JatroMed Second International Workshop
Bioenergy for enhancing sustainable development in medteraneen countries.

Bio-energy in Morocco: Opportunities and Challenges

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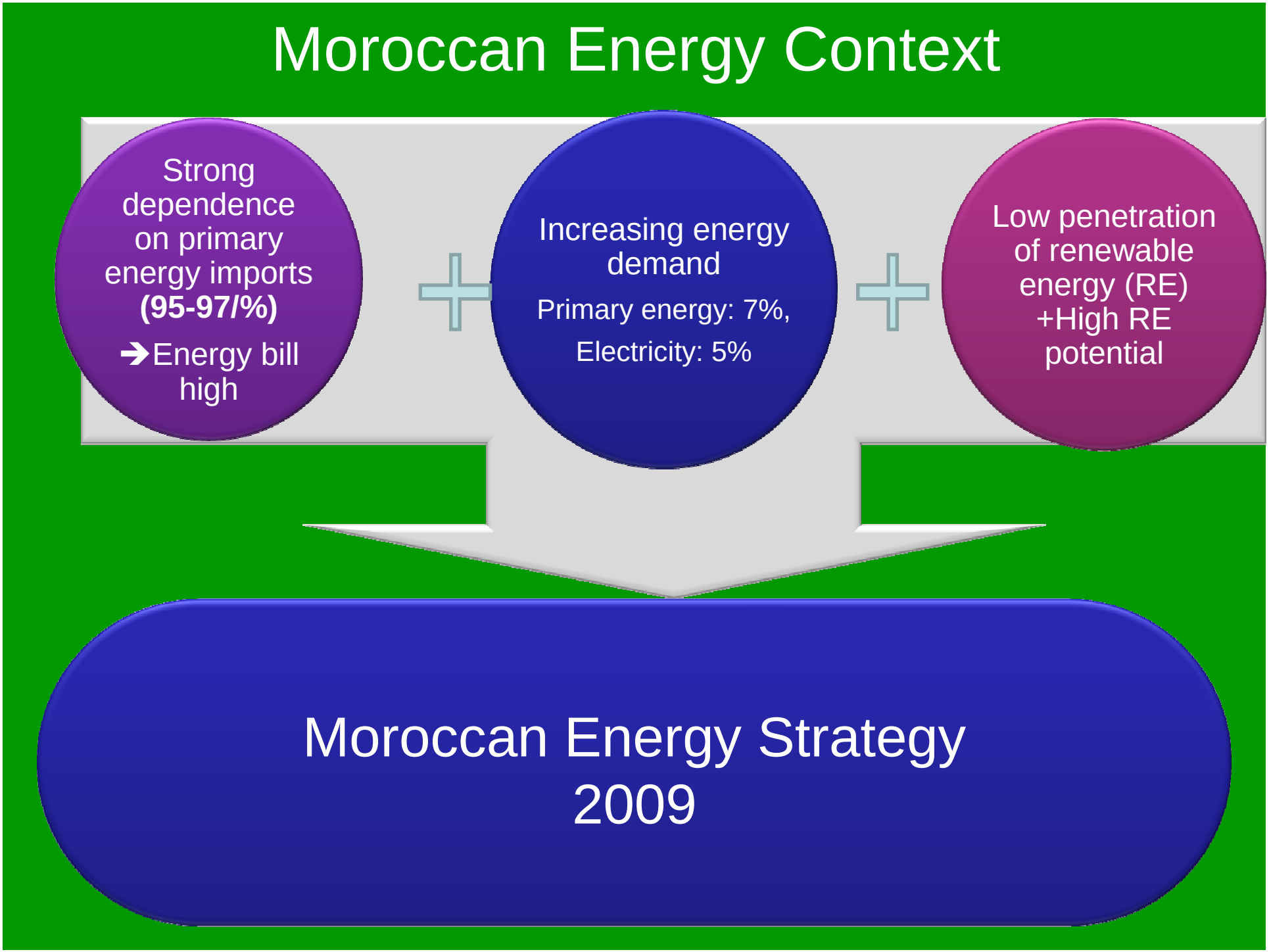
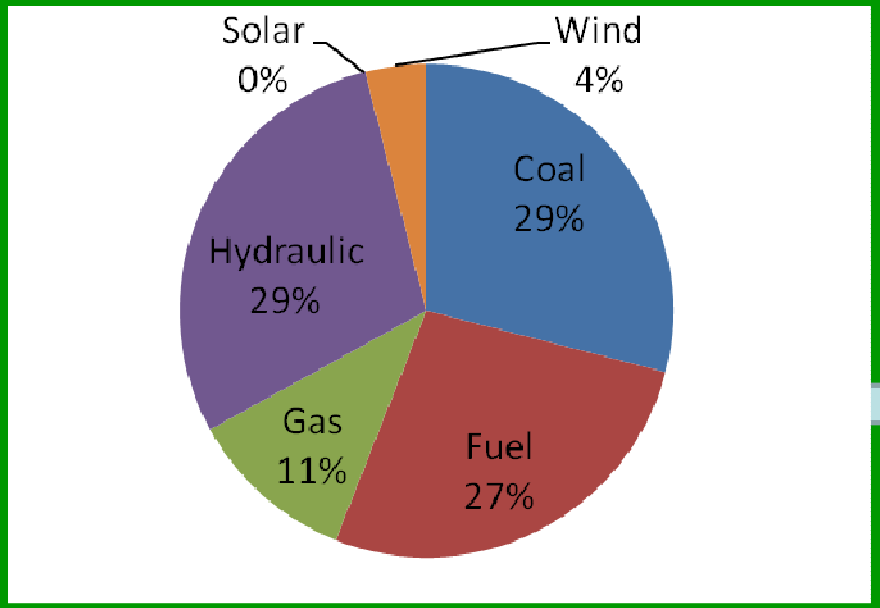
Moroccan Energy Context



