Perception of risks in renewable energy projects: The case of concentrated solar power in North Africa

Nadejda Komendantova a,*, Anthony Patt a, Lucile Barra b, Antonella Battaglini b

a International Institute for Applied Systems Analysis (IIASA), Austria
b Potsdam Institute for Climate Impact Research (PIK), Austria

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Abstract

The world needs to reduce greenhouse gas emissions to prevent climate change, while meeting the energy needs of developed and developing economies. Recent studies suggest that generation of electricity from concentrated solar power in North African countries and its transmission to Europe could provide European and North African partners with low-carbon electricity. The private capital will be likely required to achieve the scale of new investment and yet the North African region experience difficulties with sustaining high levels of foreign direct investment from the private sector. The literature identifies a number of risks as barriers to investment, and we examine these in the particular context of renewable energy development. We conducted three stages of interviews with stakeholders to learn their perceptions of the risks most likely to affect renewable energy projects. Three class of risks—regulatory, political, and force majeure (which includes terrorism)—stand out as being of high concern. Of these, regulatory risks are perceived as being the most consequential, and the most likely to occur. This suggests that attention to building the capacities of North African countries to develop, implement, and enforce sound regulations in a transparent manner could be an important step in promoting renewable energy cooperation with Europe.

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1. Introduction

A rise of more than 2 °C above pre-industrial average temperatures could make it impossible for humankind to adapt to the impacts of climate change (Parry et al., 2007). Following a business-as-usual scenario, however, the global temperature might increase by 6 °C by 2100, with dramatic implications for all countries (IEA, 2008; IPCC, 2008). To prevent this scenario from happening, the stabilization of atmospheric concentrations of CO2 below 450 parts per million (ppm) is necessary (Solomon et al., 2007), and several prominent scientists suggest that even lower targets—such as 350 ppm—may be required (Hansen et al., 2007). Achieving even the 450 target would require reducing CO2 emissions by 2050 by 50% globally and by 80% in developed countries (Metz et al., 2007).

Several regulatory instruments at global, national and regional levels have been created to reduce CO2 emissions. Globally, the United Nations Framework Convention on Climate Change (UNFCCC) contains a non-binding commitment to reduce CO2 emissions to 1990 levels by 2000. The Kyoto protocol contains binding commitment to reduce emissions to the levels indicated in the Annex, or to obtain credits through the “flexibility mechanisms”. The architecture of a post-Kyoto framework is being discussed currently. At the European level the goal of policies is to transform the European Union (EU) to a low-carbon economy with strong competition on internal markets, and an improvement of security of supply and employment prospects. The goals for 2020 include reducing greenhouse gas (GHG) emissions from all primary sources by at least 20% in comparison to 1990, increasing the share of renewable energy sources (RES) in final energy consumption by 20%, and improving energy efficiency by 20%.

Within the EU framework there will be an opportunity for trading renewable energy quotas among member states, and to gain credit for electricity imported from renewable sources in countries outside the EU. This would have to be accounted for with Guarantees of Origin (GOs), and physically transmitted into the EU. Such trades are also envisioned in initiatives such as the Mediterranean Solar Plan (MSP). The goal of the MSP is to create 20 GW of new power production capacity based on renewable energies (especially solar and wind) in the Mediterranean basin by 2020, to contribute to energy efficiency in the region and to associate states, institutions, firms and investors from North and South in a common industrial project, which would allow technology transfer and development of local industries, encouraging economic growth and employment. An even more ambitious plan for renewable energy, known as the Desertec Industrial Initiative (DII), was announced by a consortium of German...
investors in July 2009. The DII has a target of making €440 billion in investments in concentrating solar power (CSP) in the North African region, largely for export to Europe.

There are several studies showing that electricity from North Africa could be instrumental in helping the EU to meet its 2020 targets, and its likely targets for 2050. Indeed, these suggest that renewable energy resources from North Africa could come at a lowest cost and greater security than from coal with carbon capture and storage (CCS) or nuclear (Czisch, 2005; DESERTEC (2008); German Aerospace Center, 2006). However, to develop this resource would require large investment. A goal of European and North African climate policy could be to encourage this to take place. But there are major barriers to such investment.

