higher income later. It will have follow up industries, many industries, it will be a driver for industrialization and that will be very much for the benefit of their industrialization, which will create development. This is the one reason. The other reason is that they can operate and run these plants by themselves.
C1R2Q1	I actually rather believe that Fresnel technologies, with the possibility for agriculture below the mirrors presents mainly a range of benefits. To me it presents mainly advantages. You can even achieve cooling effects with it.
C1R3Q2	Correctly making it is to save a lot of transportation cost and try to do the equipment locally in the parts where it will be installed. That will provide industry and jobs in the area and will help people getting more efficient in thinking and acting and that is giving advantage for democracy.
C1R3Q3	Another thing is that the people have an understanding for it and electricity is something that not only comes from a plug but they have to do something for it and than they will have more understanding for their natural resources. Then they will have a benefit from it. It is a change of

	mentality.
C1R16Q2	Desalination and jobs would be other benefits. I believe also domestic industry development, with CSP components being produced locally – we can make up to 60% of the components here. You need to collaborate with EU companies. You should really look for the MENA market, you need a certain volume for this market.
C1R18Q1	Participation is key, especially of the local people, Not only of the local decision makers and the power holders, but the people living in the area (…). This will end in jobs and economic participation and add on a completely new set of benefits. (…) I am thinking of an iterative participation process, so you can cover learning of the people and give them the ability to decide.
C1R19Q2	Fossil energy is limited. Sooner or later you have to make a shift. (…)The sooner you do the shift the better it will progress. It has benefits for foreign companies in terms of profits and they will create jobs for construction, commissioning and operation. It is a clean energy and you protect your environment and don't pollute it with dirty sources like coal and oil. It has a lot of benefits resulting from the sunbelt characteristics.
C1R21Q1	I you do it right, it would be beneficial first of all to the end user. It will benefit the innovator, to supply a technology that will satisfy the demand and will suit the setting. The investor in between will facilitate the situation which will in turn create the win-win situation. So here you have to demonstrate to them in the export first option, how it will benefit the people here in the long run. At the end of the day it must benefit the local market.
C1R22Q1	There are many advantages. One is the self sufficiency in the long term of energy, MENA would be exporting energy as well, possibly exporting technology as well, creating jobs, helping the development of the countries. Europe there are good things too, have some carbon credits. Europe gets the electricity and also having economic development in MENA is going to decrease the demographic push of people going to Europe and look for better opportunities.
C1R23Q2	I think you can ensure spill-over effects by educating the people in the region with specialized knowledge that could be integrated in the projects implementation, but that will not provide benefits for all people in the area. I think one way of implementing this could be done through corporate social responsibility programs of the contracted companies.
C1R27Q2	Of course there is the technical argument of dispatchability, due to the potential for storage. It is suitable for small or fragile grids. In the case of Morocco for example the storage option would be highly beneficial for the grid. Moreover there is the argument of job creation. We are in the process of researching the effects on GDP impact, in terms of how to stimulate spill over effects. It is usually a natural process to have knowledge transfer and create a certain know-how over time. From a political perspective a main benefit would be to create hope through a future vision for the region. Through corporate tax and withholding tax (import duty) you will have increased revenue for the whole state.
C1R29Q1	The main benefits will be industrial development, education and local off take. In general the Export is basis to get the whole process going, because of the strong interdependence of export and other financing options.
C1R30Q2	This would create benefits on the level of education and vocational training. Also it would mean that you assist those societies which are currently in turmoil to create new perspectives through generating a new export flow for their economies. I believe this could lead to some mind altering experiences and it could change the overall consciousness. It would allow those countries to harvest their natural resources. Moreover I believe that the large-scale application of concentrated solar power allows for the provision of baseload power plants. This would mean a significant enhancement of the energy supply structure. Today we already have temporary black outs and provision lags which present serious threats to the infrastructure like hospitals in some regions.