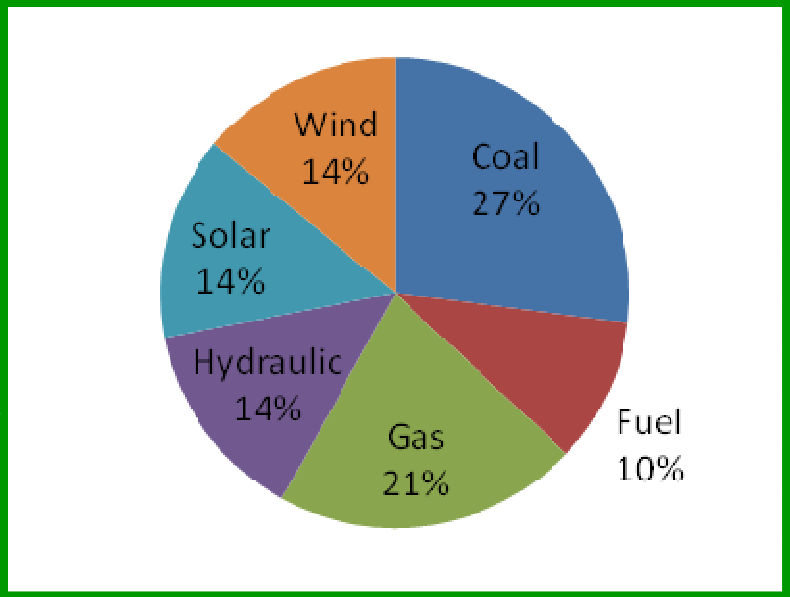
Strategic orientations

- Increase the share or RE in the energy Mix (Solar, Wind, hydro..)
  - Objectives: 42% of electricity power from RE by 2020
- Promote Energy efficiency (in buildings, industry, transportation, green cities..)
  - Objectives: 12% saving b y2020
- Mobilize all the national energy resources (Hydro, shale, **biomass**, geothermal..)
- Promote regional Integration: extension of the interconnections between Spain and Algeria….
- Reorganize the energy sector ➔ institutional and legislative reforms