The year 2007 saw record foreign direct investment (FDI) flow into developing economies, amounting to $500 billion and an increase of 21% over the previous year. In Africa, FDI inflows reached $53 billion in 2007, most of which was linked to the extraction of natural resources (United Nations Commission for Trade and Development, 2008). But relative to that of other regions, the share of Africa in global FDI remains small. There are reasons for this. One survey, conducted by the United Nations Commission for Trade and Development identified major risk factors for global FDI in 2008–2010. Forty-three percent of responses identified war, conflict and political stability as very important, 32% listed threats to personal and business safety, 21% listed volatility of prices for petroleum and raw materials, 18% listed financial instability and global economic downturn, and 15% listed changes in the investment regime. As factors to stimulate FDI, 50% listed the market size and growth, 8% listed the quality of business environment, including availability of skilled labor, 7% listed the adequacy of infrastructure, and 6% listed the adequacy of suppliers. Respondents also highlighted the importance of the legal environment and government effectiveness (United Nations Commission for Trade and Development, 2008). These are areas where North Africa countries fall short.

FDI covers a broad spectrum of investment, from a tiny factory or distributor, to investment worth billions of dollars or euros, having long payback periods, and facing numerous uncertainties. In this paper, we examine which of these general barriers to foreign direct investment are perceived as most important by different kinds of stakeholders in the area of large-scale renewable energy in North Africa.

2. Background

Large-scale electricity generation from CSP in North Africa and its further transmission to Europe require not just large projects, but indeed so-called “mega projects,” typically costing more than US$ 1 billion and attracting public attention because of their substantial impact on communities, budgets, and the environment (Flyvbjerg et al., 2003). Such mega projects are especially threatened by risks of cost overruns because of their vulnerability to sunk costs of investment and high transaction costs, due to complex contractual situations and their unique character of assets (Globerman and Vining, 1996). Moreover, mega projects in infrastructure and power production often suffer from other factors that increase project costs. The most significant is the politicized nature of pricing, which makes investors dependent on governments or regulations reneging on commitments once investments have been done (Levy and Spiller, 1996; Vernon, 1971).

2.1. Existing RES targets

Foreign investment in renewable energy in North Africa comes on top on an existing effort by states themselves to expand renewable energy to meet local demand: Algeria’s target is for 6% of power generation to be based on RES by 2015; Egypt’s target is for RES to cover 3% of electricity demand by 2010 and 14% by 2020; Libya’s target is for RES to cover 6% of demand by 2020; Morocco’s target is for RES to cover 10% of the national energy balance, and 20% of power generation, by 2012 (IEA, 2008; OME, 2008). National entities such as the National Renewable Energy Agency (NREA) of Egypt and the Center for Development of Renewable Energy (CDER) in Morocco have been established to implement such goals as the export of clean electricity to Europe, the restructuring of energy sector, the development of alternative energy sources, and the encouragement of private investment.

The targets have led to three projects so far that integrate CSP and gas, and it is possible to learn from these experiences. Although each of the projects has been small compared to the level of investment envisioned by the MSP or DII, they have nevertheless proven difficult to build. In each case, the government originally planned the facility to be built and operated by independent power producers, separate entities that are not public utilities and which own and generate electric power for sale to utilities and end users. But in all three cases, the private investors withdrew during the preparation of project documents. The Egyptian case provides an example of why this happened: in 2002 the national government of Egypt introduced new legislation regarding independent power producers, stipulating that they be financed in local currency or in foreign currency but with annual repayments from export revenues. This change was done with the goal of reducing the burden on the national treasury caused by an unexpectedly high exchange rate of the US$ against the Egyptian Pound, but it had the effect of making participation in the project unattractive to private investors from outside the country. This led to a shift to state financing, with support from the World Bank. Currently there are no renewable energy projects in North Africa relying primarily on private investors (Palei, 2008). This suggests that a variety of factors, like the change in regulation in Egypt, create risks that private markets avoid and hence a problem for the involvement of private capital.

2.2. Reasons for private involvement

State financing has contributed the major share of investment in renewable energy projects in North Africa so far, but continued reliance on state investment may prove to be both unsustainable and unattractive. Reasons for this include the unprecedented level of investment that planned investments will require, the potential drain on public budgets of these projects, and the likely gains in efficiency that the involvement of private markets typically creates. We discuss each in turn.

