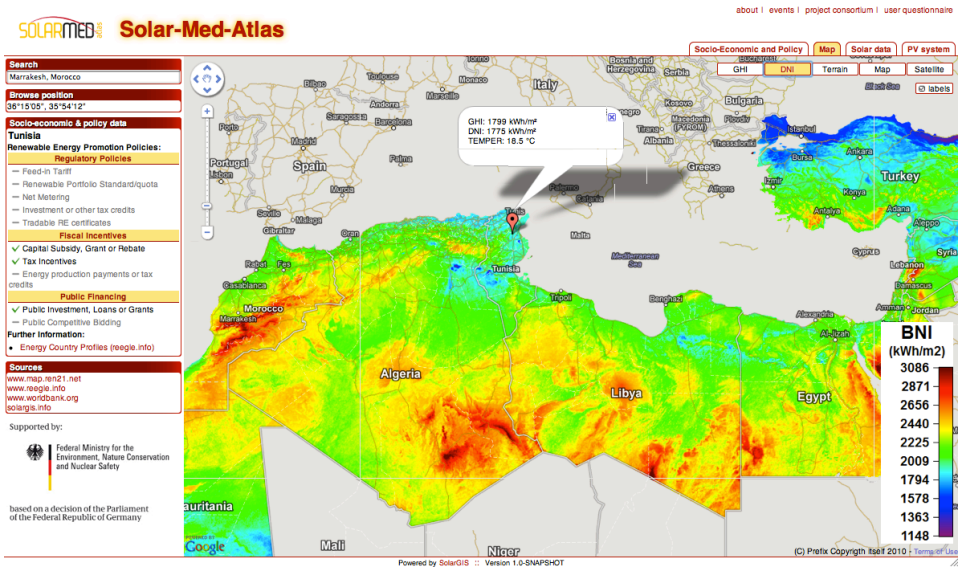
Solar Atlas for the Mediterranean- User Interface

Marcel Suri

GeoModel Solar
marcel.suri@geomodel.eu

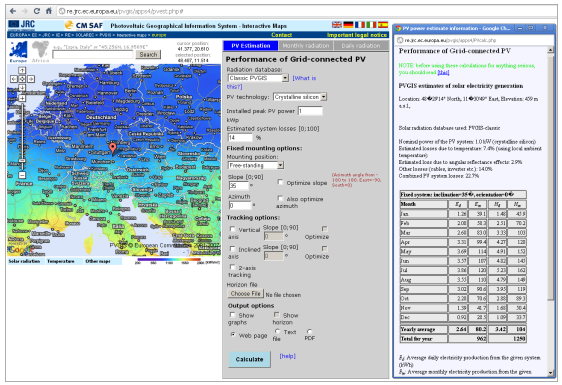


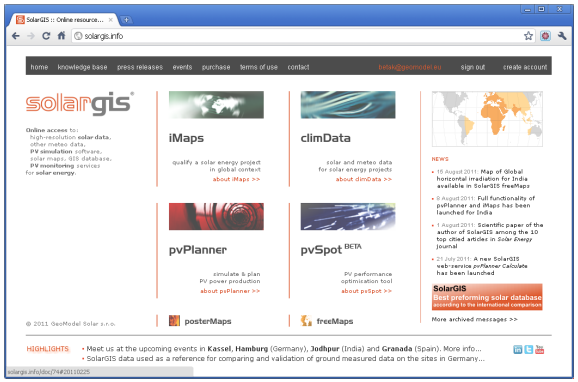
http://www.solar-med-atlas.org/

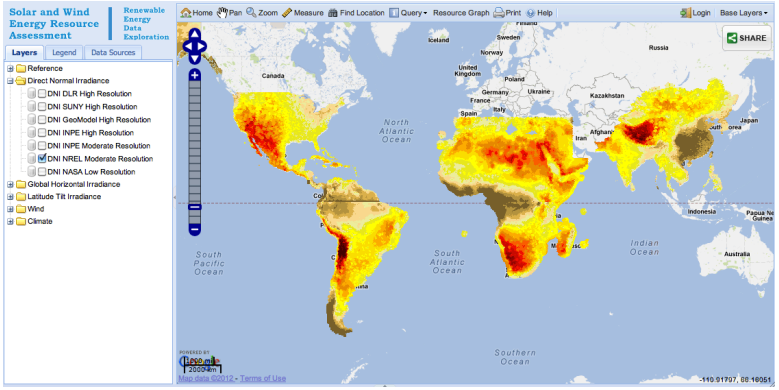
Solar Atlas for the Mediterranean: User Interface

- Standardized access to the data and tools
- Data download
- Easy geographic navigation
- Easy to understand also for non-experts

- Based on previous experience and other web systems: PVGIS, SolarGIS, SWERA, national and other Atlases



