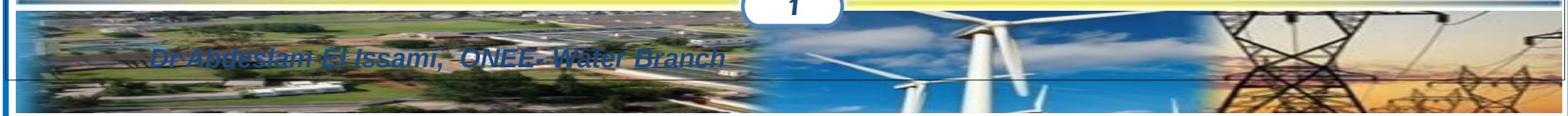
Regional capacity building workshop

"Water - Energy Nexus Operational Toolkit : Resource Efficiency"

20 – 21/02/2017 Manama - Bahrein

NEXUS WATER-ENERGY APPROACH IN MOROCCO



Dr Abdeslam El Issami, ONEE- Water Branch

Institutional framework of the water sector

Consultative Authority

Higher Council of Water & Climate

Planning Authorities

M. Agriculture et pêche maritime

MEMEE - MDE

M. Santé

M. Intérieur

ONEE

Operators/ Users

ORMVA

Water Sector

Drinking Water

Producers:
- ONEE
- Communes
- Régies
- Privé

Distributors:
- ONEE
- Communes
- Régies
- Privé

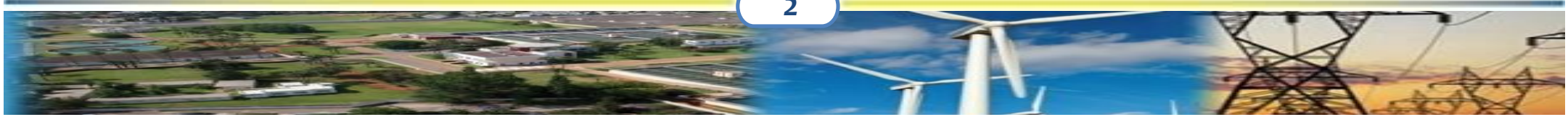
Sanitation

Collection and treatment
- ONEE
- Communes
- Régies
- Privé

Electricity Sector

Producers:
- ONEE
- Privé

Distributors:
- ONEE
- Régies
- Privé



ONEE : A public institution ensuring five main missions

Planning:

- ❑ *Supply of drinking water throughout the country*
- ❑ *Programming of investments (drinking water and sanitation)*

Study and infrastructure:

- ❑ *Drinking water and sanitation projects*
- ❑ *Bids procurement and follow up of projects' implementation*

Management on behalf of municipalities / communes

- ❑ *Service of drinking water distribution*
- ❑ *Service of liquid sanitation in municipalities where ONEE ensures water distribution*

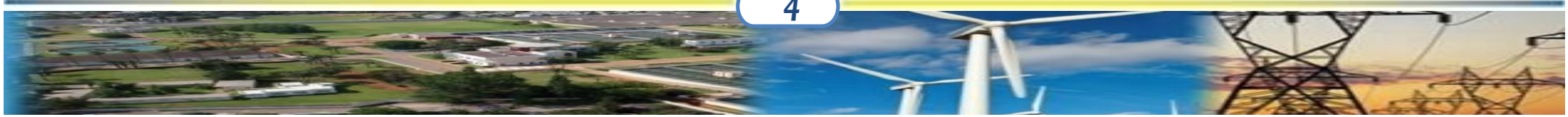
Quality control:

- ❑ *Produced and distributed water*
- ❑ *Water sources likely to be used for drinking water consumption*

Assistance in the elaboration of legislative texts and participation in the studies related to drinking water and sanitation sector as well as providing technical support to third parties

