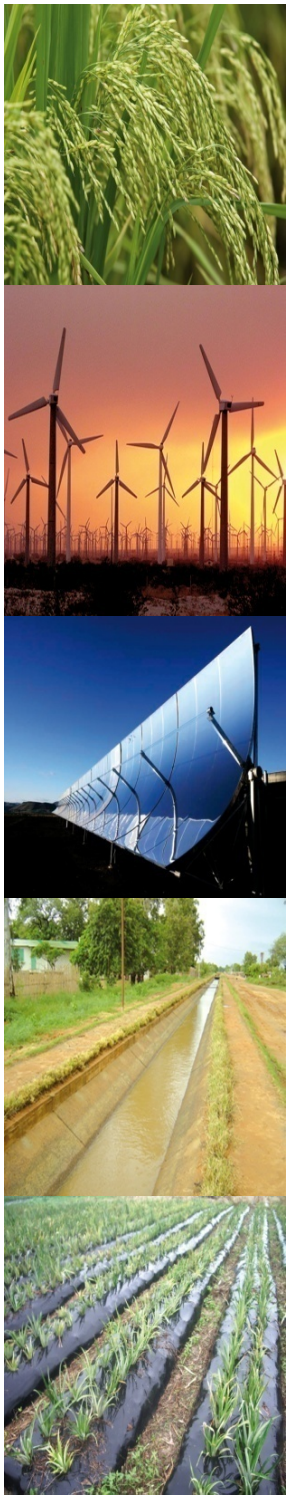


African Development Bank:

Ouarzazate Solar Complex Phase 1 : Up to 160MW CSP Trough

Infrastructure Consortium for Africa

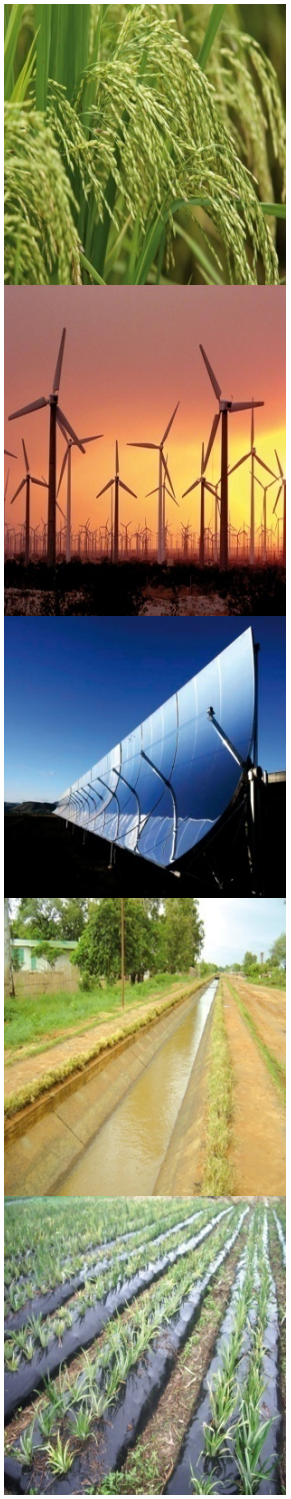
8th Annual Meeting

13th June 2012

Energy, Environment and Climate Change Department

Agenda:

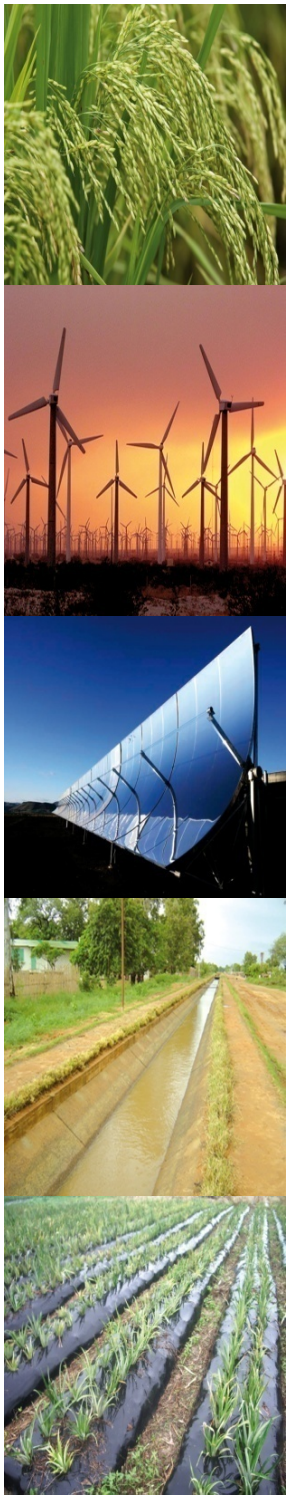
1. Brief on the Moroccan Solar Plan and the rationale behind
2. Ouarzazate Solar Complex: Various technologies with R&D Platform
3. Ouarzazate First Phase: The largest CSP Plant in the MENA region
4. Perspectives