Energy strategy objectives



2009



2020

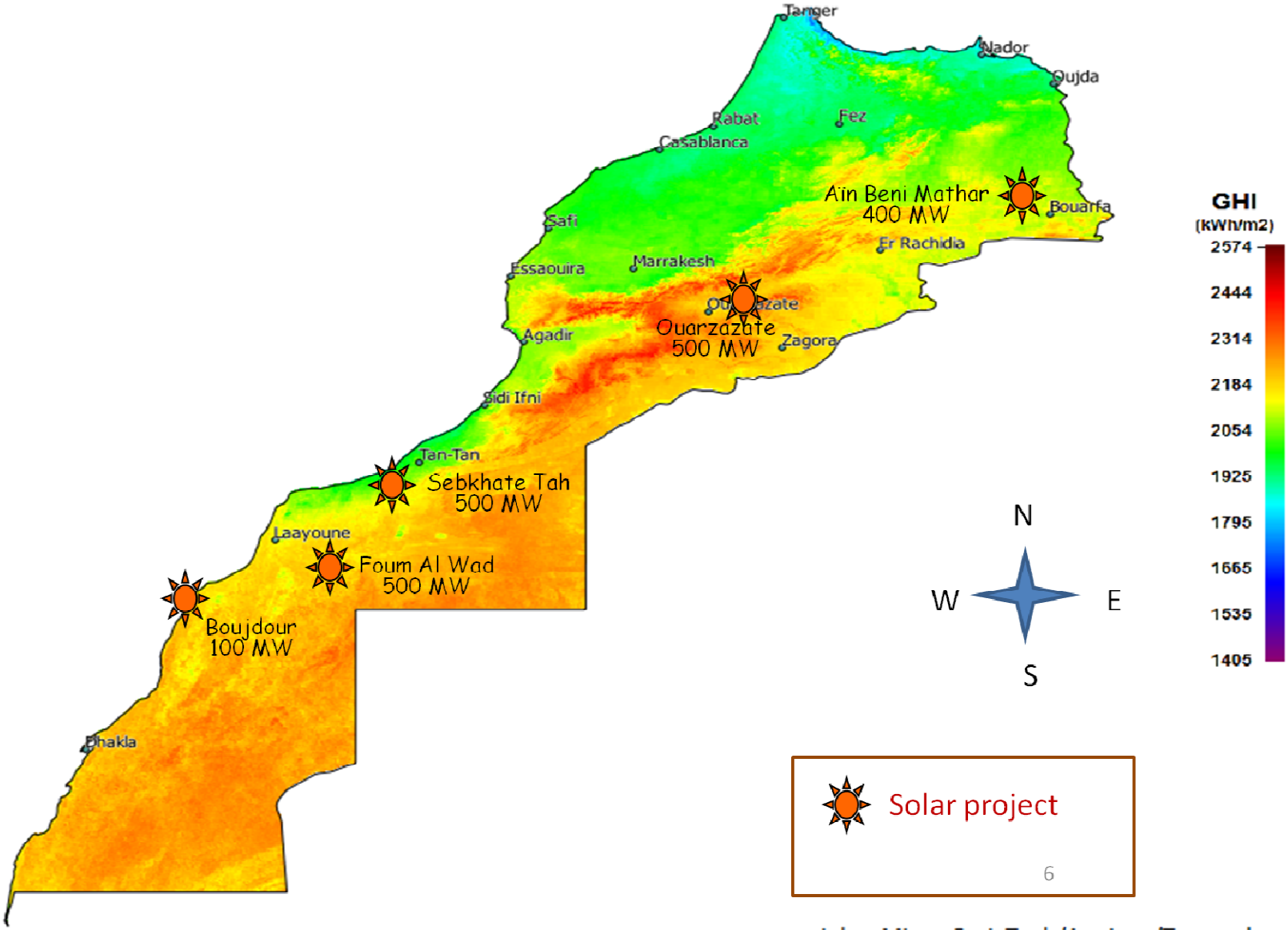
42% of installed power in 2020 from RE sources

