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Market Study of Solar Thermal Energy for Industrial / Commercial Use (Pakistan, Egypt, Morocco)

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2. EXECUTIVE SUMMARY

OBJECTIVE This study investigates the potential contribution that solar thermal technology could make to the energy requirements of the identified industries in Pakistan, Egypt and Morocco. The goal of the study is to evaluate a range of industries in subject countries in order to guide further market development and activity. The study was focused only on low-temperature solar thermal applications (i.e. less than 100 °C) and it aims to identify and prioritize industries in selected countries with respect to the potential contribution and related investment potential that solar thermal technology could make.

SUBSIDIES Fossil fuels, such as oil, coal and natural gas are by far the largest sources of energy in the subject countries and are widely projected to dominate the energy mix in the future. However, all three reference countries have recognized their sizeable potential in solar energy. As part of the new initiatives that aim to stabilize the energy sector, the contribution of renewable energy sources, including solar, should be increased significantly in order to diversify the energy mix in respective countries. Despite these ambitious plans Pakistan, Egypt and Morocco have failed to make significant advancements in the renewables sector, mainly due to a poor regulatory framework and a lack of financial incentives.

The major limiting factors for the installation of solar thermal applications are low prices of conventional energy sources that are still heavily subsidized (especially in Egypt), followed by the lack of human resources and lack of strong political will for implementing reforms in the energy sector. For solar thermal applications to contribute significantly to the ambitious renewable energy targets in reference countries, the removal of subsidies for fossil fuels is the first prerequisite.

EGYPT Top five industries with highest potential for implementing low temperature solar thermal application in Egypt have been identified as follows (in order of interest): **tourism, chemical, food, textile, agriculture**. Maximal total contribution of low temperature solar thermal applications to low temperature heat demand is estimated at 4.571.139,00 MWh/a for the top five identified industries. The total collector area of 4.6 mil.m² would be needed to reach this value. Greatest potential has been identified in the chemical industry that has the potential of installing up to 1.47 mil.m² of collector area, followed by the tourism and food sector with estimated 1.42 mil.m² and 0.94 mil.m² of collector area respectively.

In the short term perspective (investments in low temperature solar thermal applications with the payback period <10 years), there are no scenarios that would recover the cost of investment for installing solar thermal applications, therefore there is **no short term investment potential under current market conditions** due to high subsidies for fossil fuels.

Total long term investment potential under current market conditions (payback periods on investment in low temperature solar thermal applications between 10 and 20 years) is estimated at **0.5 billion USD**. Within this, greatest potential is identified in the tourism sector, with estimated 0.23 billion USD, followed by the chemical and food industry sector, each estimated at 0.11 billion USD and 96 million USD respectively. According to the developed scenarios, under current market conditions CO_2 mitigation potential is estimated at 883.256,57 tons in total on the long term.

Given the removal of subsidies for conventional energy supplies: According to the investigated case given the removal of subsidies, short term investment potential in Egypt is estimated at **3.59 billion USD**, with the related CO_2 mitigation potential of 1.696.032,59 tons. In this case, significant potential is identified in the tourism sector with estimated 1.18 billion USD in the short term perspective, followed by chemical and food industry, estimated at 1.1 billion USD and 0.73 billion USD respectively. Given the removal of subsides, additional long term potential is estimated at **0.83 billion USD** (investments in low temperature solar thermal applications with payback period between 10-20 years).

MOROCCO

Top five industries with highest potential for implementing low temperature solar thermal application in Morocco have been identified as follows (in order of interest): **surface treatment, food, chemical, textile, leather**. Maximal total contribution of low temperature solar thermal applications to low temperature heat demand is estimated at **1.714.650,00 MWh/a** for the top five identified industries. The total collector area of 2.3 mil.m^2 would be needed to reach this value. Greatest potential has been identified in the surface treatment industry that has the potential of installing up to 1.75 mil.m^2 of collector area, followed by the food and chemical industry with estimated 0.31 mil.m^2 and 0.14 mil.m^2 respectively.

Under current market conditions the total investment potential is estimated at **0.57 billion USD in the short term perspective** (payback periods for investment in low temperature solar thermal applications <10 years). Within this, the greatest potential is identified in the surface treatment industry with **0.43 billion USD**, followed by food and chemical industry with estimated 81 and 33 million USD. For short term scenarios under current market conditions, total CO_2 mitigation potential for identified top five industries in Morocco is estimated at 354.757,62 tons.