African Development Bank:

1. Brief on the Moroccan Solar Plan and the rationale behind

Energy, Environment and Climate Change Department



Brief on the Moroccan Solar Plan and the rationale behind:

An ongoing Plan based on a Strong Government Support

Taking advantage of Solar Resources

2 000 MW

14%inst. capacity

By 2020

Electrical Production

Training

Local Development

Industrial integration

Research and development

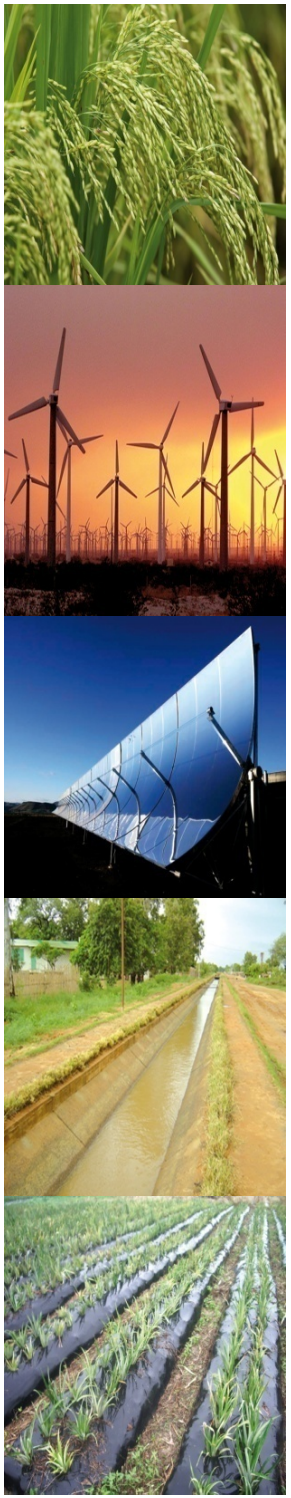
Well on Track

masen

Necessary means in place securing high standards' implementation

Goverment financial support materialised in a Convention signed on October 26, 2010

Each developped project should positively contribute to the achievement of the aforementioned objectives



African Development Bank:

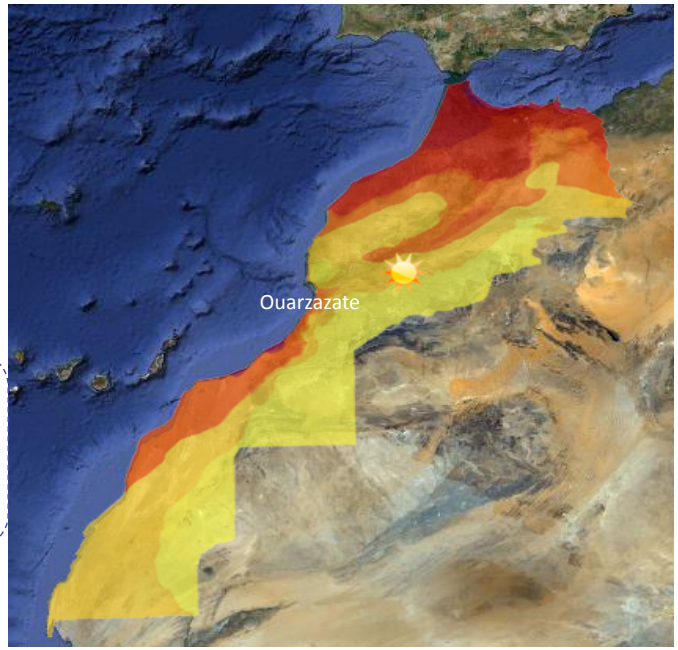
2. Ouarzazate Solar Complex: Various technologies with R&D Platform

Energy, Environment and Climate Change Department

Ouarzazate Solar Complex: Various technologies with R&D Platform:

Ouarzazate Solar Complex	Operational priority
500MW	2015

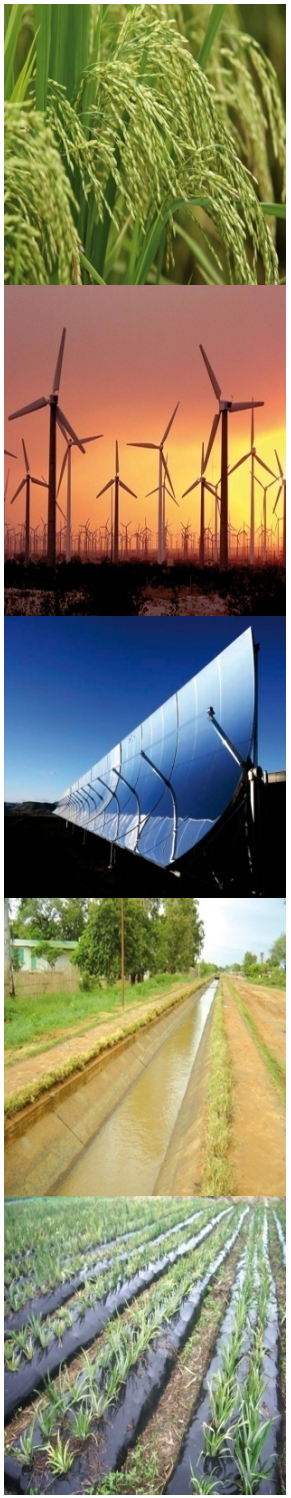
Direct Normal Irradiation of 6,5 kWh/m²/day



Solar Direct normal radiation

10 km North East Ouarzazate	Proximity to Mansour Dahbi dam 440 hm^3
2 500 hectares	Proximity to transmission lines 225 / 60 KV

Perfect site conditions for Solar Projects:
A result of multiple site studies



Ouarzazate Solar Complex: Various technologies with R&D Platform:

Multiple phases and technologies

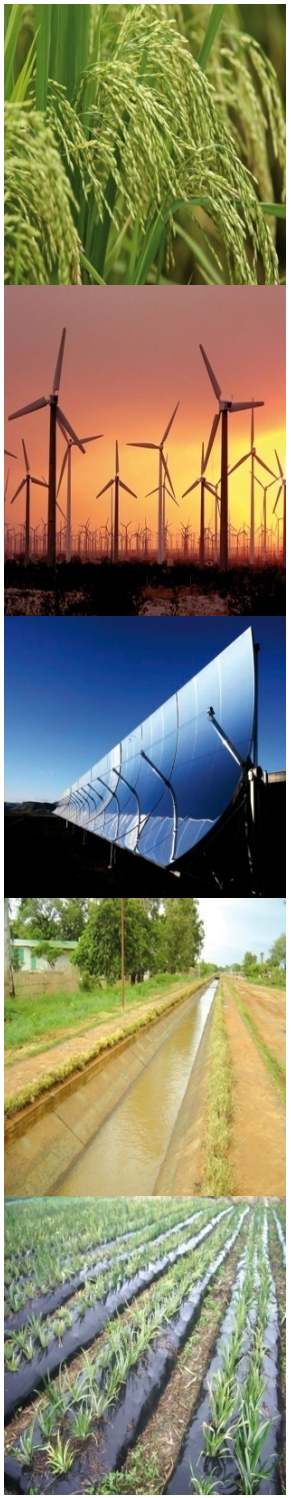
Multiple phases	Multiple technologies
Phase 1 : between 125 MW et 160 MW	Solar thermal, (CSP) / parabolic trough
Phase 2	CSP (Parabolic Trough, Tower…)
Phase …	Photovoltaic

Common infrastructure works for the site

financed through Masen equity (from USD 100 to 130 m)

+

Research &Development Platform dedicated to the Solar sector



Ouarzazate Solar Complex: Various technologies with R&D Platform:

Ouarzazate Complex : positive socio-economic impact

Definition of preliminary measures to help the optimization of the socio-economic benefits of the Ouarzazate solar power complex

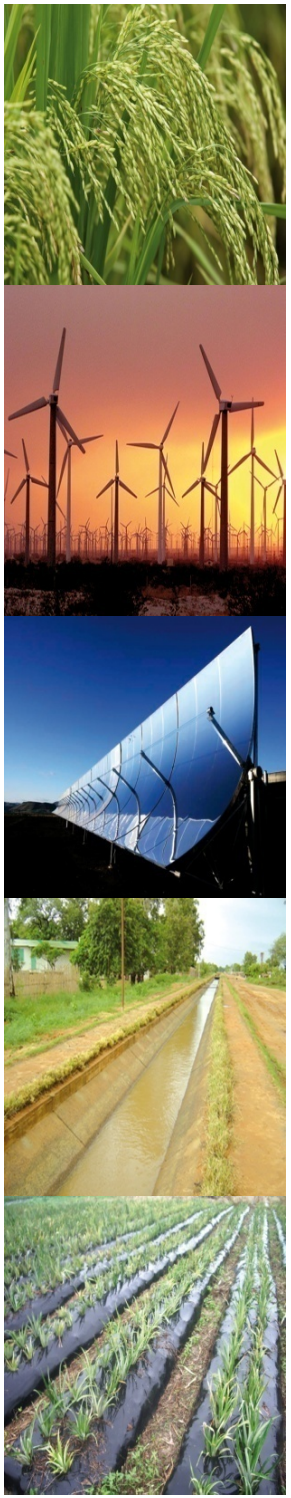
Objectives

- Encourage the participation of local labor and contribute to the implementation of fair recruitment mechanisms and adapted trainings.
- Improve the existing infrastructure for the local communities and management of the additional traffic and extensions
- Introduce new activities to encourage job creation in relation with the complex (R&D Platform , scientific tourism, …)