✓*2 GW* Solar

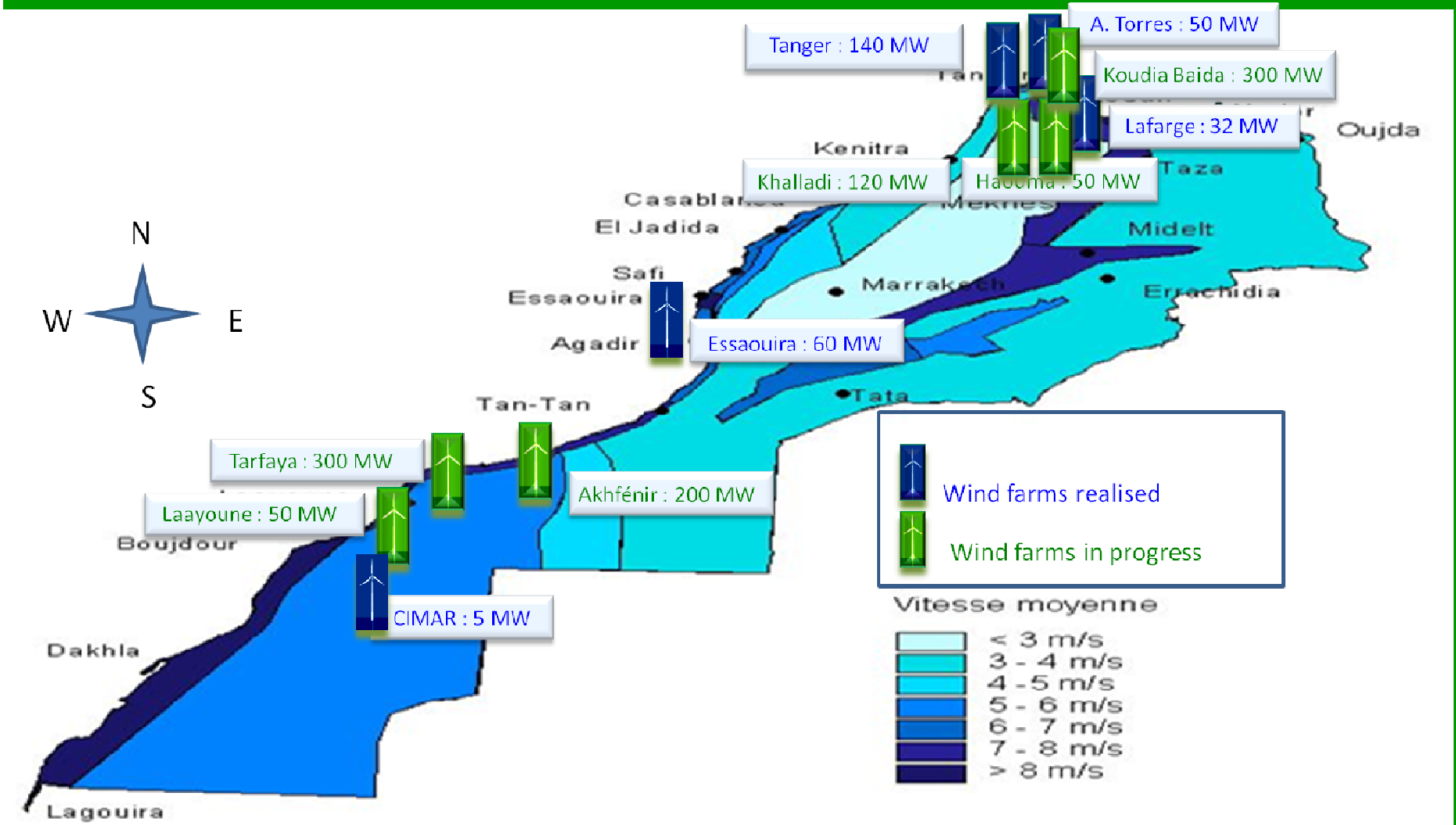
✓*2 GW Wind*

✓*2 GW Hydro*

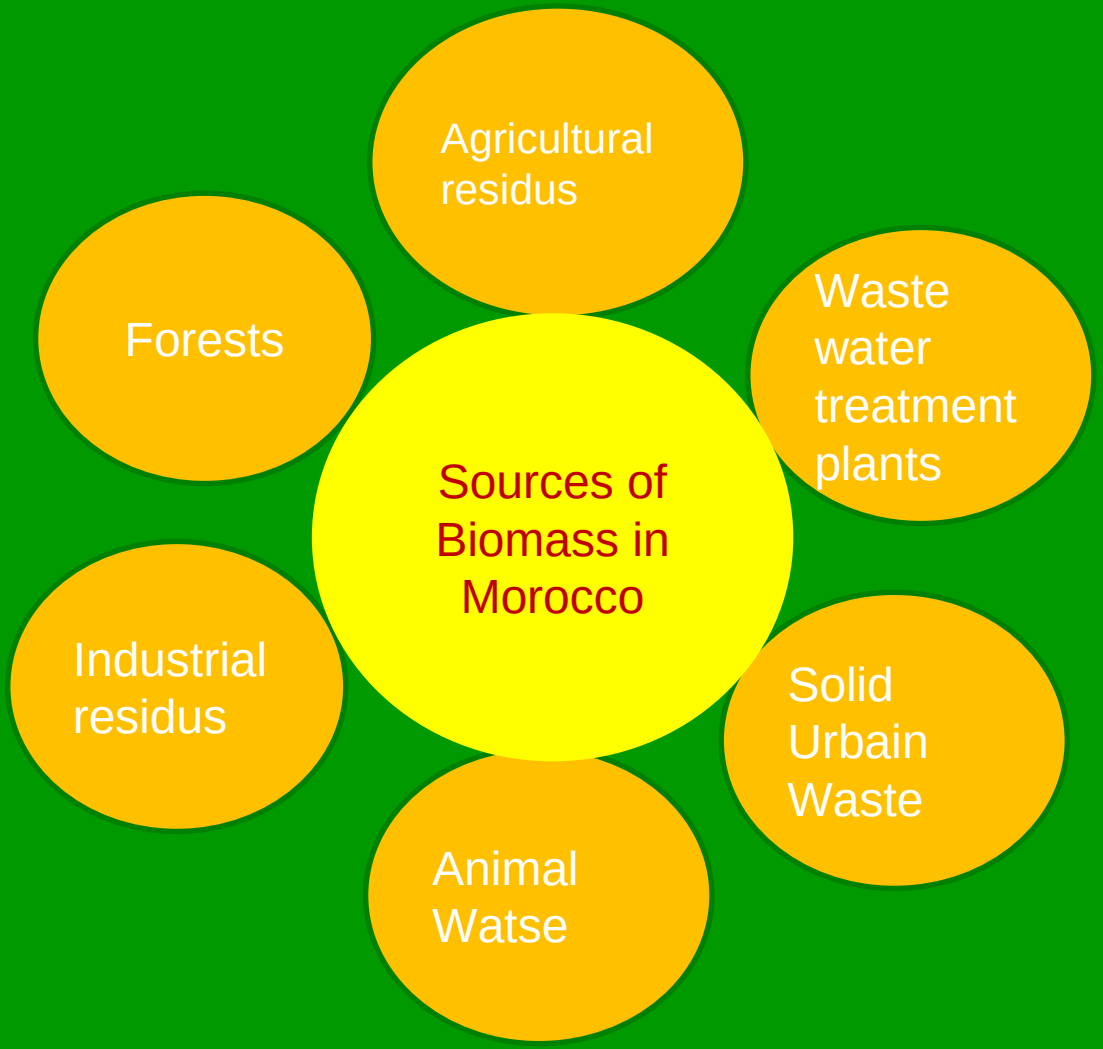
Solar Energy Projects



Wind Energy Projects



Bioenergy In Morocco



Mostly from residues, and forest!!! Mostly used for thermal energy or biogas production.

Microalgae: Small scale experimental stage (MASCIR)

National Biomass-energy Plan

Short term:

Energy production: 160 GWh (2012) with an Installed power of 45 MW.