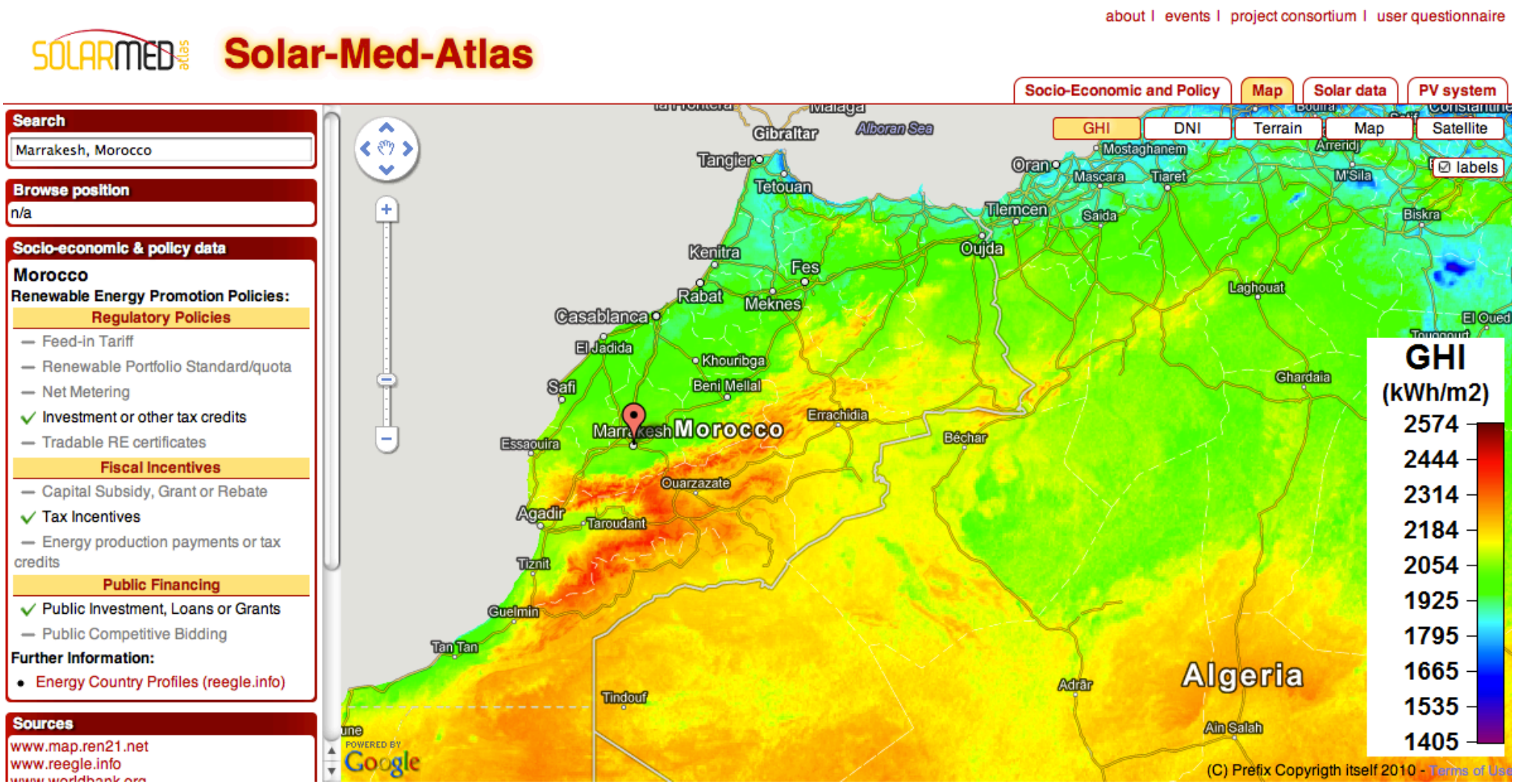




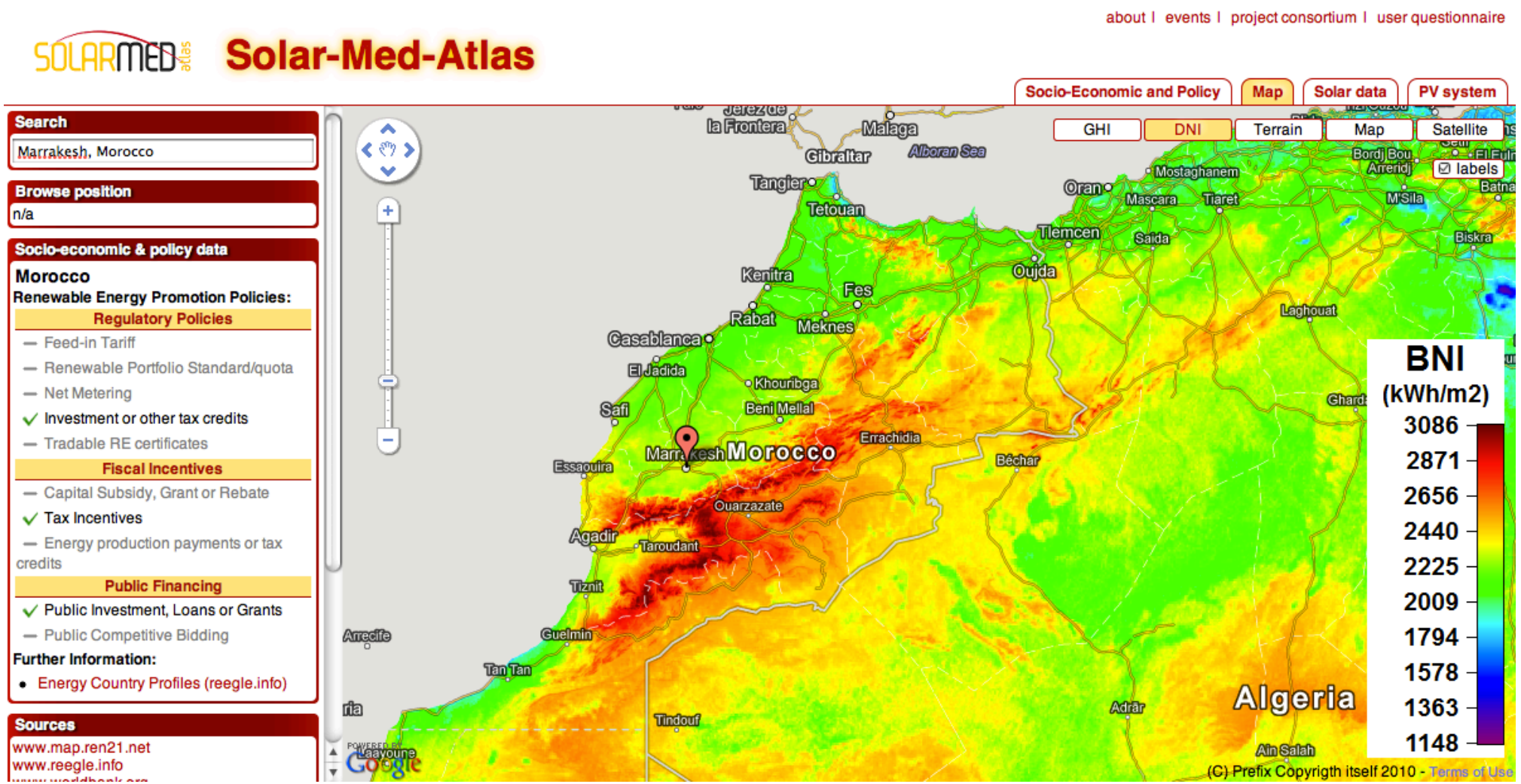
Contents


about I events I project consortium I user questionnaire
Solar-Med-Atlas
Socio-Economic and Policy
Map
Solar data
PV system
Search
Browse position
n/a
Socio-economic & policy data
Renewable Energy Promotion Policies:
Regulatory Policies
— Feed-in Tariff
— Renewable Portfolio Standard/quota
— Net Metering
✓ Investment or other tax credits
— Tradable RE certificates
Fiscal Incentives
— Capital Subsidy, Grant or Rebate
✓ Tax Incentives
— Energy production payments or tax credits
Public Financing
✓ Public Investment, Loans or Grants
— Public Competitive Bidding
Further Information:
• Energy Country Profiles (reegle.info)
Sources
www.map.ren21.net
www.reegle.info
www.worldbank.org
solargis.info
Supported by:
GHI
DNI
Terrain
Map
Satellite
labels
GHI: 2006 kWh/m²
DNI: 2083 kWh/m²
TEMPER: 17.6 °C
Casablanca
Azemmour
El Jadida
Berrechid
Settat
Oualidia
Safi
Jemaa-Shaim
El Agagcha
Larbaa Ouled Amrane
Khouribga
Oued Zem
Boujad
Souk Tlete Des Beni Oukil
El Borouj
Kasba Tadla
Fkih Ben Salah
Beni Mellal
Azilal
El Attaouia
Zemrane charqia
Marrakesh
Essaouira
Chichaoua
Ghazoua
Aghmat
Toubkal National Park
Kalaat M'Gouna
Tinghir
Khenifra
M'Rirt
Ait Ishak
Azrou