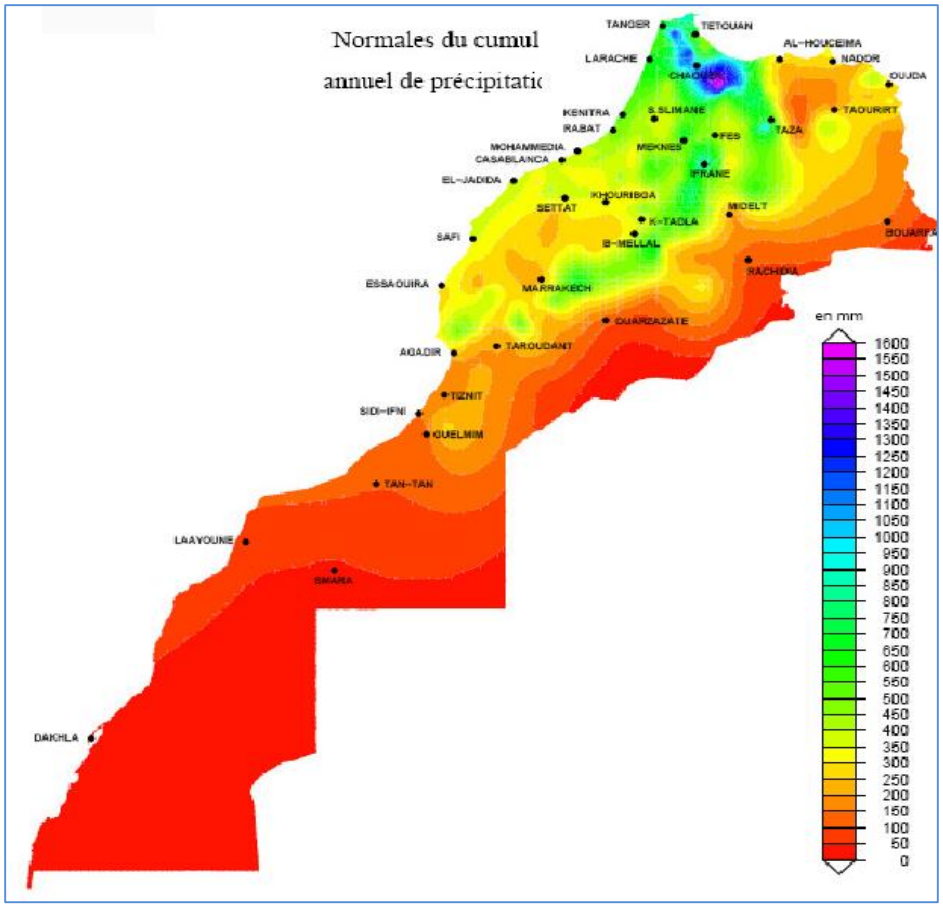
Key Numbers (2016)

- **National drinking water producer** : Over **85%** of drinking water national production, **1.1 billion m3 per year**.
- **1st Distributor of drinking water** : With nearly 2 million customers in more than 678 centers/cities across the entire country,
- **Supplier of drinking water** with an access rate of:
  100 % in urban areas
  96 % in rural areas
- **Major actor in the management of liquid sanitation service** : Sanitation services in 112 cities and municipalities with a treatment capacity of 353.000 m3/day
- **500 million US$** is the annual investment for the **year**



AVAILABILITY OF WATER

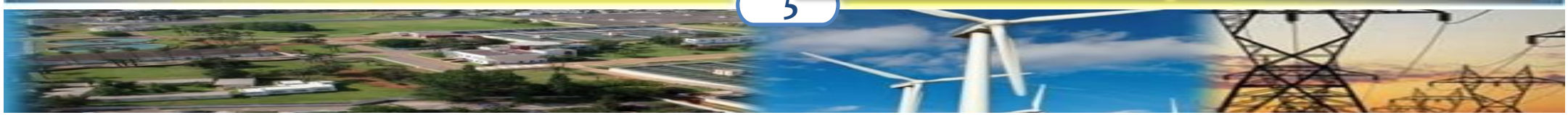
Precipitations



Precipitations average
140 billion m³/an

Mobilized water resources potential
22 billion m3/an

Surface water	***Underground water***
18 billion m³/an	***4 billion m³/an***

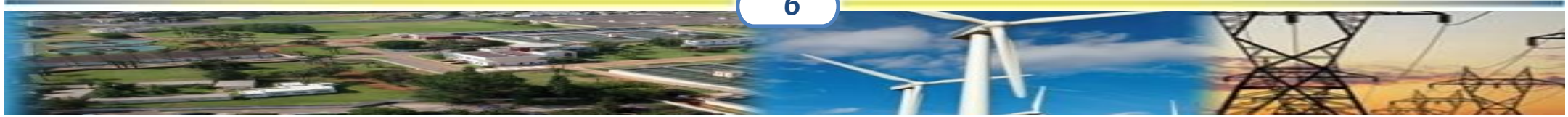


WATER MOBILIZATION

- ✓ Important hydraulic infrastructure (140 barrages) :
  17,5 billion de M3
- ✓ Several thousand water wells to exploit groundwater
- ✓ More than a dozen water transfer systems

These infrastructures have ensured :