First, in order to compete in European electricity markets, significant price reductions in electricity from CSP will be necessary. CSP appears to be a technology that benefits from significant economies of scale, meaning that the more total investment in the technology, and the larger the size of individual projects, the less expensive the electricity becomes. Cost estimates for CSP range from €0.10–0.20/kWh, depending on siting, plant size, and specific technologies used (McKinsey, 2008; German Aerospace Center, 2006, 2009; Williges et al., 2009). The costs of CSP electricity are projected to fall with greater investment, and this could lead CSP to be competitive with wind, nuclear, and coal with CCS in the next ten to twenty years. The studies considering the learning effect on CSP technology regard it as possible to reach €0.04/kWh, plus an additional €0.01/kWh for transmission, long before by 2050. Estimates of the necessary investment to reach this break even point with coal range from €
20 billion to €400 billion, depending on specific assumptions about future learning rates, carbon prices, and several other factors (Ummel and Wheeler, 2008; German Aerospace Center, 2005; Willigies et al., 2009). An analysis conducted pursuant to the MSP estimated that €60–80 billion would be necessary to reach the target of 20 GW of new renewable capacity by 2020 (OME, 2008).

Second, the volumes of public investment are decreasing relative to what many analysts estimate is needed (IMF, 2008). In Europe, there is an increasing trend of involving private capital in the provision of services that were traditionally regarded as public ones. In developing countries, there is a severe shortfall between 3% and 4% of GDP that states currently invest in infrastructure, and the 7–8% that is estimated to be necessary (World Bank, 2008c). Multilateral and international financial institutions, like the European Investment Bank (EIB), the Global Environment Facility (GEF), and the World Bank do not have enough funds to fill this gap, and acknowledge that the involvement of private capital is required (World Bank, 2008c).

Third, there is evidence that the participation of private capital in infrastructure projects helps to improve the efficiency and quality of management of state-owned electricity enterprises, even though critics exist. In developing countries the state-owned electricity enterprises are characterized by low labor productivity, inadequate investment, and an inability to provide services to large groups of the population (World Bank, 1994). Several state-owned electricity utilities have suffered from huge financial losses, and have experienced frequent supply interruptions, with resulting major losses to the economy (Boardman and Vining, 1989). Politically motivated interference by the government in enterprise management has caused losses from inefficiencies, under-pricing policies, a lack of maintenance, and poor operational performance (World Bank, 1994). For this reason, during the period 1990–97 more than sixty developing and transition countries engaged in some sort of privatization of their electricity sectors. Over this time the private sector participated in the construction, management, operation, and rehabilitation of 534 projects, with total investment of US $131 billion; analysis suggests that while this effort at privatization encountered some problems, by and large it worked to improve the efficiency of the sector (World Bank, 1998). There have been contradictory findings about the results of privatization. In most cases privatization has apparently led to increasing profitability of companies (Meggison et al., 1994), a result of unit cost reductions, boost in outputs, and lower level of employment, in turn brought about through restructuring and productivity improvements. In some cases efficiency gains were achieved at societal expense, namely lower salaries for workers, higher costs for consumers, and a lower quality of goods and services (Birdsall and Nellis, 2002; Bayliss, 2002). Other research has shown, however, that wages have increased after privatization (Galal et al., 1994; Estache and Rodriguez, 1996), and the quality and value of services has improved (Fischer et al., 2003). Multilateral financing agencies broadly support the involvement of private capital in project development (World Bank, 1998), in large part because of these success stories, and ones like them (Frydman et al., 1999; Meggison and Netter, 2001).

2.3. Risks connected with investment in North Africa

All large energy projects involve a measure of technical and market risk, but investment in North African countries could raise additional concerns, namely the issue of political risks. Al Khattab et al. (2008) interviewed FDI stakeholders active in developing countries, and reported that political risks, including regulations and political stability, were identified more frequently as a cause of concern (76% of all respondents) than financial (63%), cultural (40%) and natural (16%) risks. The Bleyzer Foundation found, at a qualitative level, three types of risks to be most important for FDI actors: those connected with the effects of state monopoly, with the lack of a stable legal framework, and with bad corporate and public governance, including corruption and bureaucratic procedures (Bleyzer Foundation, 2002).