Imagery ©2012 TerraMetrics, Map data ©2012 Google, Tele Atlas - Terms of Use

Contents


about | events | project consortium | user questionnaire
SOLARMED atlas
Solar-Med-Atlas
Socio-Economic and Policy
Map
Solar data
PV system
Search
Marrakesh, Morocco
Browse position
n/a
Socio-economic & policy data
Morocco
Renewable Energy Promotion Policies:
Regulatory Policies
— Feed-in Tariff
— Renewable Portfolio Standard/quota
— Net Metering
✓ Investment or other tax credits
— Tradable RE certificates
Fiscal Incentives
— Capital Subsidy, Grant or Rebate
✓ Tax Incentives
— Energy production payments or tax credits
Public Financing
✓ Public Investment, Loans or Grants
— Public Competitive Bidding
Further Information:
• Energy Country Profiles (reegle.info)
Sources
www.map.ren21.net
www.reegle.info
GHI
DNI
Terrain
Map
Satellite
labels
Gibraltar
Alboran Sea
Tangier
Tetouan
Oran
Mostaghanem
Mascara
Tiaret
M'Sila
Tlemcen
Saida
Biskra
Oujda
Kenitra
Fes
Rabat
Meknes
Casablanca
Laghouat
El Jadida
Khouribga
Beni Mellal
Safi
Ghardaia
Errachidia
Marrakesh
Morocco
Essaouira
Béchar
Ouarzazate
Agadir
Taroudant
Tiznit
Guelmin
Tan Tan
Tindouf
Adrar
Algeria
Ain Salah
GHI
(kWh/m2)
2574
2444
2314
2184
2054
1925
1795
1665
1535
1405
POWERED BY Google
(C) Prefix Copyrigth itself 2010 - Terms of Use