Annex 7 **Case 1 Opportunities**

Theme: Limitations	
Code	Retrieval
C1R1Q3	So the risks are of course that Europe becomes dependent on power supply from North Africa. That is different from oil, because of the way you can store oil.
C1R1Q4	Corruption is the only obstacle I can see. Corruption could lead to projects of minor … being done, only to channel money into some pockets. Corruption prevents development.
C1R16Q3	I feel the main threat is political instability. This will increase the financial risk and increase the lending rates. We are in the situation that things will stabilize maybe it takes half a generation. You have seen what is happening to the gas pipeline, this is because we still have instability. If

	people are hungry and they see investors grabbing millions of dollars, there will be the desire to revenge. You need to look at the social stability.
C1R18Q2	The main limitation and this is independent from the region, is that we don't have feasible economic models how to run such systems. It is about how to get the investment, how to set up a business model for the plant, how to calculate the electricity prices and so on.
C1R18Q3	So the main obstacle I believe is the trust in the people. Many of my colleagues in the foundation don't think that people are able to create their own processes – this is one of the main obstacles. Many of the German people think we have such democratic processes and they should copy those processes. But I think that wont work, they have to create their own way of civil society dialogue.
C1R19Q3	Everybody wants to protect his knowledge, so they guard their IP. This is a big obstacle of the development of the whole CSP industry it does keep the industry from developing itself.
C1R19Q4	Cultural differences are a major obstacle in the daily work, but I do not understand why. We always talk about cultural differences they are not able to do the job because the culture is a different one. An example that would prove the opposite is the airline industry and it works here very efficiently. Maybe we are not able to explain to them, how valuable the plant is, how much money the plant is worth. From my point of view, it works in military or in aircraft industry. They have a certain discipline. We have to implement certain accuracy in our field as well.
C1R23Q3	I think the main obstacle could be the education of the people at the moment. I see a problem there. People are well educated at universities and you have many engineers, but they don't have the same education as other engineers in the CSP markets, educated in industrialized countries.
C1R25Q2	The lack of coordination between the different initiatives. It is not acceptable, because Europeans know that they have to do teamwork here. Why can they not get together and set up one plan together. It is just going to be pockets of individual activities here and there. Just like the grid in the MENA region, now they only realizing the benefit they get from connecting to neighbouring countries. Another point is the poor infrastructure in the MENA region, especially if you want to sustain this industry and there is a lot of money necessary for that. I don't think the Europeans are ready to invest into the CSP industry to flourish here. Also the graduates here are not up to the challenge.
C1R25Q3	The intention of the people from Europe is a real obstacle.
C1R26Q2	To my mind the main limitations lie currently in the high cost of the technology and in the technology transfer. The main issue here is the localization of manufacturing and the lack of knowledge on it.
C1R26Q3	As already mentioned technology transfer and costs are major obstacles. Moreover a disregard of intercultural differences. We are facing significantly differing understandings of work, efficiency and awareness. I.e. there is no awareness yet in the region about energy efficiency and the potential of economic gain through this option. This sort of process is very time intensive.
C1R27Q3	I tend to believe that when the stimulation of the educational system does not take place it might display a severe obstacle. A limitation right now is to create regulatory frameworks and support mechanisms that are attractive to investors.
C1R27Q4	Another limitation is posed by the fact that there are other renewables which are more competitive and there are some overlaps. A lot here will depend on the development of storage technology.
C1R27Q5	Water scarcity might impact the development of the process in the future. Dry cooling technology still needs more development and water is already an obstacle in inter-MENA relationships.
C1R29Q2	The financing is definitely a major uncertainty up to now. A broader concern that is also valid is the political stability in the region and in the individual countries. We also do not know how the price reduction of CSP will continue and this will be a crucial factor to the time frame and the intermediate success of the concept. Another limitation would be the establishment of regulatory frameworks, but I am rather confident on this one.
C1R30Q3	In general there are the three most important limitations which are described in literature so far, which are financing issues, security issues and the current lack of political will. From my perspective those three can be summarized as fear.

