

# **SOLAR ERA FOR TURKEY**

## **OPPORTUNITIES & THREATS**

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# TURKEY'S SOLAR ENERGY POTENTIAL

Turkey's Solar Energy Potential: 500 -700.000 MWe

Turkey



Yearly sum of global irradiation [kWh/m<sup>2</sup>]

1400 1500 1600 1700 1800 1900 2000>

1050 1125 1200 1275 1350 1425 1500>

Yearly electricity generated by 1kW<sub>peak</sub> system with performance ratio 0.75 [kWh/kW<sub>peak</sub>]

Authors: M. Sür, T. Cebecauer, T. Huld, E. D. Dunlop  
PVGIS © European Communities, 2001-2008  
<http://re.jrc.ec.europa.eu/pvgis/>

0 75 150 300 km

## FIT in Turkey- for Renewables

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Turkey introduced subsidy to photovoltaic & AE power generation

Renewable energy generation FiT

FiT for RES plants are as follows (\$-c/ kWh):

Solar:	13.3
Biomass (including landfill gas):	13.3
Geothermal:	10.5
Hydroelectric:	7.3
Wind :	7.3

Licensing granted by the supervisory Energy Market Regulatory Board, in coloboration with the Interior Ministry, Energy and Natural Resources Ministry, and State Hydraulic Works'

FiT also support concentrated solar power (CSP) and hybrid power plants

FiT valid for ten years (May, 2005 - December 31, 2015)  
Companies starting operation after December 31, 2015,  
subject to new FiT rates to be determined

Local content in solar power plants , FiT may be improved by  
0.6 to 6.2 \$-c/kWh

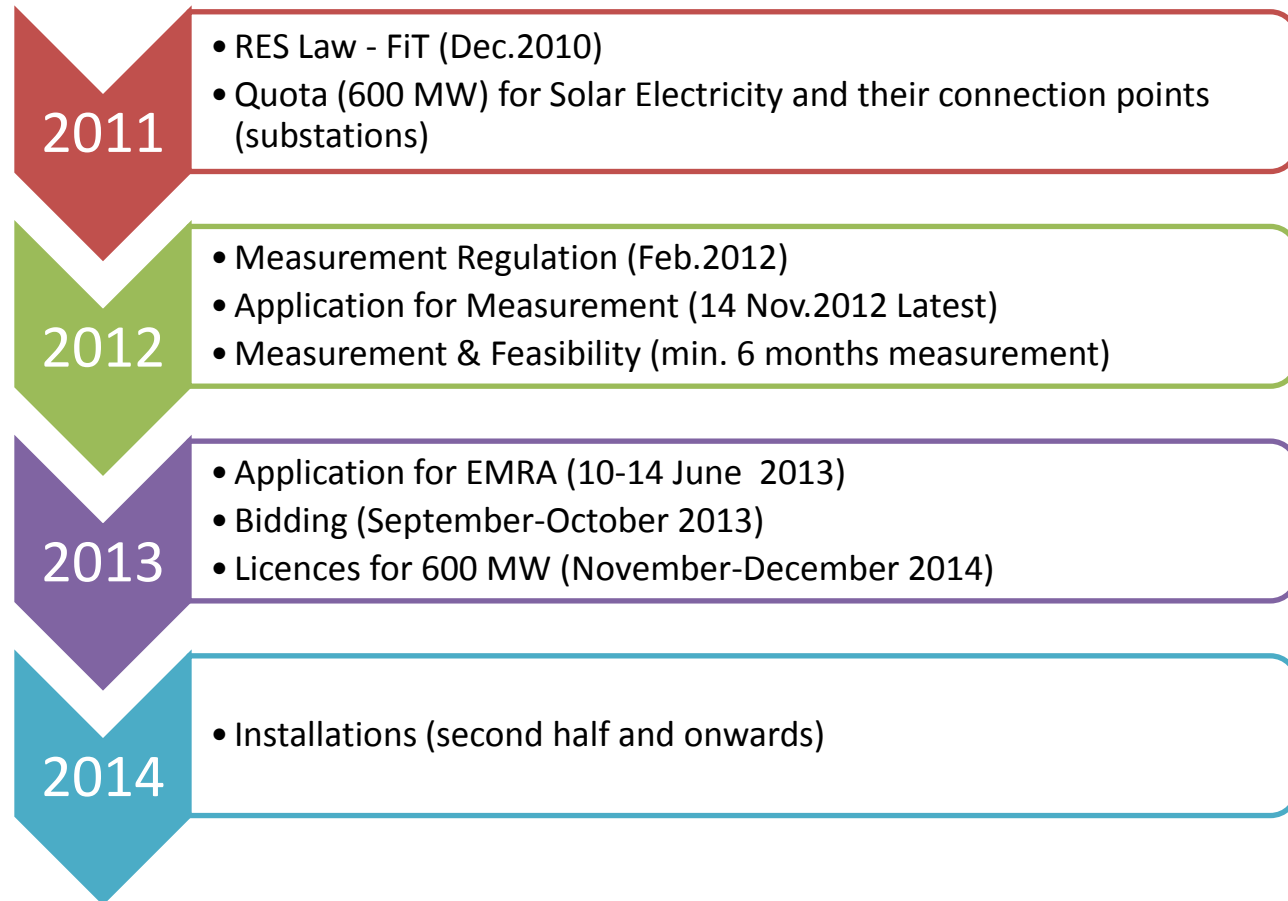
Mechanical 0.8c, Modules 1.3c, Cells 3.5c, Inverter 0.6c  
for five years after start of operation