Contents


about | events | project consortium | user questionnaire
SOLARMED atlas
Solar-Med-Atlas
Socio-Economic and Policy
Map
Solar data
PV system
Search
Marrakesh, Morocco
Browse position
n/a
Socio-economic & policy data
Morocco
Renewable Energy Promotion Policies:
Regulatory Policies
— Feed-in Tariff
— Renewable Portfolio Standard/quota
— Net Metering
✓ Investment or other tax credits
— Tradable RE certificates
Fiscal Incentives
— Capital Subsidy, Grant or Rebate
✓ Tax Incentives
— Energy production payments or tax credits
Public Financing
✓ Public Investment, Loans or Grants
— Public Competitive Bidding
Further Information:
• Energy Country Profiles (reegle.info)
Sources
www.map.ren21.net
www.reegle.info
GHI
DNI
Terrain
Map
Satellite
labels
BNI
(kWh/m2)
3086
2871
2656
2440
2225
2009
1794
1578
1363
1148
Morocco
Algeria
Marrakesh
Casablanca
Rabat
Fes
Meknes
Tangier
Tetouan
Oujda
Tlemcen
Oran
Agadir
Ouarzazate
Errachidia
Béchar
Laghouat
Biskra
Tiznit
Guelmim
Tan Tan
Tindouf
Adrar
Laayoune
Arrecife
Gibraltar
Malaga
Alboran Sea
(C) Prefix Copyrigth itself 2010 - Terms of Use

Contents

about | events | project consortium | user questionnaire

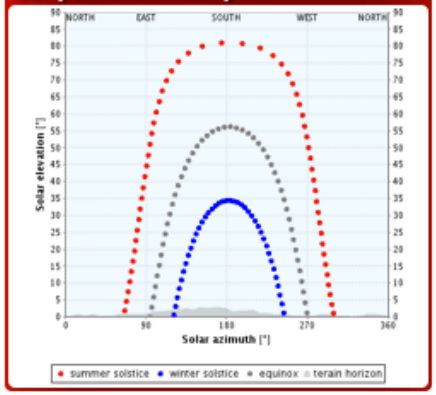
SOLARMED atlas **Solar-Med-Atlas**

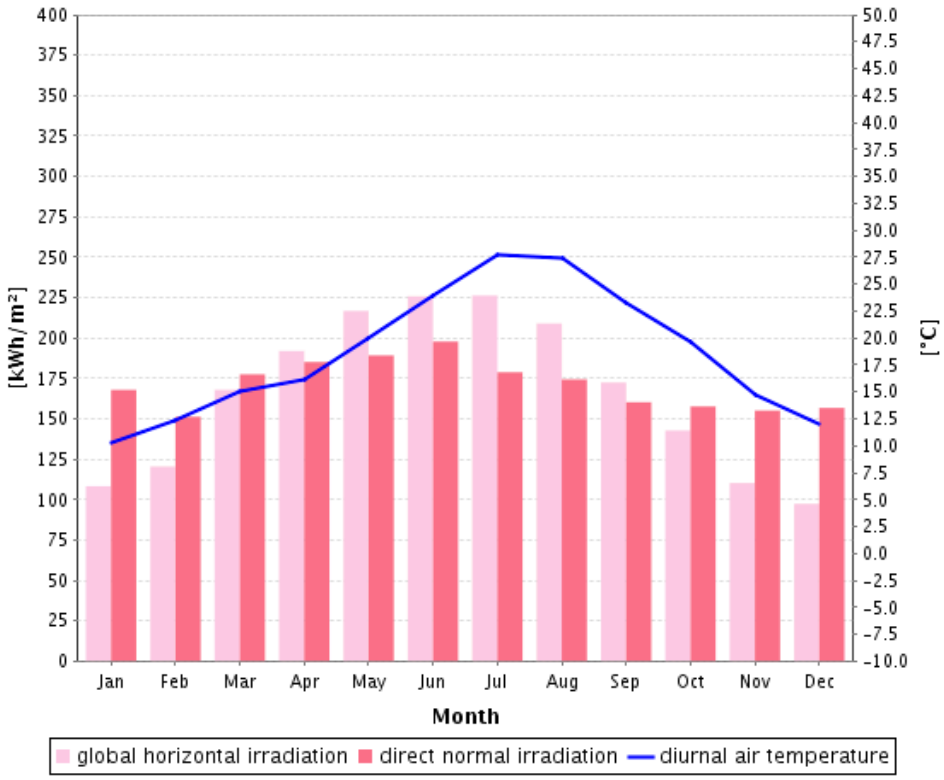
Socio-Economic and Policy | Map | Solar data | PV system

Location 31°38'05", -07°59'53"

زنقة بوطويل, Marrakesh, Morocco

Sun path and horizon plot





Longterm values | Interannual variability

Month	GHI	DNI	TEMPER
Jan	108	168	10.3
Feb	120	151	12.3
Mar	168	178	15.1
Apr	192	185	16.2
May	217	189	19.9
Jun	226	198	24.0
Jul	226	179	27.7
Aug	209	174	27.4
Sep	172	160	23.3
Oct	143	158	19.7
Nov	110	155	14.8
Dec	97	157	12.0
Year	**1989**	**2052**	**18.5**

Download data in CSV format

Download Excel report

GHI: global horizontal irradiation [kWh/m²]
DNI: direct normal irradiation [kWh/m²]
TEMPER: diurnal air temperature [°C]