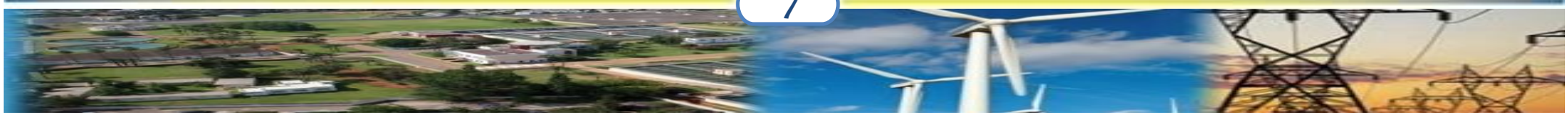
- Large scale irrigation development
- Drinking water in urban area (100%) and rural aeras (96%)
- Satisfay industrial and touristic needs of water
- Contribue to protect property and people against flood
- Watershed management for soil conservation and erosion control .



CONSTRAINTS & CHALLENGES

- Unequal distribution of water in time and across the country
- Degradation of water quality (liquid sanitation, agricultural pollution, seawater intrusion)
- Water scarcity : 700 m^3/capita/year < critical threshold (1.000 m^3/capita/year)
- Increase of extreme weather phenomena (floods, drought) : effects of des cc
- Overexploitation of aquifers
- Regularized volume losses due to siltation.

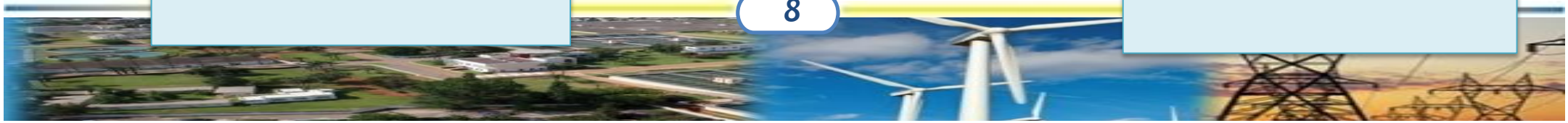
- Need to mobilize water resources further from consumption areas
- More expensive treatment processes to face the degradation for water resources quality
- Use of non-conventional water resources (desalination, demineralization, …)
- Need to accelerate liquid sanitation projects.