First licence quota has a 600MW cap to be finalised by Dec 31,  
2013.

Further licence quotas will be announced by the Council of  
Ministers.

**For the first decade**, 85% discount be applied for power grid  
permission, lease, easement and certificate of occupancy fees  
for the facilities until December 31, 2015.

# PV Power Plant Installations in Turkey (600 MW)



# PV & Small Wind Installations in Turkey



2012

- Regulation for the RES Power Production <500 kW without Licence

2013

- Huge capacity for PV & Small Wind (and other RES)
- FiT is applicable
- **A new regulation will be issued in a month time to increase 500 kW to 1 MW.**



# OPPORTUNITIES

- Turkey has already adopted most of the political, economical and energy policy issues issued by EU
- Environmental Awareness (public acceptance for solar) is high, except for hydro power





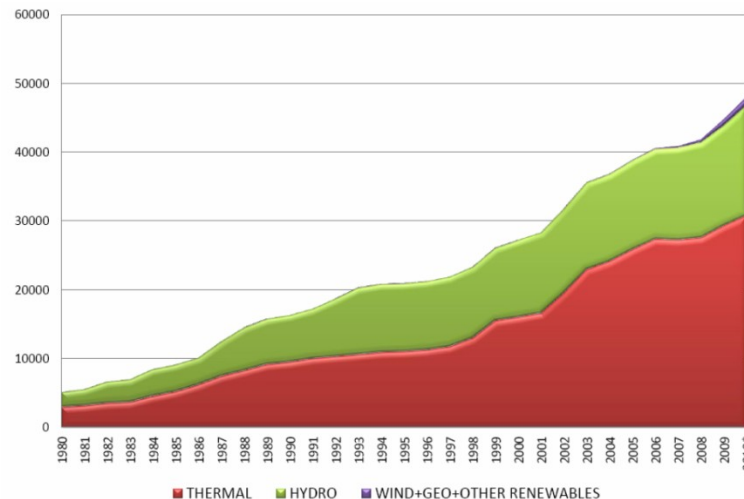
# OPPORTUNITIES

- Investment credits are available (long term 8-16 years, interest rates are 5-7%)
- FiT is available
- Sustainable FiT: Not rocket high (no surprise taxes tomorrow) Close to grid parity, FiT not used

	FIT EUR cent/kV
Germany	13.6
Spain	13.5
Czech Republic	28.8
England	10
Turkey	10
Greece	37.2-9.5

# OPPORTUNITIES

- **Local content (bonus, upto 47% of FiT)**
- **Big energy market; more than 57,000 MW installed power**  
**High increase in the consumption (7-8% / year)**
- **Very big potential, only 5-8 MW installed**
- **High solar radiation intensity**
- **Increase in the electricity prices**



# OPPORTUNITIES

- Prices of system components are still going down. Turn-key: around 1 million Euro/MW for MW size power plants
- Experienced International/European investors, EPC companies, Banks, component manufacturers are seeking new stable & sustainable markets.
- Local technical capacity + manufacturing capability



***T Energy Greece, Kastoria Solar Plant (1.5 MW): Joint Investment of T Dinamik(Tr) + Egnatia and Lenco(Greece)***

# THREATS

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- **Licence Fee (whenever applicable). For the wind projects it is around 100-300 kEuro/MW**
- **FiT reductions in bidding proces used for wind, replaced by Contribution Fee to Government**
- **The margin of CFtG will influence the IRR**
- **Local content: how will it be applied? When?**
- **Interest rates (may be prohibitive, IRR rates ?).**
- **Equity needs: to overcome the low IRR, banks may/will ask higher equity (30-50%) in order to secure repayments**

# THREATS

20% Equity; Cash Injections.