Contents

about | events | project consortium | user questionnaire

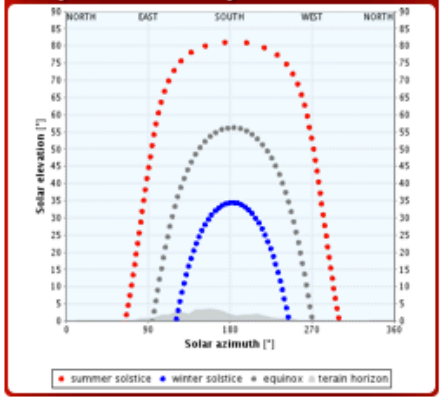
SOLARMED atlas **Solar-Med-Atlas**

Socio-Economic and Policy | Map | Solar data | PV system

Location 31°34'43", -08°01'12"

Route du Barrage, Marrakesh, Morocco

Sun path and horizon plot

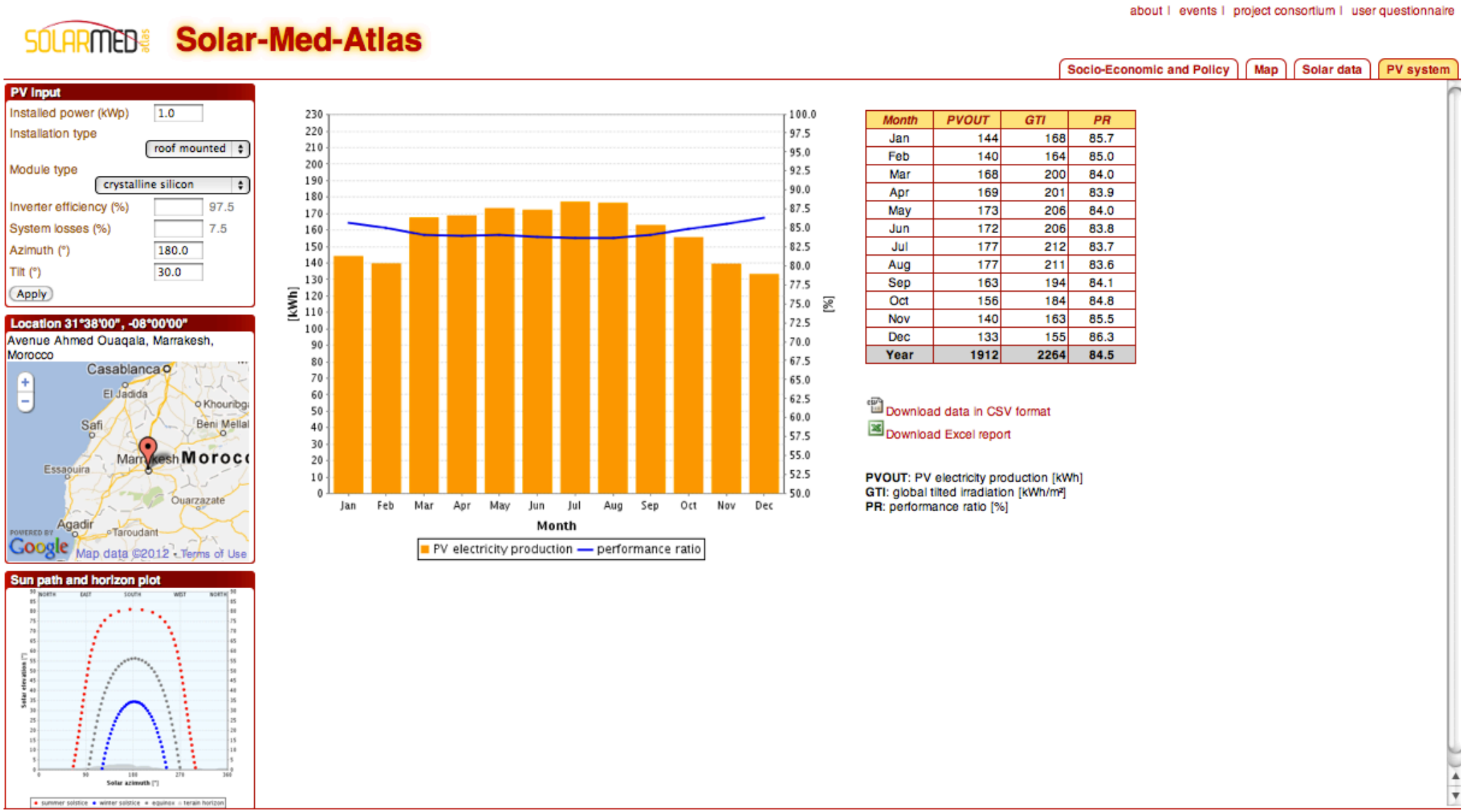


Longterm values | Interannual variability

Year	GHI	DNI
1994	1983	2027
1995	1949	1960
1996	1942	1905
1997	1971	1968
1998	2008	2068
1999	2016	2103
2000	2049	2132
2001	2059	2137
2002	2001	2048
2003	1983	2094
2004	1914	1990
2005	2058	2234
2006	1964	1995
2007	2047	2273
2008	2045	2162
2009	2000	2082
2010	1955	1918
Average	**1997**	**2064**

GHI: global horizontal irradiation [kWh/m²]
DNI: direct normal irradiation [kWh/m²]

Contents



Month	PVOUT	GTI	PR
Jan	144	168	85.7
Feb	140	164	85.0
Mar	168	200	84.0
Apr	169	201	83.9
May	173	206	84.0
Jun	172	206	83.8
Jul	177	212	83.7
Aug	177	211	83.6
Sep	163	194	84.1
Oct	156	184	84.8
Nov	140	163	85.5
Dec	133	155	86.3
Year	**1912**	**2264**	**84.5**