Annex 8 **Case 1 Limitations**

Theme: Local stakeholder	
Code	Retrieval
C1R1Q5	In particular in North African countries, there are no real visions. The academic sector should support visions for the development of the countries.
C1R2Q2	I think there is a right of the neighbouring communities of information. I do not believe that the people there are in a situation that they can be involved in a decision making process. But information has to be disseminated.
C1R3Q4	Universities have to be included and industry has to be involved so they understand they have to do their own research and the social communities, small communities, which do not have a direct benefit from the CSP, but they have an indirect benefit by being connected to the grid.
C1R3Q5	Besides governmental organisations, it is important to look at NGOS because they have a much better base with the local people, who don't have so much contact with the government. And they can convince them they are very sceptical in their nature.
C1R16Q4	The benefits to the local community are mainly jobs and the infrastructure, you establish roads, provide power for them.
C1R18Q4	I think we should be a little bit careful, about how to integrate the people living in those areas. Not only in terms of financial participation they will receive some money, water and electricity. But this is not enough from my perspective. (…) I don't think that we will achieve ownership by giving them some money. We need them to design the whole concept. This is not covered at the moment by any initiatives.
C1R18Q5	All those people who have power at this moment are successful in the old system. (…)Maybe you have to look at people who are not so successful under the current systems. You have to start with the younger people. Maybe those people who have initialized the Arab spring.
C1R18Q6	One GW power plant will cover 40 square kilometres, if you have to guard this with armed guards, it will be more expensive. Hence we need the acceptance from the local people.
C1R19Q5	During construction you create much more jobs, than you do during operation and maintenance. In Andasol 3 there were 400 to 500 people on site during construction, later during operation you have only 40 people. But you need to assess their education, it is very important that you have people that can communicate. To have a base communication, in terms of understanding and the implementation and feed back of work orders. You need to know: okay they did their job and the job was good or bad and this is what we need to improve. It is necessary that they can write something down and this in a language that is international, like English. Another thing is a typical European one: it is a certain kind of discipline. But for the skilled labour, you will not find them in the vicinity of the plant, but you have to go and attract them from big cities to come to live near to site and work in the rural areas.
C1R21Q2	I mean you should have a vision. Having a vision is one thing that was lost over time. But as a social scientist and as a political activist I have a vision. I think you need both, the technocrat who knows how things work and a politician who knows where he wants to go.
C1R22Q2	They will not be people neighbouring the plants, because it is in the desert. In those countries nobody is involved, the government decides and they are going to do it. The people are going to work there and they can benefit from it.
C1R22Q3	There are other problems now. The last thing people will think of are the local communities and to work on them. The bigger problems people are looking at, this is not one of them it is not on the radar. I am not saying it is not important, but it is not on the radar.
C1R23Q4	A CSP plant is mostly constructed in the desert, in unpopulated areas.
C1R24Q1	The decision makers are well aware of climate change but maybe not all the people are. I think it will be a chance as well for Arab non-governmental organizations that start working on raising the awareness in terms of renewable energies and environmental protection.
C1R24Q2	I think we need in addition to these engineering studies we will need some social studies. We need the people to be moving from poverty to rural municipalities in the deserts. Most of the people think why should I do that? We need to show them that they are going there for a better live, for better services and communities and healthcare. That awareness should be raised.
C1R25Q4	If you decide on a location on the basis of such an assessment and the developer has really the intention of developing the area, use those local communities. After assessment you realize what they can and can not do. Establish public awareness meetings with the Communities and find out what they want to do. If you open the door to the community, you will have a lot of genuine and innovative ideas coming up and by doing that you will give ownership to the communities.
C1R26Q4	Of course you need to involve the relevant industries and ministries potentially regional centres for

	research should assist. Moreover it is very important to consult with the local communities and make sure that the project is well integrated.
C1R26Q5	Making the establishment of benefits to the local communities an additional focus in the planning and promote possible development opportunities on the project sidelines.
C1R27Q6	It needs to be communicated well, in terms of benefits as well as in terms of disadvantages such as water and land use issues. As you can see in the recent Californian projects this is crucial to have the support from the local communities.
C1R30Q4	The socio-economic benefits can not simply be measured in terms of GDP, but rather by a comparison of indicators in different national contexts. What we actually need here is very close to what is described in the Millennium Development Goals, we need to work towards goals like eradicating illiteracy and the empowerment of women. We need to encourage pupils to go with their education in the fields that are required for the application of renewable energy.
C1R30Q5	I think we need to involve all potential stakeholders and maybe install something like the German model of the "community energy manager". This sort of inclusion does imply a democratic involvement into decision making.