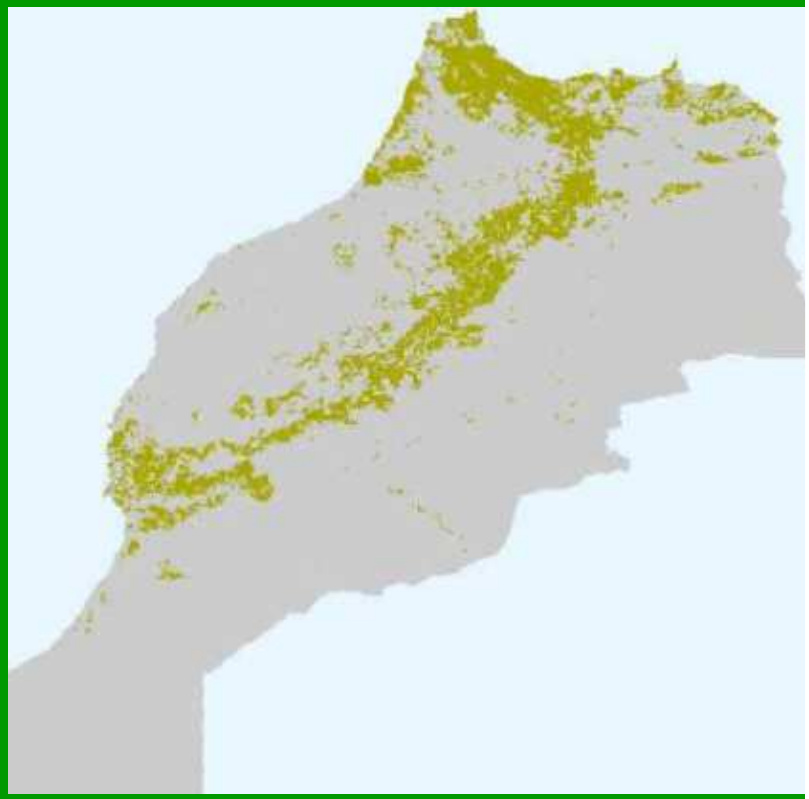
- Landfills (household waste): 542 GWh/year
- Wastewater treatment : 272 GWh/year
- Agricultural residues and waste: 345 GWh/year

Medium Term:

* 3778 GWh thermal energy/year
* installed power 144 MW in 2020.
  - Landfills (household waste): : 1406 GWh/year
  - Wastewater treatment : 1166 GWh/year
  - Agricultural residues : 1206 GWh/year

Forest biomasse (Fire wood)