Estimated job creation

Construction : **Thousands**
O&M : **Hundreds**

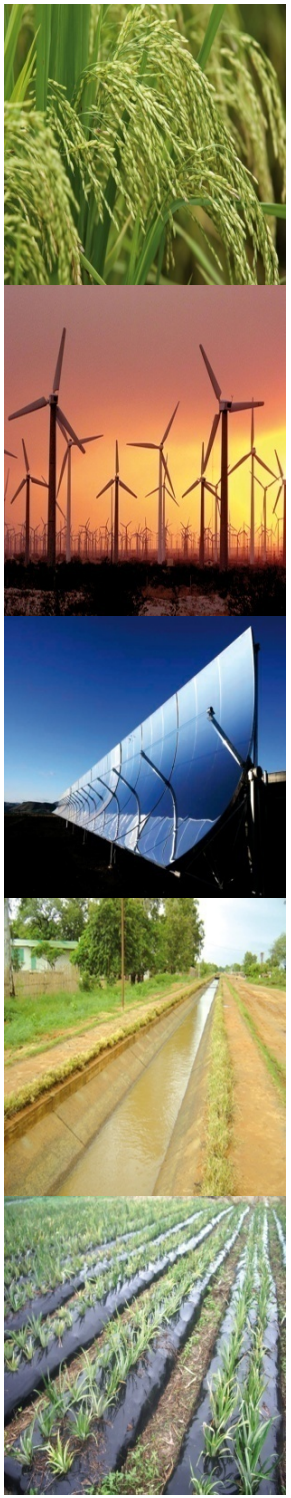
For a local development promoting an optimized integration



African Development Bank:

3. Ouarzazate First Phase: The largest CSP Plant in the MENA region

Energy, Environment and Climate Change Department



Ouarzazate First Phase: The largest CSP Plant in the MENA region:

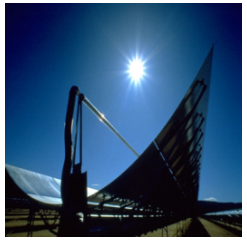
OZZ 1 : For a CSP Plant at Highest Standards

Maximize solar resource use

Address electrical grid operator requirements

Performant & competitive

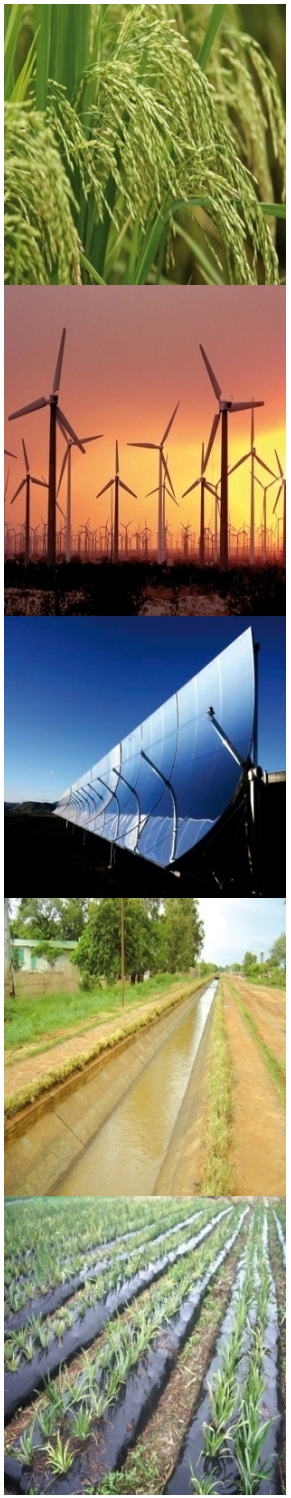
CSP trough Plant



Deliver on time

Best applicable quality, security and environmental standards

Maximised Economic Value



Ouarzazate First Phase: The largest CSP Plant in the MENA region:

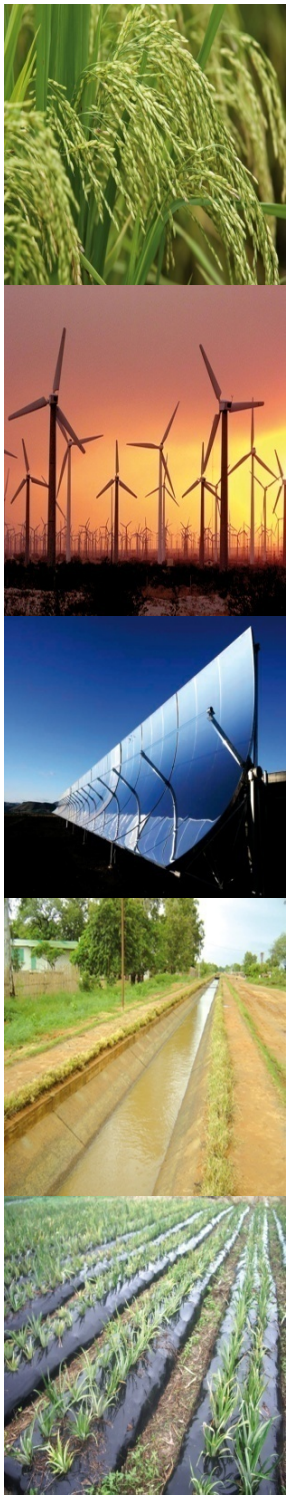
OZZ 1 : Main Technical Specifications

First tier financial and technical consultants

Technology	CSP Trough
Gross Capacity	125 – 160 MW
Storage	3h full load
Cooling	Wet / Dry
Land surface	**450 ha maximum**

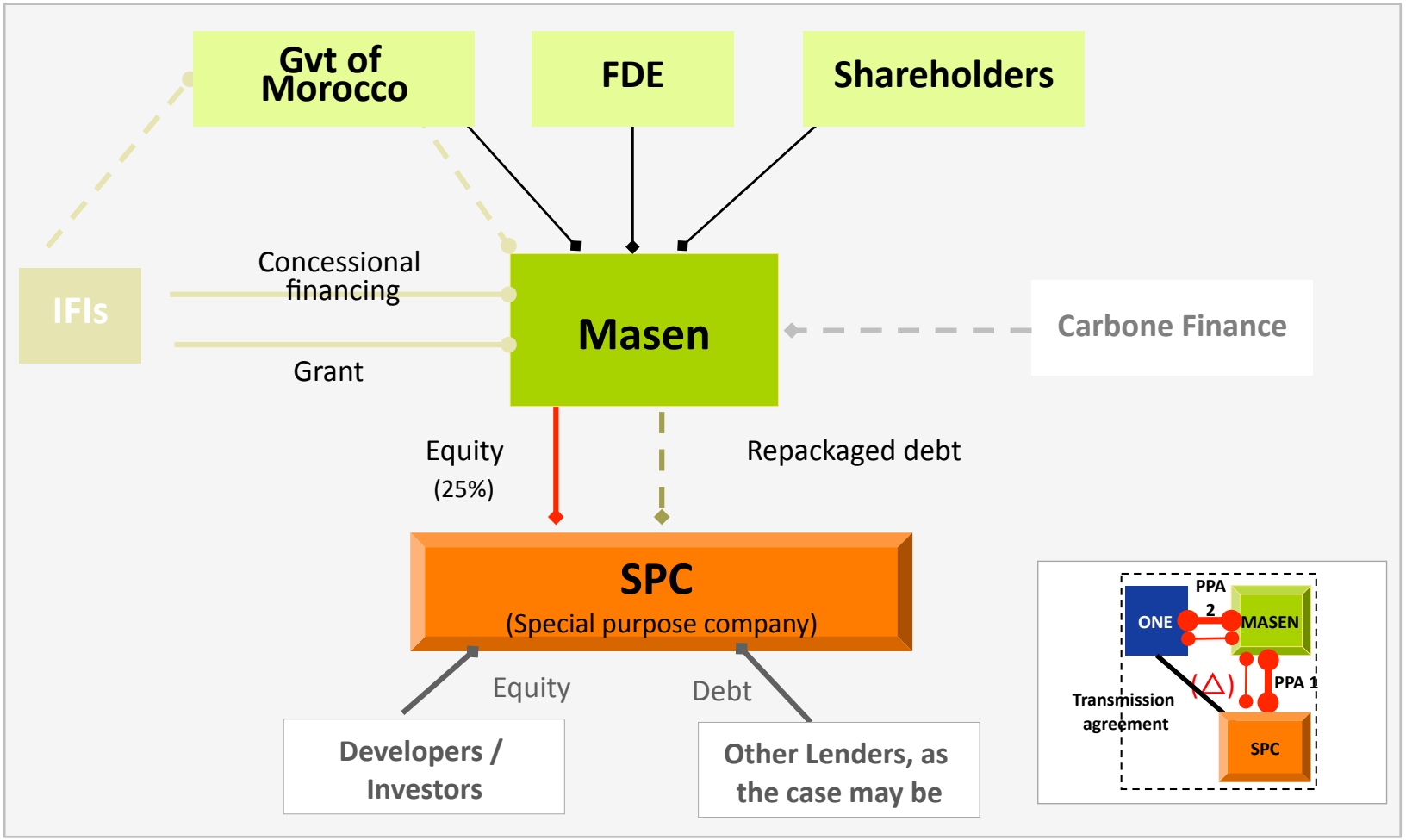
- Adequate answer to predictable needs of ONE by 2014 (to serve peak hours)
- A guarantee for large competition during the RFP process
- A cross criteria between production level , LCOE and subsidy per kWh
- A maximized use of available resources on site (water, land, …)