Contents

about | events | project consortium | user questionnaire

Solar-Med-Atlas

Socio-Economic and Policy | Map | Solar data | PV system

PV input

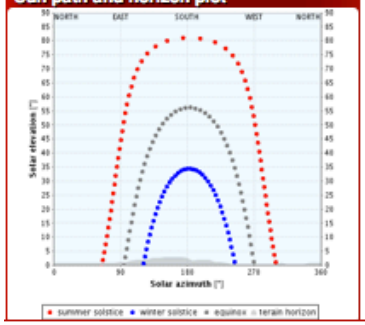
Installed power (kWp)	1.0	
Installation type	roof mounted	
Module type	crystalline silicon	
Inverter efficiency (%)		97.5
System losses (%)		7.5
Azimuth (°)	180.0	
Tilt (°)	30.0	

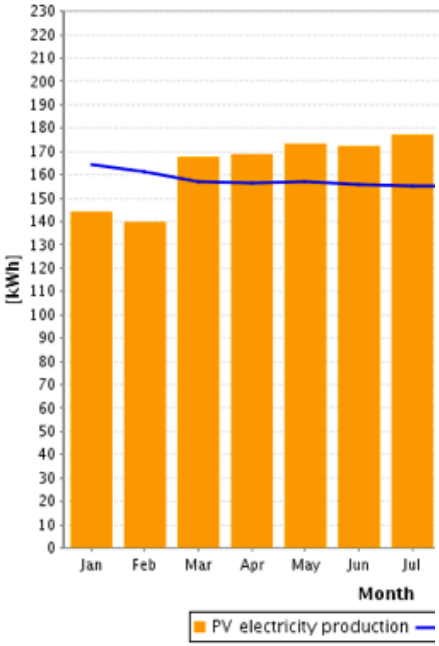
Apply

Location 31°38'00", -08°00'00"