NATIONAL STRATEGY FOR WATER

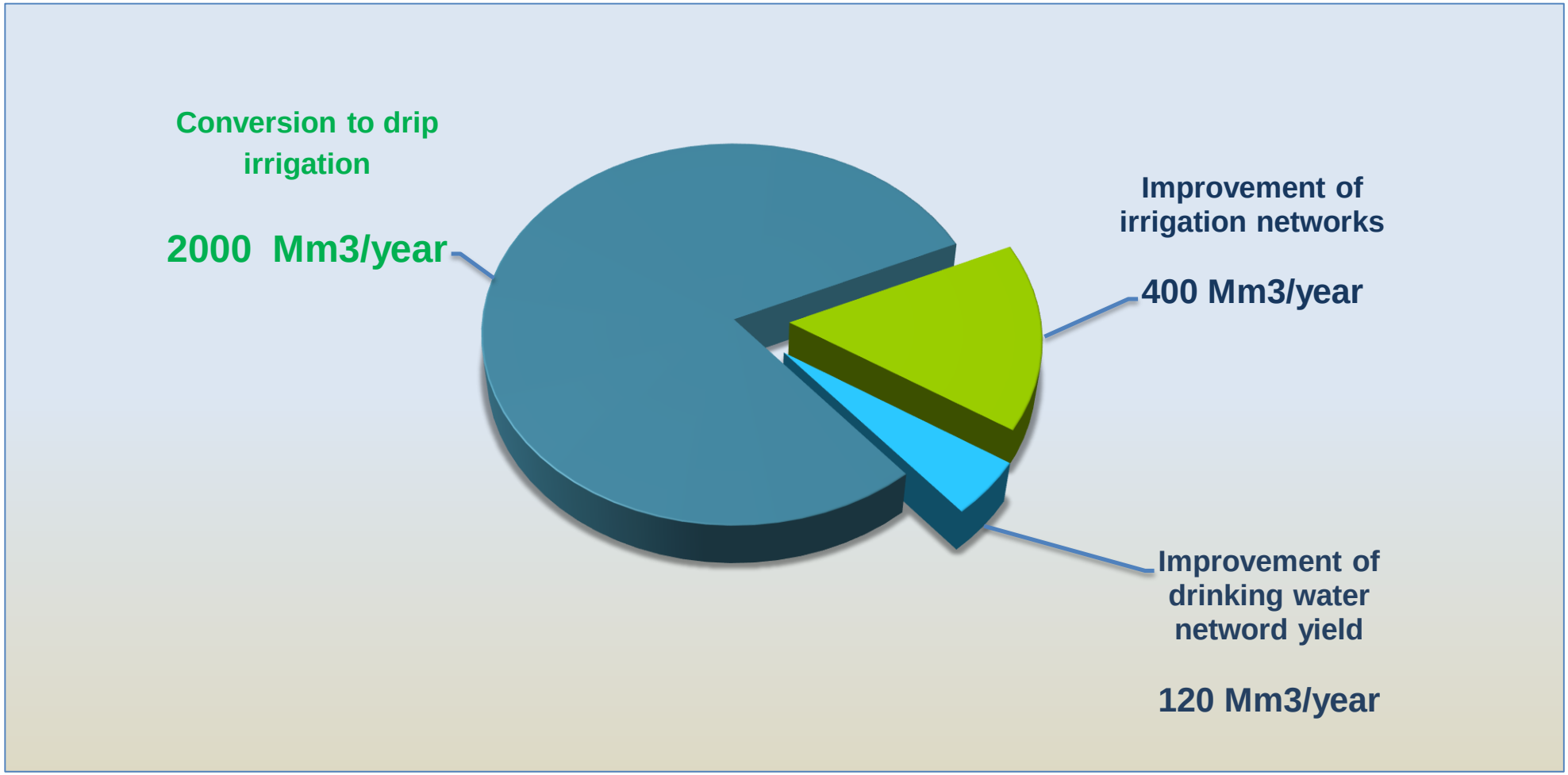
National water Strategy

1. *Water demand management and valorisation of water resources*
2. *Management and development of water offer*
3. *Preservation and protection of water resources, natural habitats and fragile areas*
4. *Reduce vulnerability to natural water risk and adaptation to climate change*
5. *Continuation of the legislative and institutional reforms*
6. *Upgrading information systems and capacity building and skills*