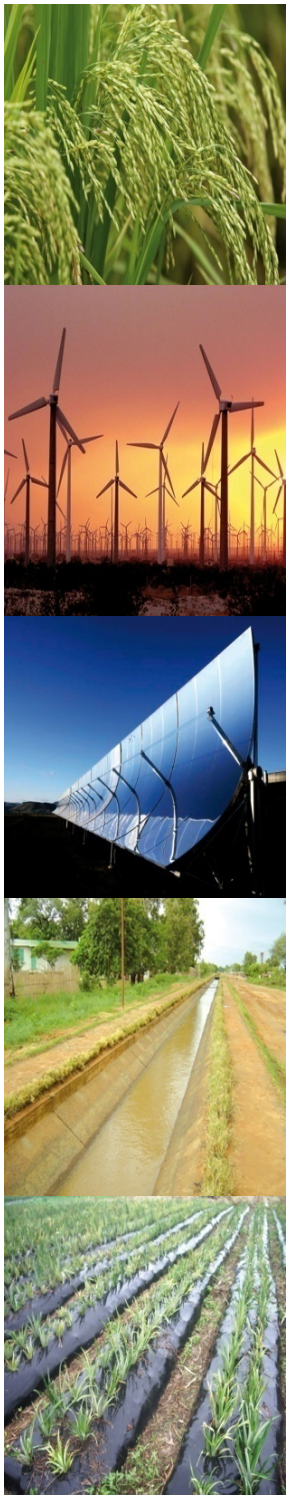
Taking advantage of available local resource to maximize the value of the produced energy



Ouarzazate First Phase: The largest CSP Plant in the MENA region:

OZZ 1 : Financing structure



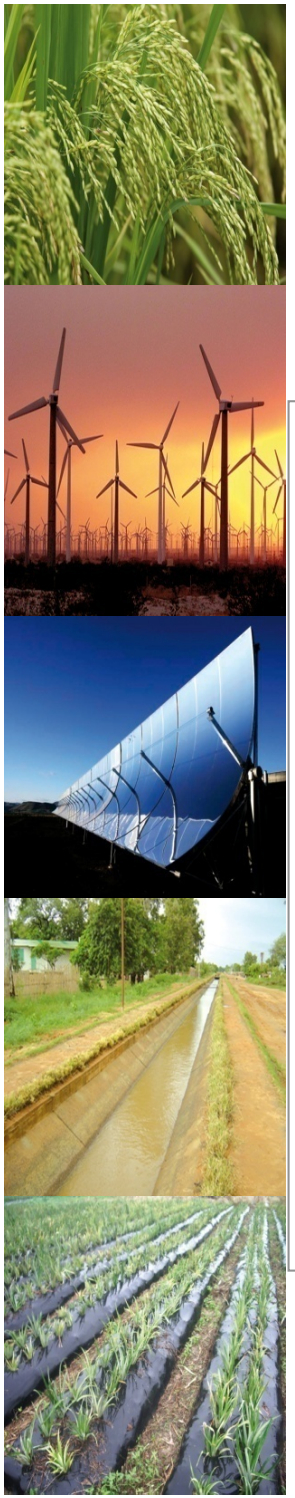


Ouarzazate First Phase: The largest CSP Plant in the MENA region:

… towards an optimal risk allocation …

Public	Shared	Private
— Regulation change specific to the project — Change in the technical specification due to government's request — Environmental risk (preexisting) — Inflation / Foreign exchange risk	— Financing — Solar resource risk — Permits and authorizations — Regulation change non specific to the project — Force majeure	— Design / Planning — Technology — Construction (delays, cost overruns, under capacity) — Performance during operation (incl. O&M) — Operation over costs

… the aim being to transfer risks to the most appropriate actor to handle them



Ouarzazate First Phase: The largest CSP Plant in the MENA region:

OZZ 1 : Estimated project cost

Assumptions

Technology	CSP Trough
Capacity (Trough)	160 MW (Gross)
Storage	3 hours
Site surface	450 Ha (max)
Cooling	Wet / Dry
Construction period	3 years
PPA duration	25 years