Annex 9 **Case 1 Local stakeholder**

Theme: Knowledge and technology transfer	
Code	Retrieval
C1R1Q6	Knowledge transfer is first you have to have people who are able to understand knowledge, so general education. Like universities and so on, also primary schools is not the normal case everywhere there. There are too many illiterates there.
C1R1Q7	The vocational and scientific education and research capacities. This has to be prepared by these countries to be able to receive knowledge. If they are not there knowledge transfer can not happen. Technical sector, management sectors – I think management is differently developed, you need management skill transfer.
C1R1Q8	One thing is knowledge and technology transfer and one thing is knowledge and technology disclosure, these are two different things. Maybe we get the Chinese solution. That the Chinese learn everything, they go around and take a few pictures and then they don't need contracts. Say they are in violation of some patents it may take years to fight that out at court. So that protective approach becomes very difficult to be implemented. If you become too protective you loose partners there.
C1R1Q9	Institutes of technology, engineering departments at universities and high schools. They need to have the capacity to teach and absorb the knowledge. It is not only about patent knowledge transfer but also about competence, to use knowledge properly. If you transfer knowledge it has no impact unless the knowledge becomes operative. To make knowledge beneficial is the most important.
C1R2Q3	It is very difficult. I believe we need to have experts send to the region who help to promote the understanding. Also the people have to come here as in the structure of Remena for example. They have to be able to elaborate the basics for the thing down there. It does not help if an engineer goes there and does not have any local knowledge. We have to install a phase where we comprehend the region and approximate in our understanding. This is totally different in each country of the region.
C1R2Q4	I think that trade chambers and comparable industrial organizations. I could also imagine that people who are already retired go down there and apply their accumulated knowledge.
C1R3Q6	We don't need special structures, but building a factory to produce that equipment will cause the knowledge transfer, it will come with the factory.
C1R16Q5	I see a conflict. Intellectual property should be restricted and there is a price for it. I think this can be done in the frame of technology transfer or joint ventures. This is well recognized, we suffered from that in the first phase of Zafarana. The government refused, because of added costs to invest in it. The agreement in the parliament removed that clause totally. Even if it would have cost more money, it would be better now. We still have not manufactured anything.
C1R16Q6	Yes I think so. We have different cultures regarding regulations and contracts. That is one thing we try to achieve in Remena to understand both sides. Now you know how Egyptians think, you can easier achieve agreements.
C1R21Q3	I mean you can always verify this by looking if people from the South got send to the North for training and if that did not happen, you know you did have any knowledge transfer. How many

	of your people have been sent to be trained with your partner in the North? That would be the value added. So it is really about how we can decrease the share of fake knowledge transfer. We need to elaborate how we can create a common ground where they can meet.
C1R23Q5	I think the best case is interconnection between governments and private parties. If foreign companies are entering these markets, joint ventures are a very good option. Joint ventures with a local partner, I think knowledge transfer will follow up. Even if they don't exchange key knowledge, they will gain massively in terms of project development. I think that is a main important step.
C1R26Q6	To my mind the main limitations lie currently in the high cost of the technology and in the technology transfer. The main issue here is the localization of manufacturing and the lack of knowledge on it.
C1R26Q7	As already mentioned technology transfer and costs are major obstacles. Moreover a disregard of intercultural differences. We are facing significantly differing understandings of work, efficiency and awareness. I.e. there is no awareness yet in the region about energy efficiency and the potential of economic gain through this option. This sort of process is very time intensive.
C1R27Q7	It really is dependent on how you define knowledge transfer. It will come along with manufacturing, but I don't believe that MENA will have cutting edge technology for the next 5-10 years. I don't believe that sending over intellectual property rights would help or make a big difference here. The role of the local research and development will be adjusting the technology to local conditions. Components such as receiver tubes are currently in the hands of very few companies, but it will scale up in the long run.
C1R27Q8	I think the range of people with extended knowledge on this topic is small, because socioeconomics are new to the overall research on the concept.