Avenue Ahmed Ouaqala, Marrakesh, Morocco

Sun path and horizon plot

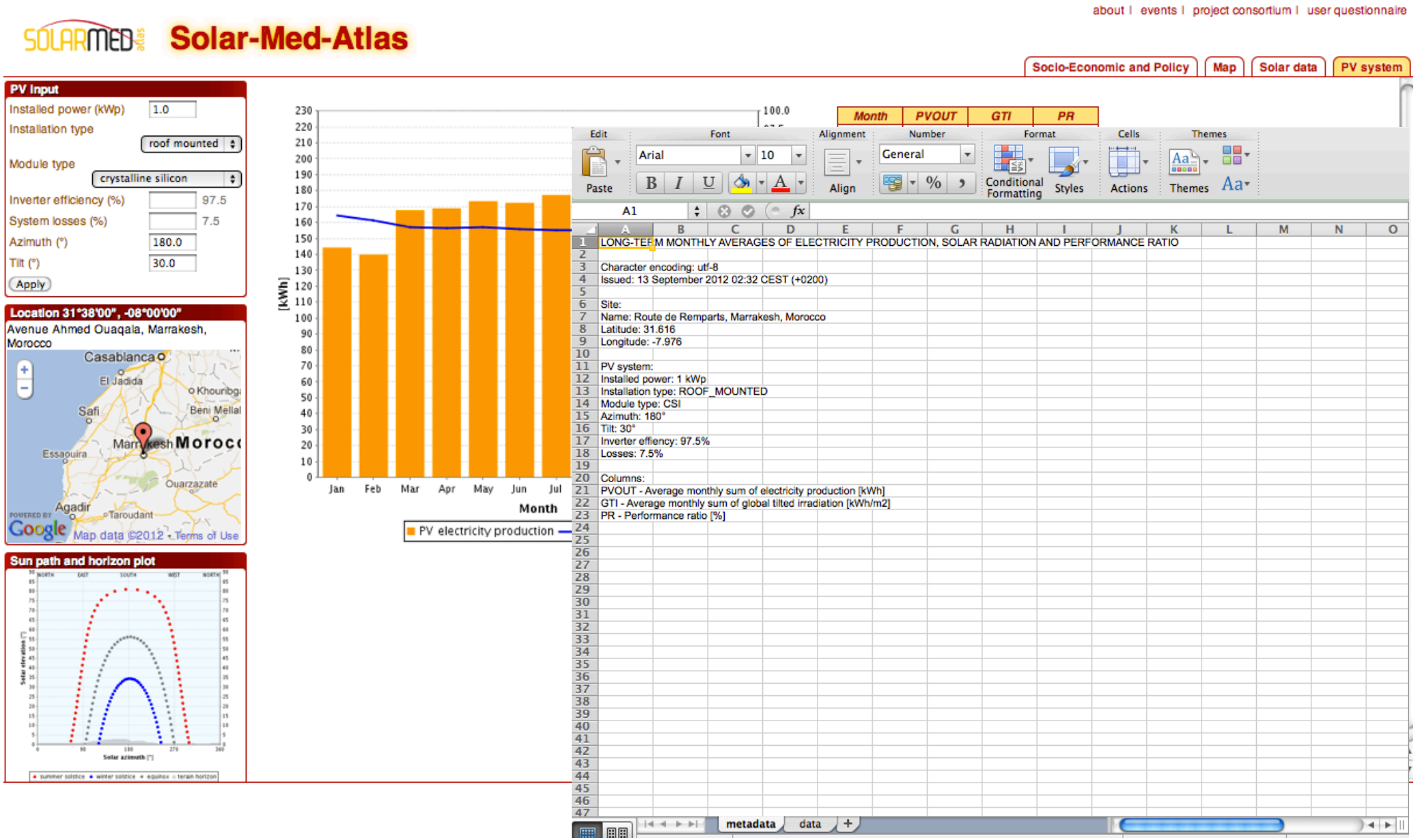




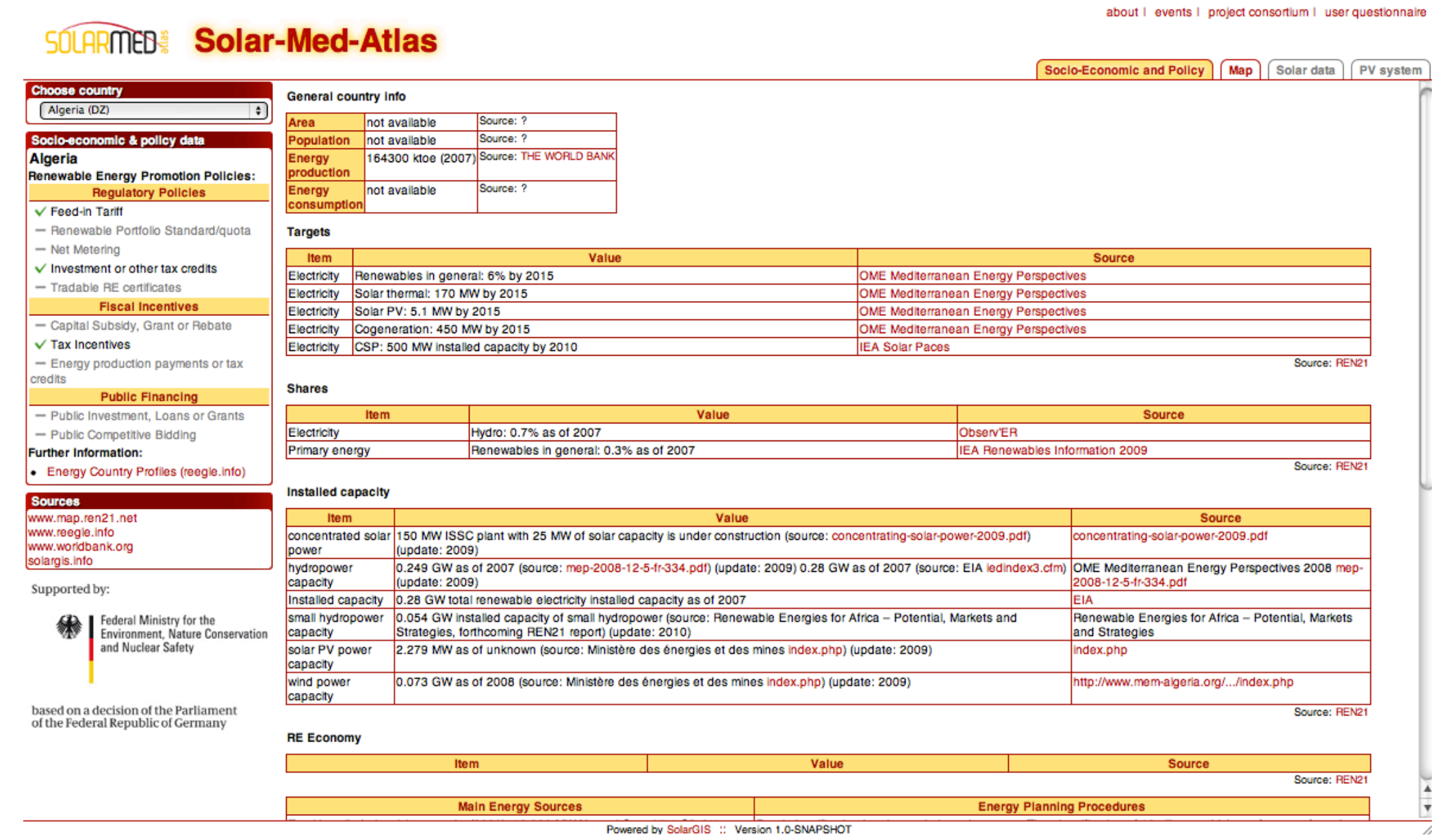
Month	PVOUT	GTI	PR
Jan	144	168	85.7
Feb	140	164	85.0
Mar	168	200	84.0

```
#LONG-TERM MONTHLY AVERAGES OF ELECTRICITY PRODUCTION, SOLAR RADIATION AND PERFORMANCE RATIO
#
#Character encoding: utf-8
#Issued: 13 September 2012 02:32 CEST (+0200)
#
#Site:
#Name: Route de Remparts, Marrakesh, Morocco
#Latitude: 31.616
#Longitude: -7.976
#
#PV system:
#Installed power: 1 kWp
#Installation type: ROOF_MOUNTED
#Module type: CSI
#Azimuth: 180°
#Tilt: 30°
#Inverter effiency: 97.5%
#Losses: 7.5%
#
#Columns:
#PVOUT - Average monthly sum of electricity production [kWh]
#GTI - Average monthly sum of global tilted irradiation [kWh/m2]
#PR - Performance ratio [%]
#
#Data:
Month;PVOUT;GTI;PR
Jan;145;169;85.7
Feb;140;165;85.0
Mar;168;200;84.0
Apr;169;201;83.9
May;173;206;84.1
Jun;172;205;83.8
Jul;177;212;83.7
Aug;176;211;83.6
Sep;163;194;84.1
Oct;156;184;84.8
Nov;139;162;85.6
Dec;134;155;86.3
Year;1912;2264;84.6
```