Output

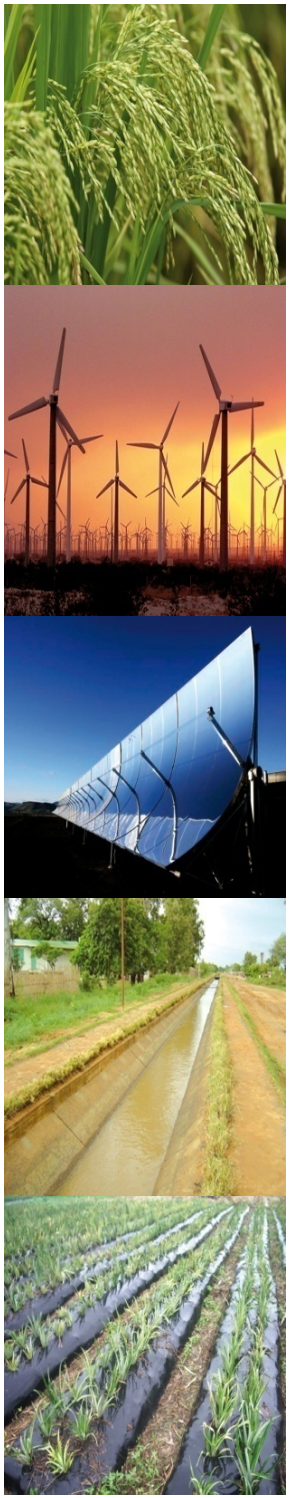
CAPEX (split over 3 years) **USD 931m**

Per MW (gross) *USD 5,5m*

2012 e	2013 e	2014 e
204	242	485
22%	26%	52%

CAPEX split	USD m	%
Solar system*	578	60%
Power block	196	20%
Storage	123	15%
Site improvements	33	5%

*** includes solar field and HTF system*

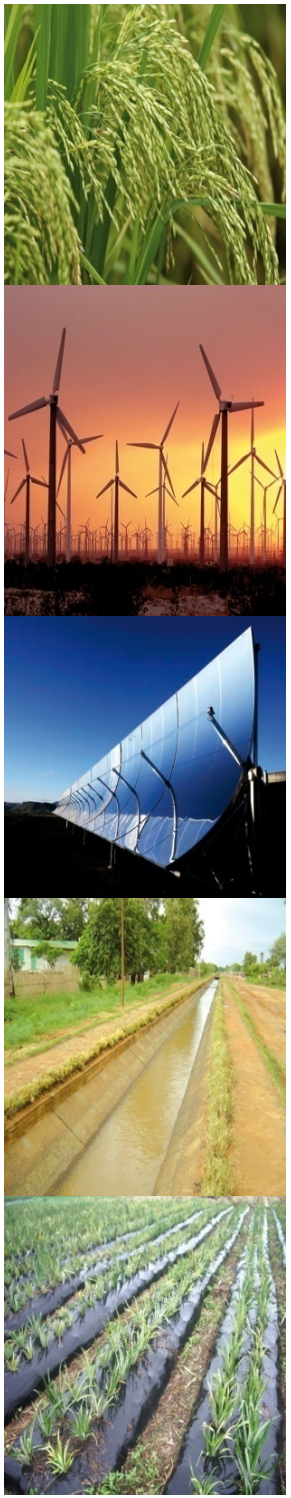


Ouarzazate First Phase: The largest CSP Plant in the MENA region:

OZZ 1 : Announced amounts by IFI

	Amount (up to)	Maturity	Fixed interest rate	Grace period
CAPEX				
AFD	EUR 100m	17 years	4,00 %	3 years
AfDB	EUR 200m	20 years	4,00 %	5 years
CTF	USD 197m	40 years	0,25%	10 years
BEI	EUR 250m	23 years	4,00 %	3 years
KFW	EUR 100m	15 years	2,50 %	3 years
NIF	EUR 30m	-	-	-
OPERATIONS				
WB	$ 200m	30 years	< 4,00%	5 years

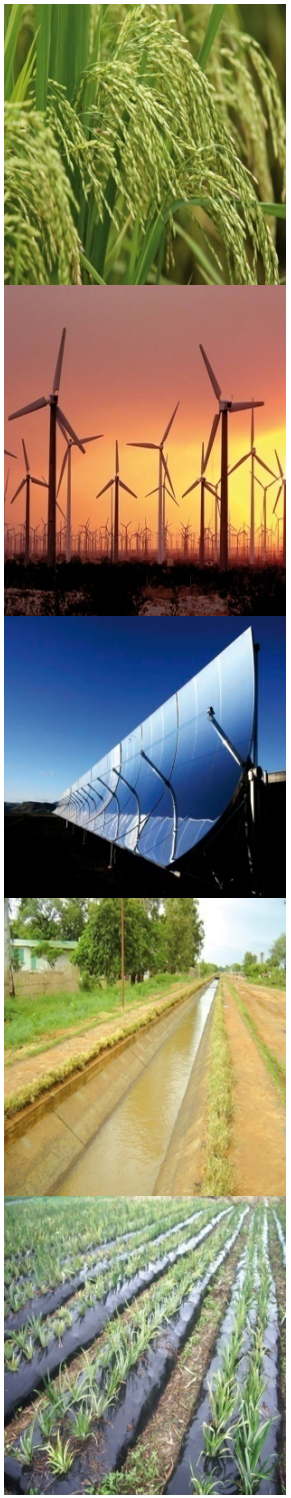
The amounts showed per IFI are the maximum announced. The exact amount will be known once the final bidder is selected and the conditions are fixed.