There have been other efforts to identify different kinds of political risks as major barriers for investment, starting from regulatory barriers and uncertainty regarding future regulations (Joskow and Tirole, 2005), moving to geopolitical risks—namely that national governments will take advantage of the energy dependency of their contractual partners (Mabro, 2006)—and finishing with terrorism and sabotage risks, the actions not of governments but of non-governmental social groups taken against energy infrastructure (Homer-Dixon, 2002). We start by classifying all of these risks into two basic kinds: regulatory risks, which result directly from government actions (Butler and Joaquin, 1998; Rockett, 1999; Robock and Simmonds, 1973), and security risks, which result from the actions of non-governmental groups (Howell, 2001a, b; Wilkin and Zonis, 2000). Each has been the subject of frequent study.

In partnership with other organizations, the World Bank conducted three major assessments of regulatory risks. The first of these looked at the quality and accountability of government, relying on a specific set of indicators: voice and accountability, political instability and violence, government efficiency, regulatory burden, rule of law, and the control of corruption. For North African countries, the assessment identified significant problems with the voice and accountability indicator in Algeria, Egypt, and Tunisia, and with the political instability and violence indicator in Egypt and Algeria; in both cases this meant that the respective countries fell within the bottom 25% of countries globally (World Bank, 2008c). The second World Bank assessment developed an index for the ease of doing business, and pointed to significant regulatory problems across the region. In Algeria these included low rankings for the ease of starting a business in Algeria (ranked 141st out of 193 countries globally), registering property (162nd), and paying taxes (166th). In Morocco these included protecting investors (164th) and employing workers (168th). In Egypt these included closing a business (128th), enforcing contracts (152nd), and dealing with construction permits (165th) (World Bank, 2008b).

The third World Bank assessment looked not to rank countries globally, but rather to identify challenges for each, based on a survey of companies involved in FDI. It showed corruption to be the most significant problem (identified by 64% of all surveyed companies in Algeria and 60% in Egypt) followed by high taxes (55% in Morocco and 50% in Egypt), and complicated regulations (34% in Egypt and 30% in Algeria). In most North African countries, the investment climate is heavily influenced by ineffective bureaucracies. For example, in Morocco, 50% of all surveyed companies remarked that they needed to employ a full-time staff member just to deal with bureaucracies (World Bank, 2008a). A fourth and related major assessment, conducted by the civil society organization Transparency International, led to the Corruption Perception Index. This indicated significant problems, ranking Algeria 92nd, Egypt 115th, and Morocco 80th, with worse rankings signifying higher levels of perceived corruption (Transparency International, 2008).

But there are also reasons for hope. Analysts concluded that risks in Egypt declined significantly after the enactment of the Investment Law of 1997 (ONDD, 2008), and suggested that the expropriation of foreign assets, while possible, was unlikely there and in Algeria (Bull and McNeill, 2007). In Morocco and Tunisia, these risks are even lower (ONDD, 2008).
There have been a number of assessments of security risks, which have delivered often contradictory findings. On the one hand, scholars have pointed to the “age of terrorism”, and the increasing levels of security threats from violent social groups (Brodsky, 2005; Howell, 2002). On the other hand, there has been a special assessment for North African countries, conducted by the Political Insurance Risk Center, showing security risks to be relatively inconsequential. They evaluated the security risks in Algeria, Egypt, Tunisia, and Morocco as low, and thus not as a significant barrier for foreign investment (PRS, 2008).

2.4. Research questions

Despite existing political drivers and the evident necessity to involve private capital into electricity generation projects, risk has already proven to be a barrier for private investment in large renewable projects for domestic production. There is reason to believe it will be an even greater barrier standing in the way of mega projects to export power to Europe (Komendantova et al., in review). An important issue, however, is which risks. We conducted stakeholder-driven empirical research to address this issue, considering two related questions:

1. What political risks connected with technology and the North African region are perceived by current and potential investors as the most important barrier for investment into renewable energy capacities?
2. Are these risks differentiated on the regional and on the country level, or according to characteristics of the investment itself?