Annex 10 **Case 1 Knowledge and technology transfer**

Theme: Opportunities	
Code	Retrieval
C2R4Q1	The first benefit will be an own industry, this will be job creation. For the normal person they will not feel the effect before 3 or 4 projects.
C2R6Q1	But in a large scale approach everybody will benefit. It is understood that Europe is looking to diversify their energy sources, so the target by 2050 will ensure that prices will go down. Also there is a much increasing demand for energy in the south Mediterranean. So it could cover substantially the demand for energy which is related to socio-economic development.
C2R6Q2	I could not identify specific levels of benefit in Egypt, but of course the electricity industry will benefit. A lot of services like equipment and components will benefit. Secondly it could benefit also the export, when you can provide greener services and products it will increase the share of the market. We are focussing very much on green tourism this is the guarantee of a sustainable business.
C2R7Q1	The other angle will be that they have a diversity of relying on sources of energy, as you know the recent problem happened in Japan disaster that made people stop thinking of the nuclear energy for example the Germans have put a plan to abandon the nuclear power energy at a certain time so I think the y will be looking for a diversity of sources of energy and I think that the solar would be one of the sources that could replace some of the nuclear power energy plants.
C2R7Q2	I can imagine that having this huge power of production of solar in the desert of Egypt could help that certain communities develop around this area. People start to go there for operation and maintenance and for constructions and it will start to develop additional communities that will help the people to begin to go to other communities instead of being concentrated in the Delta what will help change the mentality of the people to go somewhere else.
C2R7Q3	Environmentally people will benefit, they feel it not in the short term, but they will not have any emissions that compare to conventional power plants. So indirectly the community around those areas the community will benefit. School visits happen from time to time. I don't think there is no other benefit than awareness this could be an additional benefit.
C2R8Q1	The only benefit is that people find work there. We have local guards, security people and lower skilled employees from the neighbouring community.
C2R10Q1	Job creation is a major benefit to the region. We hope that it will also help to address the water

	issue, to manage the water needs in the region. Desalination is more and more important.
C2R12Q1	The long term advantage is related to Egypt's predicted rising energy demand (annual growth rate electricity demand), at the latest in 20 years they will have serious trouble to cover the supply to their gas power plants.
C2R13Q2	The people living in the area of the project should be employed in the project. The other workers who come into the area also generate additional benefit for the local community. A longer project pipeline would increase the long term benefit for the region.
C2R14Q2	As I said before you need reference projects. We were talking about the issue of credibility and involvement of civil society. At the moment we have the whole electricity sector heavily subsidized, so there is no need for CSP projects. For most people electricity is coming out of the sockets, because it is artificially subsidized. This is probably one of the main detriments in the overall context, because nobody feels, except from the visionary thinkers, the necessity to go alternative ways. At the same time the conditions in Egypt are almost ideal, enough sun, a lot of space. It is just a matter of time. I see the benefit that Egypt can play a leading role.
C2R17Q2	We need successful examples and we need to begin with demonstration projects. When people find that it is successful, people will multiply. But it needs to be tuned with people, from the very beginning. We will find new applications such as desalination.
C2R20Q2	The provision of energy would create definitely benefit for any villages in the area here. There are many areas which are not connected.
C2R28Q2	The benefits lying in a chance to satisfy the domestic energy demand and having a potential commodity for trade. The large scale application will result in job creation and with technology transfer we have the perspective of developing a new industry.
C2R28Q3	I think the direct benefit to local communities is the employment opportunity, the energy provision and the overall development of the community.

Annex 11 **Case 2 Opportunities**

Theme: Limitations	
Code	Retrieval
C2R5Q1	I think the problem is that this: when you deal with the middle income country, the government itself has usually the upper hand when it does something The ideas come from the donor community and the international agencies. But the ideas and the implementation and integration, needs to come from within the country.
C2R5Q2	Whether it is on renewable energy or on energy efficiency, the amount of awareness is very poor.
C2R7Q4	I did not feel that with our German partners in Kuraymat, they were really open with us and keen to answer all the questions we had. It is only that we do not have the people or calibres that are well receptive of the information they gain, they are not there yet to get benefit of the information.
C2R9Q1	As long as we foreigners are staying on location, nothing will change. The local people don't expose themselves by taking action too much, they are waiting and watching. They should understand that this is a real chance. They only have cement, tourism and Suez channel for economic industries and all three are recently very weak. We are too expensive, we can not stay here forever. It s our job we have to transfer technology, hand it over and see what they are doing. What we are missing here is the awareness, that it is their baby, they have to take care and make it successful.
C2R11Q1	Really the problem are the projects itself, we have a lot of talk but just very few projects coming out. In the last 5 year we only had Kuraymat and Masdar city, but nothing else really launched any tenders. If they would be some projects, some companies like Schott or Siemens would think about opening a branch in the region. For the supporting structure there are some capabilities. In Kuraymat we could do most of that locally. As for the localization of components, we have to deviate a little bit of the concept of the work in CSP industry. If we go everything automated it would not work, because we need a lot of employment and the automation does not allow for that many jobs.
C2R12Q2	From Europe and the experience here, we know that as long as the government does not signal the market a long term (20 years or more) insurance, that are the first, second, third and fourth plant comes. As long as they don't give the market a clear cut signal that every year so many CSP power plants could be build under a policy and a clearly announced and structured FiT,