African Development Bank:

4. Perspectives

Energy, Environment and Climate Change Department



Perspectives:

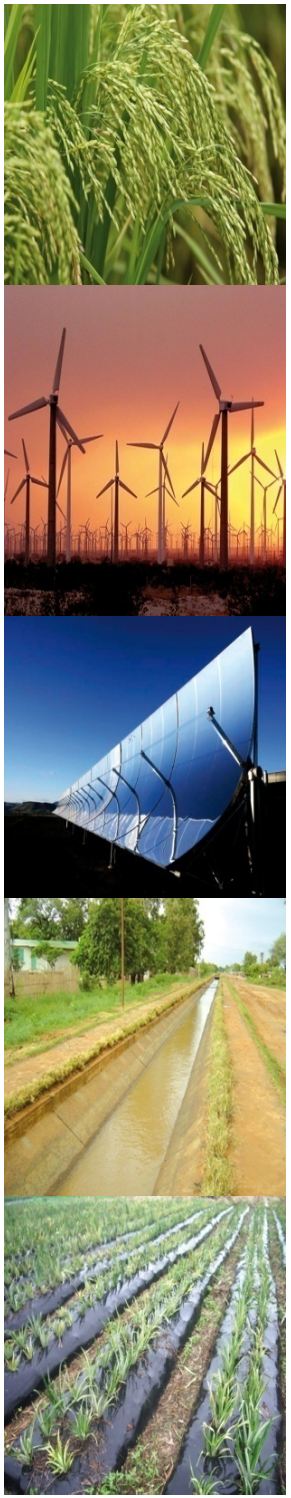
For a Sustainable Replicability

2 key objectives

Environnemental	Energy
Avoid CO_2 emissions	Bring down solar energy cost to parity

3 levels

Immediately	Short and Medium Term	Long Term
Increased MDBs contribution through more and well-adapted instruments	Electricity export in order to match environmental requirements and a viable economic balance	Mismatching between where solar resources are and where high consumption level is
+ MDBs contribution *+ Dedicated countries contribution in line with their double vision*	*In parallel with Countries discussions, pilot project can pave the way*	*Implementation of instruments and mechanisms dematerializing energy trade WW*



Perspectives:

Needing more adapted financial instruments especially in times of crisis

Maximize concessional funding

Economic development ↔ **IFIs** ↔ Climate change

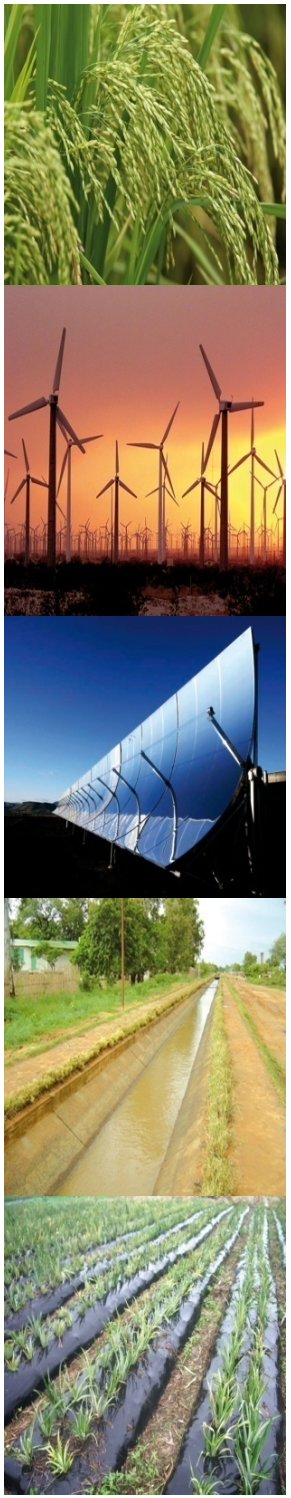
Reducing the cost of electricity is crucial for solar projets economic viability and competitiveness

Inter-state dialogue is open

Further investigation on the export opportunity (article 9, Working group Morocco/France…)

Cooperation et synergies between all initiatives

Next step: Export



Perspectives:

We welcome exchanging experiences in the solar energy development :

- ✓ **Multiple IFIs cooperation**
- ✓ **Risk allocation and sharing**
- ✓ **Socio – Economic integration**
- ✓ **Implementation and Execution quality**

Thank you for your interest and support