## KARAPINAR SOLAR PLANT



Project Year  
Remaining Long Term Debt Repayment Term  
Remaining Depreciation Years

1	2	3	4	5	6	7	8	9
9	8	7	6	5	4	3	2	1
14	13	12	11	10	9	8	7	6

<b>A. INPUTS</b>			
1	Installed Power	KWp	10,000.00
2	Productivity Coefficient	KWh/KWp	1,700
3	Electricity Production (1st Year)	KWh	17,000.000
4	Development Cost	€	10,000,000
5	Subsidy	%	0%
6	Equity	%	20%
7	Debt	%	80%
8	ΔEEMHE Contract period	01/08/10 to 01/02/11	
9	Own capital	0.00%	0
10	Short Term Debt to finance Equity capital	%	0.00%
11	Term of Short Term Debt	months	0
12	Long Term Debt Interest	%	6.00%
13	Long Term Debt Term	years	8
14	Grace Period	years	1
15	Grace Period Annual Interest	480,000.00	
16	Insurance Cost	%	0.30%
17	Operation and Maintenance Cost	%	0.50%
18	Annual Inflation	%	1.00%
19	KWh Feed In Tariff (1st year)	€	0.0800 €
20	Revenue Tax Level	%	0.00%
21	Annual generation capacity loss (1st year)	%	4.0%
22	Annual generation capacity loss (2nd year onwards)	%	1.5%
23	Depreciation period	Years	14

<b>Cash Flows</b>		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
<b>Investing Cash Flows</b>											
1	Equity Investment		2,000,000 €								
2	Long Term Debt Investment		8,000,000 €								
3	Subsidies		- €								
<b>Operating Income</b>											
1	Revenue from Electricity Sale		1,360,000 €	1,305,600 €	1,285,200 €	1,264,800 €	1,244,400 €	1,224,000 €	1,203,600 €	1,183,200 €	1,162,800 €
2	Less Revenue Tax		- €	- €	- €	- €	- €	- €	- €	- €	- €
3	Net Revenue		1,360,000 €	1,305,600 €	1,285,200 €	1,264,800 €	1,244,400 €	1,224,000 €	1,203,600 €	1,183,200 €	1,162,800 €
<b>Operating Cash Flow</b>											
1	Long Term Debt Cost		480,000 €	1,288,288 €	18,288 €	1,288,288 €	1,288,288 €	1,288,288 €	1,288,288 €	1,288,288 €	1,288,288 €
2	Insurance		30,000 €	30,000 €	30,000 €	30,000 €	30,000 €	30,000 €	30,000 €	30,000 €	30,000 €
3	Maintenance and Operation		80,000 €	80,000 €	80,000 €	80,000 €	80,000 €	80,000 €	80,000 €	80,000 €	80,000 €
4	Taxes		27,429 €	9,769 €	18,497 €	20,158 €	20,288 €	20,493 €	20,757 €	21,088 €	21,488 €
5	Total Operating Cash Flow		772,671 €	72,262 €	108,198 €	104,070 €	166,940 €	169,961 €	202,568 €	288,116 €	304,884 €
<b>Debt</b>											
1	Debt Balance		8,000,000 €	8,000,000 €	7,191,712 €	6,334,924 €	5,400,150 €	4,397,927 €	3,281,927 €	2,151,268 €	1,020,568 €
2	Interest on outstanding debt		480,000 €	480,000 €	431,503 €	380,096 €	328,604 €	267,843 €	206,616 €	141,716 €	78,922 €
<b>Financing Income</b>											
1	Operating Income		1,360,000 €	1,305,600 €	1,285,200 €	1,264,800 €	1,244,400 €	1,224,000 €	1,203,600 €	1,183,200 €	1,162,800 €
2	Operating Expenses		80,000 €	80,000 €	81,503 €	82,424 €	83,248 €	84,081 €	84,922 €	85,771 €	86,629 €
3	Interest		480,000 €	480,000 €	431,503 €	380,096 €	328,604 €	267,843 €	206,616 €	141,716 €	78,922 €

40% Equity; No cash Injections.