The identification of those political risks that cause concerns for investors, and prevent investment into renewable energy capacity in North Africa from happening, might be an important input for policy-making. First, by indicating the areas where efforts and reforms are necessary, it can serve as an input for development and prioritization of regulatory and political tools to reduce these risks. Second, it can help to identify finance or project design characteristics that can be changed, by private actors, to overcome the risks.

3. Stakeholder perceptions of risk

In this section we report on original empirical research into perceptions of risk. Our study was conducted not in order to provide insights across all types of investment, but rather to understand the specific situation connected with the development of large CSP projects in the North African region, and perceived risks and barriers connected with it. For this there is no historical data available, and so we needed to base our analysis on the results from stakeholders’ workshops, experts’ structured and unstructured interviews, and case studies.

3.1. Unstructured interviews

The first round of data collection was conducted in the form of unstructured expert interviews, in which we asked stakeholders to identify major barriers and risks connected with investment into renewable energy capacities in North Africa for local use and further transmission of electricity to Europe. The expert interviews were conducted among participants at an international conference on development of CSP held in Madrid in October 2008, at a stakeholder visioning meeting for the Mediterranean Solar Plan held in Paris in November 2008, and at a special workshop on political, economic, and social barriers to CSP development organized by the International Institute for Applied Systems Analysis (IIASA) in Austria in November 2008. Of the 23 experts interviewed, five were from industry, two were from government ministries, seven were from the financial sector, and nine were from the social scientific community.

As seen in Fig. 1, more than half of all respondents identified the complexity of bureaucratic procedures and corruption as significant barriers. According to some interviewees, bureaucracies not only increase risk and costs to business—thus lowering the quality of new investment—but also decrease the quality and efficiency of investments that had already been done. According to stakeholders, better governance would make the start of a new business and the operation of an existing one easier. Accountable and capable bureaucracies—in competition to corrupt and inefficient ones—help to reduce transaction costs for entry, operation, and exit. Transparency and inclusiveness could reduce uncertainties by providing more predictable application of government rules and regulations. Other risks identified as significant barriers were the instability of national regulations, the absence of guarantees from national governments and the international community on invested capital and revenues from projects, a low level of political stability, and the lack of support from local governments including commitment and cooperation. The latter was due mostly as a result of a low level of awareness about the advantages of renewable energy sources.

3.2. Semi-structured interviews

During a second round of interviews, we presented participants with a list of possible political risks, and asked them to rank them according to the seriousness of concern and likelihood to happen. We developed the list of risks based on an analysis of the first round interviews and a survey of the existing literature. The list contained nine classes of risks: technical, construction, operating, revenue, financial, force majeure, regulatory, environmental, and political. Respondents classified their seriousness of concern as high importance, medium importance, or low importance. They estimated the likelihood to happen according to the following scale: very likely (> 90% chance of occurring), medium likely (33–89%), and unlikely (< 33%). The interviews of the second round were conducted mostly as telephone interviews with experts from industry (3 experts), ministries (1), financial sector (6) and scientific community (8). Interviews were conducted under conditions of anonymity.

The third piece of the empirical research was a study of a single country, allowing for more in-depth discussions at a narrow geographical level. We chose Morocco as a country to study because the potentials for both wind and solar energy are high, as are the possibilities for developing grid connections with Spain in the near future. In November 2008, we conducted semi-structured in-depth interviews with major stakeholders in the country—key protagonists involved in the decision-making process and experts working in the country—again asking questions concerning their evaluation of risks. Among interviewees were experts from ONE (National Electricity Office), CIEDE (Sustainable Energy and Environment Information Center), CGEM (General Confederation of Moroccan Business), the European Commission’s delegation in Morocco, GTZ (German Organization for Technical Cooperation) and a legal advisor to MEMEE (Ministry of Energy, Mines, Water and Environment).