	nothing will ever happen.
C2R12Q3	In my opinion the biggest risks is in that we don't have enough capacity building and research activities to properly operate the first plant, so it does not give a bad name to the technology. This is for me the most dramatic risk I can always see with this kind of attempts, to transfer technology.
C2R12Q4	Some countries due to their location on the Mediterranean basin, have no chance to export, therefore Egypt is out. Egypt can not export to Europe, neither direct nor indirect – even trying to find a corridor failed (Cyprus). Egypt is in an unfortunate situation. It looks very good for Maghreb.
C2R14Q3	It is also a governmental problem the bigger such a project is the more involvement you need from the government. Currently with all the turmoil after the revolution, you will have a hard time to find somebody to take decisions.
C2R14Q4	At the moment we have the whole electricity sector heavily subsidized, so there is no need for CSP projects. For most people electricity is coming out of the sockets, because it is artificially subsidized. This is probably one of the main detriments in the overall context, because nobody feels, except from the visionary thinkers, the necessity to go alternative ways.
C2R17Q3	But is it for the private good or for the good of the country? I suspect very much it is not the good of the country. Frankly desert is not empty as you think there are people in the desert. You have to admit that they have rights also.
C2R17Q4	1d. I think if people are not taken into account there will protest and they will be against it. We have the accident of the Agrium factory, where people have prevented the construction of a polluting factory, because it would have destroyed the tourist advantage of Damietta city.
C2R20Q3	2d. Sometimes I feel very sad. I was invited to Copenhagen and talking to people, setting up a framework and templates and discussing global issues and the creation of new sources of energy. But when it comes to solving problems we face the blockage of certain countries and then we go back to our countries with empty handy. However I think one way to get out of the problem, would be to create mutual agreements between two countries.
C2R28Q4	I believe the major limitation is the cost for the installation. The problem is strongly related to the size of the CSP market, which in fact is an infant industry with around 70 projects installed worldwide.

Annex 12 **Case 2 Limitations**

Theme: Local stakeholder	
Code	Retrieval
C2R4Q2	All of our projects are communicated in society, especially in the neighbourhood of the projects. We follow up the standards of the World Bank and JBIC and make the EIA it is one of the milestones to issue this project. We have evidence that the project will create positive impact in that neighbourhood. We did that for Kuraymat and we will do that in Kom Ombo. We have a good positive sign from the communities around our projects. We do public consultations.
C2R5Q3	4a. The best way to do it is through academia, involve academics and then do the knowledge transfer to them. Of course there is an entity responsible for renewable energy in Egypt, which is NREA. There are international entities like RCREEE and you have the Arab League and you have the donor communities. If we talk about NREA and RCREEE, they should form some sort of group and then they should with the different donor communities, the World Bank, the UNESCO, the UNDP. All of these agencies have their own expert. It shouldn't be that every agency is doing its own thing they should integrate it altogether. All these donors are willing to do something, but in many cases you find that things are either repetitive or done in isolation, stuff like that. We need a more homogenous and integrated community for that.
C2R5Q4	There is still a lot of awareness that needs to be raised. Whether it is on renewable energy or on energy efficiency, the amount of awareness is very poor. One of the problems with civil society is the political. If you get civil society associated with donors, then there will always be a question mark. There is some experience in the past with some civil society groups with donors, there have been pushing foreign agendas. So this should come from within, without foreign interference. How that can be done is a different thing. But it makes it more pure and more genuine. That is the problem of civil society in this area, they would definitely need ideas and support from donors, but if they are linked to donor groups too much, then they unfortunately become politically questionable.