Contents


about | events | project consortium | user questionnaire
Solar-Med-Atlas
Socio-Economic and Policy
Map
Solar data
PV system
PV input
Installed power (kWp) 1.0
Installation type
roof mounted
Module type
crystalline silicon
Inverter efficiency (%) 97.5
System losses (%) 7.5
Azimuth (°) 180.0
Tilt (°) 30.0
Apply
Location 31°38'00", -08°00'00"
Avenue Ahmed Ouaqala, Marrakesh, Morocco
Casablanca
El Jadida
Safi
Beni Mellal
Essaouira
Ouarzazate
Agadir
Taroudant
Map data ©2012 - Terms of Use
Sun path and horizon plot
[kWh]
Month
PV electricity production
Month
PVOUT
GTI
PR
LONG-TERM MONTHLY AVERAGES OF ELECTRICITY PRODUCTION, SOLAR RADIATION AND PERFORMANCE RATIO
Character encoding: utf-8
Issued: 13 September 2012 02:32 CEST (+0200)
Site:
Name: Route de Remparts, Marrakesh, Morocco
Latitude: 31.616
Longitude: -7.976
PV system:
Installed power: 1 kWp
Installation type: ROOF_MOUNTED
Module type: CSI
Azimuth: 180°
Tilt: 30°
Inverter effiency: 97.5%
Losses: 7.5%
Columns:
PVOUT - Average monthly sum of electricity production [kWh]
GTI - Average monthly sum of global tilted irradiation [kWh/m2]
PR - Performance ratio [%]
metadata
data

Contents



about | events | project consortium | user questionnaire

Solar-Med-Atlas

Socio-Economic and Policy | Map | Solar data | PV system

Choose country

Algeria (DZ)

Socio-economic & policy data

Algeria

Renewable Energy Promotion Policies:

Regulatory Policies

- ✓ Feed-in Tariff
- – Renewable Portfolio Standard/quota
- – Net Metering
- ✓ Investment or other tax credits
- – Tradable RE certificates

Fiscal Incentives

- – Capital Subsidy, Grant or Rebate
- ✓ Tax Incentives
- – Energy production payments or tax credits

Public Financing

- – Public Investment, Loans or Grants
- – Public Competitive Bidding

Further Information:

- Energy Country Profiles (reegle.info)

Sources

www.map.ren21.net
www.reegle.info
www.worldbank.org
solargis.info

Supported by:

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

based on a decision of the Parliament of the Federal Republic of Germany

General country info

Area	not available	Source: ?
Population	not available	Source: ?
Energy production	164300 ktoe (2007)	Source: THE WORLD BANK
Energy consumption	not available	Source: ?

Targets

Item	Value	Source
Electricity	Renewables in general: 6% by 2015	OME Mediterranean Energy Perspectives
Electricity	Solar thermal: 170 MW by 2015	OME Mediterranean Energy Perspectives
Electricity	Solar PV: 5.1 MW by 2015	OME Mediterranean Energy Perspectives
Electricity	Cogeneration: 450 MW by 2015	OME Mediterranean Energy Perspectives
Electricity	CSP: 500 MW installed capacity by 2010	IEA Solar Paces

Source: REN21

Shares

Item	Value	Source
Electricity	Hydro: 0.7% as of 2007	Observ'ER
Primary energy	Renewables in general: 0.3% as of 2007	IEA Renewables Information 2009

Source: REN21

Installed capacity

Item	Value	Source
concentrated solar power	150 MW ISSC plant with 25 MW of solar capacity is under construction (source: concentrating-solar-power-2009.pdf) (update: 2009)	concentrating-solar-power-2009.pdf
hydropower capacity	0.249 GW as of 2007 (source: mep-2008-12-5-fr-334.pdf) (update: 2009) 0.28 GW as of 2007 (source: EIA iedindex3.cfm) (update: 2009)	OME Mediterranean Energy Perspectives 2008 mep-2008-12-5-fr-334.pdf
Installed capacity	0.28 GW total renewable electricity installed capacity as of 2007	EIA
small hydropower capacity	0.054 GW installed capacity of small hydropower (source: Renewable Energies for Africa – Potential, Markets and Strategies, forthcoming REN21 report) (update: 2010)	Renewable Energies for Africa – Potential, Markets and Strategies
solar PV power capacity	2.279 MW as of unknown (source: Ministère des énergies et des mines index.php) (update: 2009)	index.php
wind power capacity	0.073 GW as of 2008 (source: Ministère des énergies et des mines index.php) (update: 2009)	http://www.mem-algeria.org/.../index.php

Source: REN21

RE Economy

Item	Value	Source

Source: REN21

Main Energy Sources	Energy Planning Procedures

Powered by SolarGIS :: Version 1.0-SNAPSHOT

Solar Atlas for Mediterranean: What comes next

- Estimate of the uncertainty
- Hot water simulation tool
- Language version (French and Arabic)
- Raster data download
- Maps

- Explanatory and training information

Thank you

for your attention!

Marcel Suri
GeoModel Solar

http://www.solar-med-atlas.org/