- 30 % of the energy mix
- 11,3 million tons/year
- 89 % in rural areas (cooking, heating, production of hot water)
-11 % in urban areas (Hammams, traditional bakeries, …)



Forest: 9 million hectares

- over-exploitation (30 000 ha/year are lost)
-Deforestation

➔need to rationalize the use of wood

➔More efficient systems

Agricultural waste and by products

- Arable land surface: 9 millions ha

- Live stock herd: 7 millions (LSU),
Yield in biogas ~280 Nm3/LSU/an)

Others:
-Bagasse from sugar cane refineries (Cosumar)

Densité	120 Kg/m3
PCI	1800 Kcal /Kg

-Olive residues and by products (traditional and industrials mills)

- Argane residues and by products

-

COSUMAR Sugar refineries

Bagasse storage

Waste water treatment

Theoretical potential
230 Millions m3 of biogas/yr, 1,376 Millions MWh/an
• Technical potential: 31 millions m3 of biogas/yr, 185.463 MWh/year

Total Biogas potential > 7MW (source GIZ)

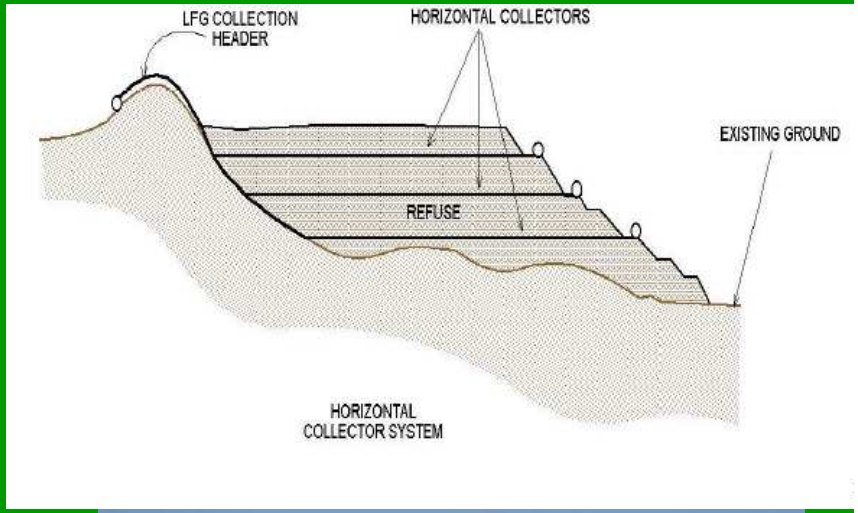
Marrakech Plant

•Capacity: 100.000 m3 waste water treated
-Biogas production (20 000 Nm3/day).

-Covers 45% of the energy needs of the plant (30 MWh/ day)

Over 70 waste water treatments plants are under construction throughout the country (**Programme National d'Assainissement Liquide et d'Epuration des Eaux Usées)**

Household waste



- 5.5 Millions tons/y (2010)
- Theoretical potential:
  - 700 millions m3 of biogas/year
  - -4,2 Millions de MWh/an.

Biogas production from Land fills
-Fes
-Oujda
-Rabat

Nominal Capacity: 5MW

In progress
-Casablanca
-Marrakech

Enery crops in Morocco

Not yet well developped

Jatropha curcas

- Foundation du Sud in Agadir region
- Demonstration field (Khmiss At Amira) by ➔ drip irrigation
  - Provide seeds and plants for agriculture.
  - No oil production yet

Novembre 2012

Jatropha in Morocco

- **Oujda** (north east of Morocco)**:**

Experimental plot (5x8) Irrigated with treated Waste water

Talk of Wafae Mokhtari and H. Elhalouan

Source: Wafae Mokhtari

Objectives:

- investigate the possibility of using treated waste water of the city of Oujda

- Demonstrate the possibility of cultivating Jatropha in zone with limited water resources/rainfall

- Evaluate the impact of waste water on Jatropha (growth, oil quality, seed cake..)

- Evaluate the effect of climatic conditions (freezing..)

Jatropha in Morocco..

- Centre Régional de Recherche Forestière CRRF in Marrakech
  - sowing of various genotypes in a nursery (seeds, cuts..)
  - Transplantation in arid regions (Marrakech, Kelaa, Eljadida).