C2R6Q3	A lot of problems the government could create for society, actually society pressure the government for doing this. I could not say that healthy environment for business, where the society is moving in one way and the government in another way. (…) So this is our and the governments responsibility maximizing the benefits from these projects. It is very important that a consensus or an agreement is there. This creates an environment where businesses and civil society could take it forward.
C2R7Q5	This was not in the plan or the vision of the precious governments, I hope with a new government this could be changed. The major hurdle was the government itself. It always starts from the education and in Egypt it was never done to support Research and Development. Running a country is like running a company in that regard. I believe the previous governments have never put this into focus.
C2R7Q6	Water issues are a problem in our country, but most people in our country do not feel or believe that this as a problem. We understand we are in the red line, but unfortunately this has not been considered with this plant. We have plenty of areas where water is wasted, for that specific project this was never been a request to reconsider additional innovations or whatever. There was one area which we already optimized, we took the initiative ourselves, one idea was to control the dust under the mirrors by the use of water, but we choose to go for a stabilizer to control the dust.
C2R7Q7	According to the environmental law, they have to have hearing sessions with local communities anyway. Involving NGOs in Egypt would be helpful and good, but it would need a huge restructuring in the financial balance sheet of Egypt. A city like Beni Suef should say that they are responsible of this project and they would get certain revenues and the project gets sponsored by the city. But this is not the way the balance sheet is structured everything goes centralized through EHC Egyptian holding company. But if we are like the US where each state has independence, this is not the case here. Everything is centralized in the capital.
C2R7Q8	People here are looking still for the basis of living, daily bread, some people work every day just to earn the money to feed their family. They are not looking for green energy. I do not think that a party with this initiative would have the support of the people. We have more important problems right now than this.
C2R8Q2	It should include the countries here in MENA. Involve them and give them the feeling that they are partners and not make them feel like they have to obey what European countries want to do. It is really important to create a real partnership to create a win-win situation.
C2R9Q2	The owner did not even know that they are the owner, not prepared. To export the energy might be a technical problem, but to make a reference plant for the world. But you have to work hard, to build a power station, which is running well, reliable and trouble free and this what we are doing here. Then you don't have to do big propaganda. But I can not see any efforts from the government to be the owner, be the driving force
C2R12Q5	The common man on the street, couldn't care less if there is CSP or not or PV or wind, they simply have a different priority list. The lights have not gone off in Egypt too often, sometimes like yesterday we had three hours of interruption. It is not the common man, even not the civil society that we have to convince it is the decision makers we have to convince.
C2R13Q3	The concept of large scale application of CSP included in the Desertec or Dii or MSP, is very nice and can be a future vision for the region. (…) It would require a special feed in tariff from North to South.
C2R17Q5	I think that the project of Kuraymat has more or less been implemented in a type of a turn key project. Who has been learning, who were the partners on the Egyptian side? Have you empowered people in our country in Kuraymat? People have not been empowered. I think that Kuraymat is just a showroom for Desertec. We don't need Desertec, we need to develop our people by our people.
C2R17Q6	We should look at the local people as real partners they are the owner of a project build in their area. We have to be sure that people really acquire technology. When I talked about the European side in Hamburg, I asked why would not use the concept of co-development and they refused this concept. Let's apply it on the level of the local community: co-development. You should coordinate with the major, but not work with him. You should try to support the local NGOs.
C2R17Q7	I think the obstacle might be that the project might be implemented in a very technocratic way and maybe not taking into consideration the local communities and also not creating the scientific and technological capabilities. It will be just a dead technical project, not giving real benefits to our country.
C2R20Q4	Definitely you also have to involve the local communities. Unfortunately most of these NGOs

	have been occupied in the last 10 years with other problems like poverty and human rights, but I believe they will involve themselves with renewable energy as well when it starts occurring in their regions.
C2R20Q5	You got to have a vision. The government needs a vision about what the need of the country is in the next 100 years.
C2R28Q5	We need to achieve a process of developing skills which will be available later on in the project. A process ante project implementation, to make sure you have certain technicians available in 5 years from now.