The interviews revealed that cognitive barriers, as much as technical ones, were regarded as most important. For example, interviewees pointed to the weakness and small size of the Moroccan grid—a technical issue—as a barrier to investment. However, interviewees also pointed to a strong lack of vision among policy makers. The policy makers, many interviewees suggested, view renewable energy sources as complements, rather than substitutes, for fossil fuels for electricity production. This is the case even though Morocco—unlike other North African countries—does not have large fossil fuel reserves of its own, and must import its fuel stock. In face of the relatively high costs of renewable energy technologies, several decision-makers were not sure about whether renewable energy expansion would be a positive influence on the local economy and society. Governance and administrative factors were named as well most frequently as barriers to investment. According to interviewees, the lack of transparency, a top-heavy administration, and a lack of communication between ministries are causing delays and incertitude about outcomes of administrative and legislative procedures. However, important legislative reforms are expected to substantially improve the conditions for renewable energy use in Morocco.

Finally, with its single buyer system, the Moroccan electricity market is under tight control of the national power company. Liberalizing the electricity market in a country with a large share of poor consumers is largely recognized as being a particularly challenging issue, and yet could be an important step towards developing new renewable resources.

4. Discussion

The literature names several classes of risks that concern stakeholders interested in investing, in general and in developing conditions. Many respondents additionally noted that investment often does not happen at all because of complex and lengthy bureaucratic procedures and unpredictable investment volumes due to corruption. The evaluations of the political situation in the region were homogenous: the risk of unstable political situation is perceived with medium level of concern by investors and they think that its likelihood to happen is medium. The evaluations of force majeure risk—mainly terrorism—are less clear. The evaluations of seriousness of concern about it are strongly polarized—in terms of seeing it as serious or not—but it seems that even though this type of risk is perceived with high level of concern by small part of investors they still think that its probability to happen is low.
countries in particular. Among them are political, technical, financial and even cultural risks. Our research, which focused particularly on risks connected with investment into renewable energy capacities, showed that stakeholders are most concerned about three classes of risks, namely regulatory, political, and force majeure. Among them regulatory risks caused by far the biggest concern. These results are in line with previous studies, which focused on FDI in developing countries in general. But they demonstrate the especially high importance of stable and predictable regulations, as well as a transparent and efficient bureaucratic state apparatus in order to secure investment into renewable energy capacities.

The findings showed as well strong agreement between the perceived likelihood and seriousness of concern of these risks, perhaps reflecting a propensity to conflate likelihood and magnitude (Patt and Schrag, 2003; Patt, 2007). The regulatory risks were perceived as being most likely to happen, and also of greatest concern. The two other risks of high concern to some stakeholders—political and force majeure—were viewed as somewhat less likely to happen.

The importance of stable regulations and efficient procedures was highlighted not only for the regional North African level but at the national level too. The Moroccan case study shows that underlying or contributing to the regulatory risks may be a lack of technical capacity among the civil service, and a lack of ambition among policy makers.

Our research provides important implications for political action. It identifies the area of risk where the action of national and international political community is urgently necessary in order to stimulate investment into renewable energy generation capacities. Stakeholders view regulatory risks as the most important and likely, more so than either force majeure or political risks. Notably, it may be possible for countries to cooperate on developing a more transparent and effective civil service, one that operates predictably and without corruption. By contrast, it would be far less easy to work with potential terrorists, or with political outsiders who may potentially cause instability within countries. Fortunately, these risks, which are thus harder to solve, are also less of a concern.

For this reason, our results highlight the importance of identifying those policies and programs that can best reduce regulatory risks, or help stakeholders to manage the risks that are there, such as through innovative financing schemes such as public-private partnerships. This could a fruitful and important area of future research. Complementing this research could be additional efforts to mainstream renewable energy development into the ongoing efforts to fight corruption, as part of a more general effort geared towards institutional and sustainable development (Transparency International, 2008). Making progress on these issues could bring benefits not only to countries seeking to increase the level of FDI and energy-related FDI, but also be an important step towards achieving regional and global climate protection targets.

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References


German Aerospace Center, 2005. Concentrating solar power for the Mediterranean Region, German Aerospace Center (DLR) Institute of Technical Thermodynamics, Section Systems Analysis and Technology Assessment, Stuttgart.

German Aerospace Center, 2006. Trans-Mediterranean interconnection for concentrating solar power, German Aerospace Center (DLR) Institute of Technical Thermodynamics, Section Systems Analysis and Technology Assessment, Stuttgart.