Source Mr. Bellaka, CRRF-Marrakech

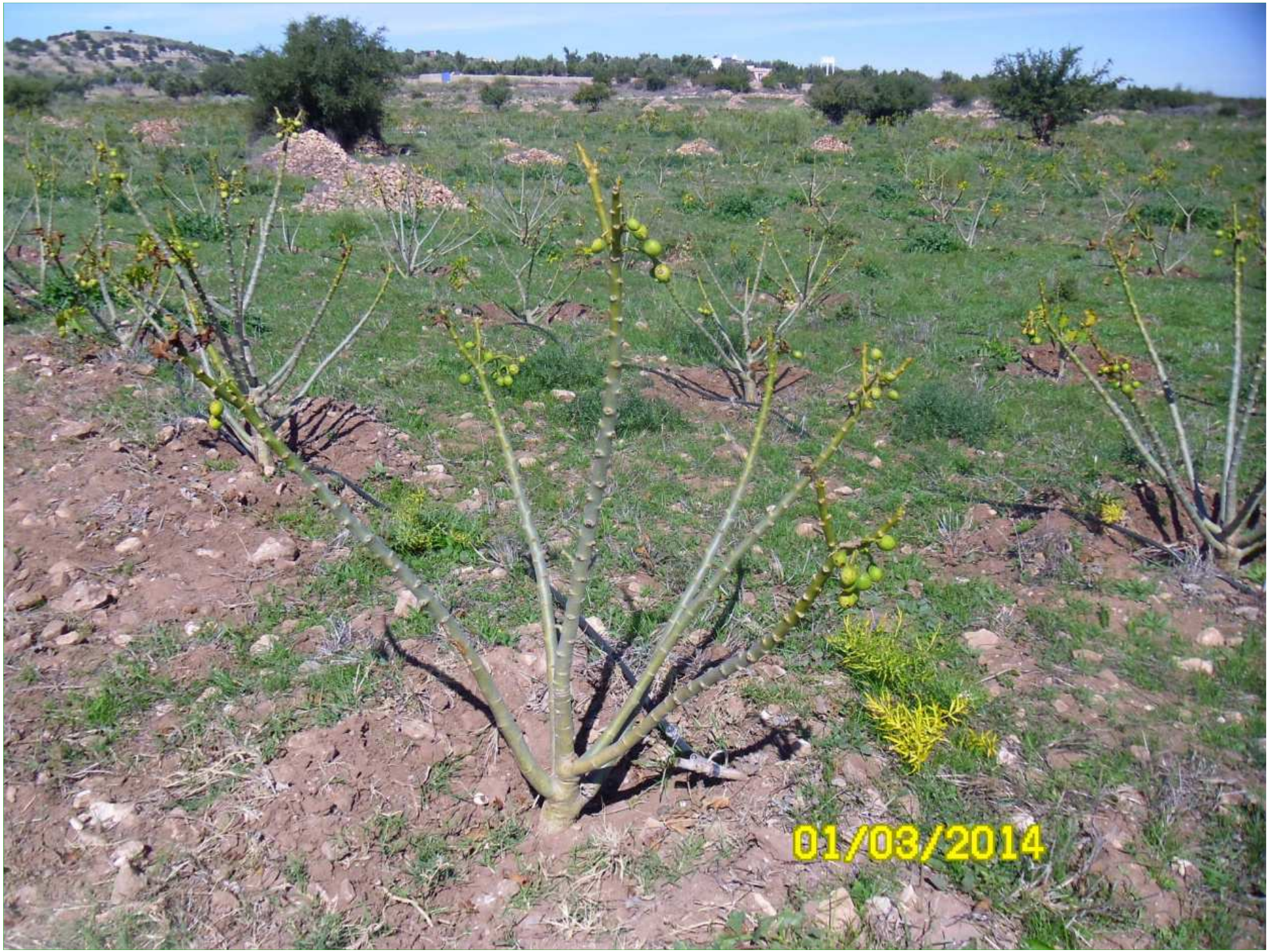
Jatropha in Morocco...

- Experiments of the Cherifien Office of Phosphate (OCP) results are still unknown
- Industrial scale project by MOSMART in Chichaoua region (2008) but was not concluded (irrigation water problems?).
- 4 hectares JatroMed demonstration field in Essaouira: comprehensive and systematic study of adaptability, needs, socio-economical and environmental impacts of *Jataropha curcas.*