Annex 13 **Case 2 Local stakeholder**

Theme: Knowledge and technology transfer	
Code	Retrieval
C2R4Q3	No I don't think intellectual property is a problem, like with Orascom and Flagsol, it is written down very clear on paper. If this is done in the right way I don't see a problem. We do not have cases in Egyptian industry where intellectual property was stolen.
C2R5Q5	IP might be one of the main reasons, why scale-up of CSP or of solar in general has not happened. Whether it is true or not, there is always the feeling in developing countries, that some ideas are only promoted to serve foreign industry and to give them a head start. And at the same time this is coming from the developed world in two messages. One is for the environment and the climate change, - lets do that and another is coming: we want to create business. But the second message is coming very cautious we want to create business on our own terms and hold on to our secrets. We are going to use your community for the kind of work that we agree upon. I think this will take time to have the idea that it can come through joint ventures, true joint ventures that would include full knowledge transfer. Other countries are done, in China they have done breakthroughs in everything and they don't own the right.
C2R5Q6	The best way to do it is through academia, involve academics and then do the knowledge transfer to them. Of course there is an entity responsible for renewable energy in Egypt, which is NREA.
C2R6Q4	Like for example the Cairo metro there was technology transfer, there was a disclosure problem. It is a general thing which is being requested. I am not sure whether all contracts should include a kind of technology transfer targets. But I am not sure this will bring a new challenge, this is an existing challenge in many businesses. This is not something specific in CSP projects. The existing limitation derives from the market being very small as the market expands you will have much larger players. Actually nobody in this market collaborates in this market because it is narrow and maturing. I believe so far for CSP specifically it is not a high tech market so far.
C2R7Q9	Knowledge transfer from what I understand should be, the outcome of knowledge transfer, I can not see any knowledge transfer here. It is not happening in Kuraymat. What is the definition of knowledge transfer? For me the definition is: that we should have had an Egyptian, 100% Egyptian team that is capable of doing the design. Than for me there is no knowledge transfer. Knowledge transfer or technology transfer means that I am capable as an Egyptian to design this power plant in Egypt, with Egyptians 100%.
C2R7Q10	The engineers – academic level, vocational training for renewable energy. If Europeans or the World Bank really want to help Egypt in knowledge transfer, they need to train engineers to design solar power plants. Once we have these capabilities, they can train other Egyptians, for manufacturing, operations and maintenance. In my opinion this should be the base of the knowledge transfer.
C2R7Q11	I did not feel this with our German partners in Kuraymat, they were really open with us and keen to answer all the questions we had. It is only that we do not have the people or calibres that are well receptive of the information they gain, they are not there yet to get benefit of the information. But I don't think this will be a problem.
C2R7Q12	Knowledge and technology transfer I can feel when there is a consultancy in Egypt that can design a power plant from A to Z. I think it really has to be government to government collaboration, this sort of training for design engineers.
C2R9Q3	(Moroccan project a catastrophe). The feeling for Quality testing and quality assurance is different here; we need that to be changed. Local people say its enough, we disagree, but what can you do about it?
C2R9Q4	This knowledge is not transferred to Egypt. Operations and maintenance must be transferred, but the owner has not too much activity in that regard, knowledge transfer does not happen, we are

	operating the power station. My presence here was three times extended to help operating the power station, because the owner is not in the position to do a good job and keep the plant running and have a transparent maintenance program. Don't ask me how to change this, because I don't know.
C2R10Q2	Real knowledge transfer comes from real project experience.
C2R11Q2	Always we are constructing only, this is not a type of knowledge transfer. In most of the MENA region it is like that, that foreign companies who have their technology. They only give black boxes and you construct. If it is kept like that it will not happen.
C2R11Q3	Well knowledge transfer is not happening properly right now.
C2R11Q4	Intellectual property? Of course it is a problem.
C2R12Q6	This is for me the most dramatic risk I can always see with this kind of attempts, to transfer technology. Therefore highly qualified engineers lacking of course, enough budget and provisions and a strategy to systemically improve performance, learn from performance and improving the technology onside is also lacking. The problem is these plants are commercially tendered, technology providers may not really look ahead and say well we include research and monitoring and improvement components.

Annex 14 **Case 2 Knowledge and technology transfer**