Total long term investment potential for the top five identified industries, under current market conditions, (payback periods for investment in low temperature solar thermal applications between 10 and 20 years) is estimated at **1.65 billion USD**. As in short term scenarios, greatest potential is identified in the surface treatment sector, with estimated 1.25 billion USD, followed by the food and chemical industry, each estimated at 0.22 billion USD and 0.11 billion USD respectively. According to the developed scenarios, under current market conditions CO_2 mitigation potential is estimated at total 368.580 tons for identified top five industries in the long term perspective (for scenarios with payback periods between 10-20 years).

Given the removal of subsidies for conventional energy supplies: removal of subsidies does not have a direct impact on the total estimated investment potential as the defined criteria remains as in previous case (identified short and long term scenarios are as under current market conditions), although the **key investment indicators are significantly better**. It is important to note, that unlike in other two subject countries, gas prices in Morocco are influenced by the international market as they are no subsidies for this fuel. For some scenarios, with oil as substituted fuel payback periods for implementation of solar thermal applications are under 5 years.

PAKISTAN

Top five industries with highest potential for implementing low temperature solar thermal application in Pakistan have been identified as follows (in order of interest): **textile, surface treatment, food, chemical, leather**. Maximal total contribution of low temperature solar thermal applications to low temperature heat demand is estimated at **5.622.500,84 MWh/a** for the top five identified industries. The total collector area of 7.1 mil.m^2 would be needed to reach this value. Greatest potential has been identified in the textile industry that has the potential of installing up to 3.9 mil.m^2 of collector surface, followed by the surface treatment and food industry with estimated 1.62 mil. m^2 and 0.84 mil.m^2 collector area respectively.

Under current market conditions the total investment potential is estimated at **2.38 billion USD** in the short term perspective (payback periods on investment in low temperature solar thermal applications <10 years). Within this, the greatest potential is identified in the textile industry with estimated **1.31 billion USD**, followed by surface treatment and chemical industry with estimated 0.55 and 0.28 billion USD. For short term scenarios, total CO_2 mitigation potential for identified top five industries in Pakistan is estimated at 1.877.915, 00 tons.

Total **long term investment potential under current market conditions** (payback periods on investment in low temperature solar thermal applications between 10 and 20 years) is estimated at **4.43 billion USD**. Greatest potential is identified in the textile sector, with estimated 2.45 billion USD, followed by the surface treatment and food industry, each estimated at 1.01 billion USD and 0.52 billion USD respectively.

Given the removal of subsidies for conventional energy supplies: removal of subsidies does not have a direct impact on the total estimated investment potential as the defined criteria remains as in previous case (identified short and long term scenarios are as under current market conditions), although the **key investment indicators are significantly better**. For some investigated scenarios, with oil as substituted fuel, payback periods for implementation of solar thermal applications are between 3,11 and 5,82 years.

KEY FIGURES

Industry		Under current market conditions				Given the removal of subsidies for conventional energy supplies			
		Investment potential short term (payback <10 year) [Mill. USD]	**Investment potential long term** (payback 10-20 years) [Mill. USD]	**CO_2 reduction** [thousand tons/a]: short-term	**CO_2 reduction** [thousand tons/a]: long-term	**Investment potential short term** (payback <10 year) [Mill. USD]	**Investment potential long term** (payback 10-20 years) [Mill. USD]	**CO_2 reduction** [thousand tons/a]: short-term	**CO_2 reduction** [thousand tons/a]: long-term
EGYPT	Tourism	0	226.5	0	195.4	1.181,8	183.0	565.6	51.4
	Chemical	0	110.7	0	334.2	1.099	312.9	515.1	87.9
	Food	0	96.1	0	186.5	727.8	174.6	343.6	49.1
	Textile	0	36.1	0	100.0	338.6	93.6	159.0	26.3
	Agriculture	0	27.9	0	67.1	239.8	62.9	112.8	17.7
MOROCCO	Surface treatment	427.1	1.249,9	264.6	280.6	Estimated investment potential remains unchanged as under current market conditions (scenarios for short-/long term perspectives remain unchanged) but with key investment indicators(payback period and IRR) being significantly improved			
	Food	81.1	218.1	51.6	46.7				
	Chemical	33.1	105.6	19.9	24.7				
	Textile	18.4	56.9	11.2	13.1				
	Leather	10.8	20.9	7.4	3.5				
PAKISTAN	Textile	1.312,2	2.437,0	1.028,7	271.0	Estimated investment potential remains unchanged as under current market conditions (scenarios for short-/long term perspectives remain unchanged) but with key investment indicators(payback period and IRR) being significantly improved			
	Surface Treatment	545.0	1.012,1	430.9	113.3				
	Food	281.2	522.2	224.6	59.1				
	Chemical	213.4	396.3	167.0	44.0				
	Leather	32.1	59.5	26.7	7.0				

Table 2-1: Overview of the key findings