JatroMed demonstration field in Essaouira


JCLMAX
27/10/2013


JCLMAX
09/02/2014

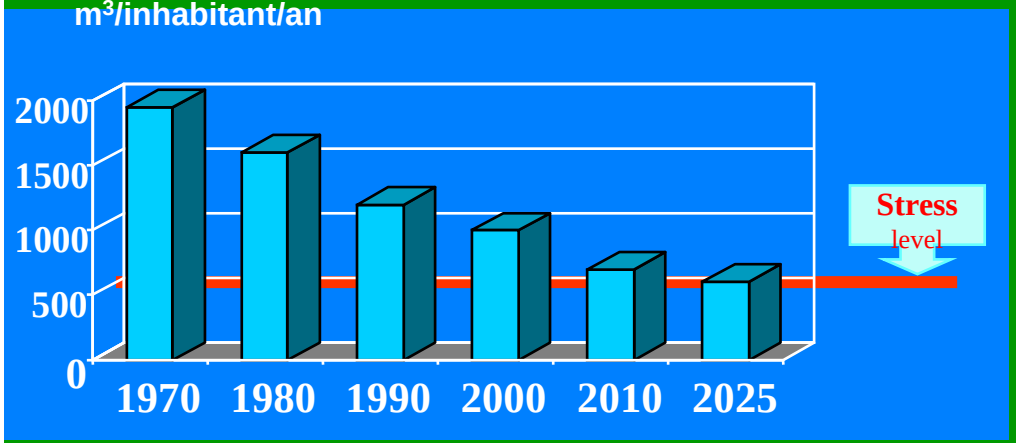

01/03/2014

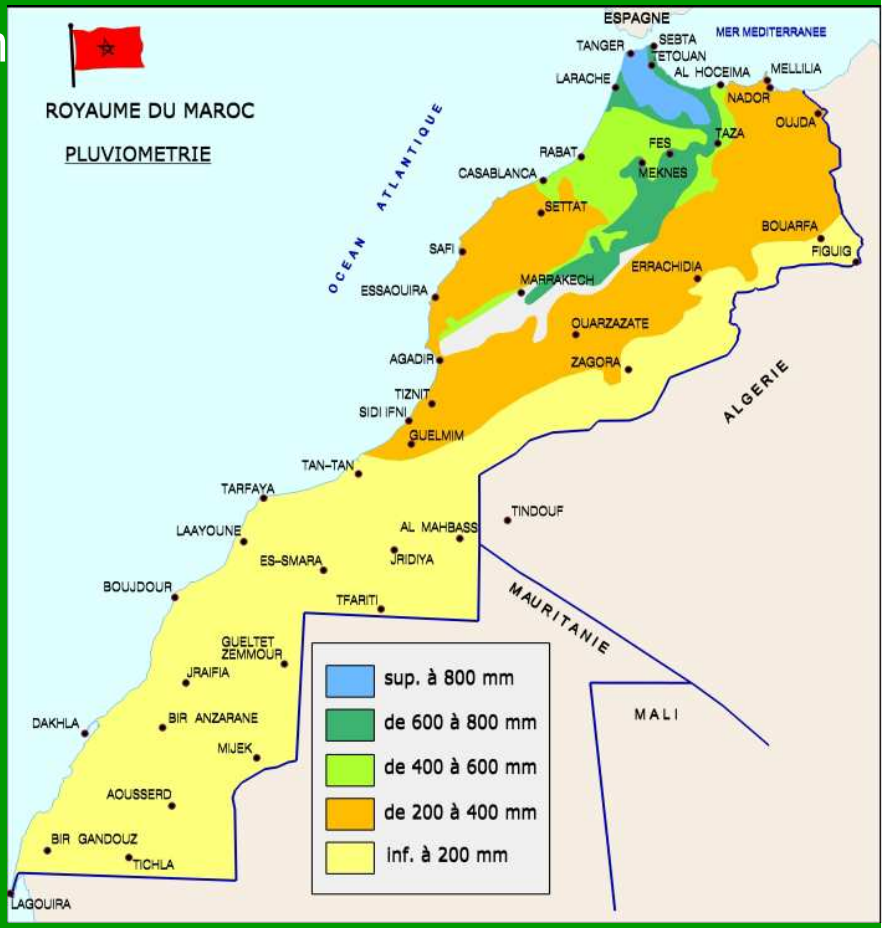
Bio fuels/Energy crops: Challenges

- Energy crops not yet well developed in the country

Reasons

- Scarcity of water resources (< 700 m3/capita/year)
- Un-even distribution of rain fall
- Limited useful agriculture land
- Food security is prioritized….





Need drought resistant crops!!!

Bioenergy feed stocks: opportunities

Driving forces:

- Energy dependence
- Energy demand increasing (even in rural areas)
- Availability of marginal non-cultivated lands
- Bio-refinery concepts (cooperative of small farmers)

But still: Need to find suitable energy crops for our climatic conditions and available uncultivated ➔ one of the objectives of JatroMed and other future projects (Opuntia, Castor ....)

Thank you for your attention