## KARAPINAR SOLAR PLANT



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<b>A. INPUTS</b>			
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2	Productivity Coefficient	KWh/KWp	1,700
3	Electricity Production (1st Year)	KWh	17,000.000
4	Development Cost	€	10,000,000
5	Subsidy	%	0%
6	Equity	%	40%
7	Debt	%	60%
8	ΔEEMHE Contract period	01/08/10 to 01/02/11	
9	Own capital	0.00%	0
10	Short Term Debt to finance Equity capital	%	0.00%
11	Term of Short Term Debt	months	0
12	Long Term Debt Interest	%	6.00%
13	Long Term Debt Term	years	8
14	Grace Period	years	1
15	Grace Period Annual Interest	360,000.00	
16	Insurance Cost	%	0.30%
17	Operation and Maintenance Cost	%	0.50%
18	Annual Inflation	%	1.00%
19	KWh Feed In Tariff (1st year)	€	0.0800 €
20	Revenue Tax Level	%	0.00%
21	Annual generation capacity loss (1st year)	%	4.0%
22	Annual generation capacity loss (2nd year onwards)	%	1.5%
23	Depreciation period	Years	14

<b>Cash Flows</b>		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
<b>Investing Cash Flows</b>											
1	Equity Investment		4,000,000 €								
2	Long Term Debt Investment		6,000,000 €								
3	Subsidies		- €								
<b>Operating Income</b>											
1	Revenue from Electricity Sale		1,360,000 €	1,305,600 €	1,285,200 €	1,264,800 €	1,244,400 €	1,224,000 €	1,203,600 €	1,183,200 €	1,162,800 €
2	Less Revenue Tax		- €	- €	- €	- €	- €	- €	- €	- €	- €
3	Net Revenue		1,360,000 €	1,305,600 €	1,285,200 €	1,264,800 €	1,244,400 €	1,224,000 €	1,203,600 €	1,183,200 €	1,162,800 €
<b>Operating Cash Flow</b>											
1	Long Term Debt Cost		360,000 €	966,216 €	966,216 €	966,216 €	966,216 €	966,216 €	966,216 €	966,216 €	966,216 €
2	Insurance		30,000 €	30,000 €	30,000 €	30,000 €	30,000 €	30,000 €	30,000 €	30,000 €	30,000 €
3	Maintenance and Operation		80,000 €	80,000 €	80,000 €	80,000 €	80,000 €	80,000 €	80,000 €	80,000 €	80,000 €
4	Taxes		65,829 €	48,168 €	53,017 €	58,586 €	64,555 €	71,920 €	79,815 €	88,594 €	98,302 €
5	Total Operating Cash Flow		864,171 €	210,420 €	184,268 €	167,684 €	150,684 €	101,783 €	72,846 €	42,820 €	11,864 €
<b>Debt</b>											
1	Debt Balance		8,000,000 €	8,000,000 €	6,588,784 €	4,761,198 €	4,070,062 €	3,348,039 €	2,632,708 €	1,771,453 €	911,524 €
2	Interest on outstanding debt		360,000 €	360,000 €	323,627 €	285,072 €	244,203 €	200,882 €	154,962 €	106,287 €	54,691 €
<b>Financing Income</b>											
1	Operating Income		1,360,000 €	1,305,600 €	1,285,200 €	1,264,800 €	1,244,400 €	1,224,000 €	1,203,600 €	1,183,200 €	1,162,800 €
2	Operating Expenses		80,000 €	80,000 €	81,503 €	82,424 €	83,248 €	84,081 €	84,922 €	85,771 €	86,629 €
3	Interest		360,000 €	360,000 €	323,627 €	285,072 €	244,203 €	200,882 €	154,962 €	106,287 €	54,691 €
4	Depreciation		714,286 €	714,286 €	714,286 €	714,286 €	714,286 €	714,286 €	714,286 €	714,286 €	714,286 €

<b>B. DEBT CALCULATIONS</b>			
1	Annual Long Term Debt Repayment amount		966,216 €
2	Total Long Term Debt Repaid		7,729,725 €
3	Annual Short Term Debt Repayment		0 €
4	Short Term Debt Cost		0 €

<b>Financing</b>		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
1	Operating Profit		208,714 €	150,514 €	168,679 €	183,015 €	202,689 €	224,751 €	249,430 €	276,896 €	307,194 €
2	Tax		41,143 €	30,123 €	33,136 €	36,904 €	40,535 €	44,950 €	49,856 €	55,371 €	61,439 €
3	Financing Tax		10,000 €	10,000 €	10,000 €	10,000 €	10,000 €	10,000 €	10,000 €	10,000 €	10,000 €

# THREATS

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- Possible economical/political problems in the region or in Turkey, i.e. Foreign Trade imbalance
- Governmental support to solar & wind, or to coal/nuclear?
- Financial difficulties or bankruptcy of the PV manufacturers

**20 years warranty for the equipment, How many of the equipment manufacturer will be around in 2030s?**

# CONCLUSIONS

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- **New market, high radiation potential**
- **Newcomers from the local companies/ Portfolio**
- **Quota for AER (solar, wind and others)**
- **Realistic and sustainable economy**
- **A Newfrontier for existing solar companies**
- **Intensive foreign interest from West and F. East**

**Welcome to Solar Era in Turkey**

**THANK YOU**

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