NATIONAL STRATEGY FOR WATER

Economy of 2.5 billions m³/year

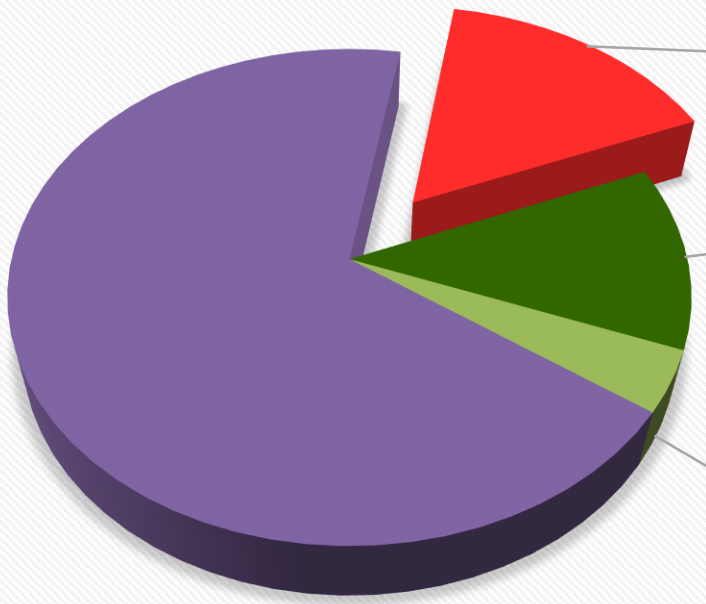


NATIONAL STRATEGY FOR WATER

Mobilisation of 2.5 billion m3/year

Surface water : Mobilization of 1.7 billion m3

- 60 large dams
- 1000 small dams
- North-South transfert : 800 Mm^3



Sea water desalination : 400 Millions m3

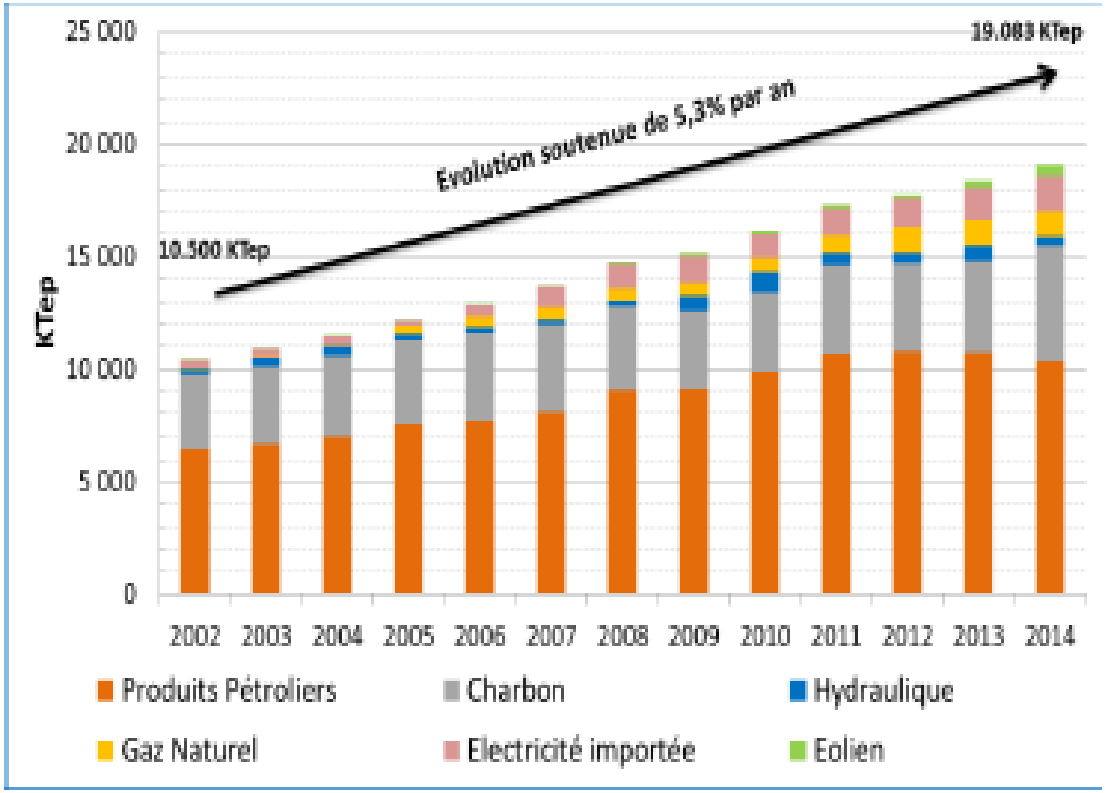
Water reuse 300 millions m3

Rainwater catchment : 100 millions m3

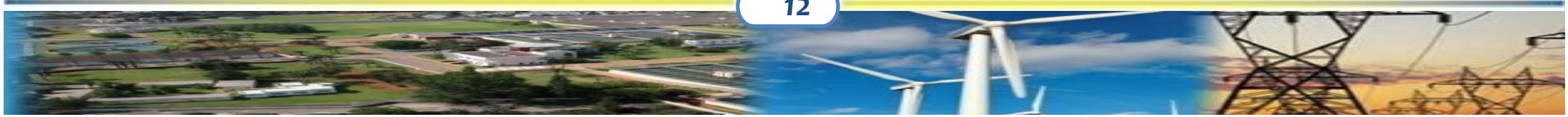
FOCUS ON ENERGY IN MOROCCO

Morocco's economic development driven by structured sectorial strategies ➔ Increased energy demand that has envolved over the last few year : Primary energy 5,3% , Electricity 7% and Petroleum products 5%

The objectifs of the Energy transition Strategy adopted by Morocco Is to increase the part of renewable energies installed to 42% by 2020 and to 52% by 2030 : solar 45% (of additional capacity), wind turbine 42% and Hydraulic 13%.



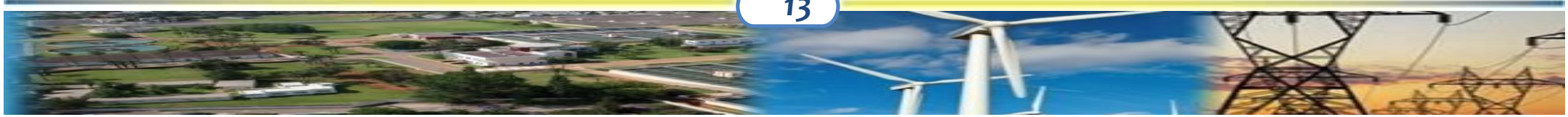
NEXUS WATER - ENERGY



NEXUS : Institutional and Regulation

A favorable institutional and regulatory framework for the implementation of the Nexus Water and Energy approach in Morocco

- Creation in 2007 of the Ministry of Energy, Mines, Water and Environnement (MEMEE) ;
- The ONE and the ONEP consortium into ONEE organization ;
- Multiservice for water supply, sanitation and electricity ;
- Publishing of Law 36/15 on Water ;
- Law n° 37-16: law of MASEN (Moroccan Agency for Sustainable Energy).
- Law 13-09 on Renewable Energies : opening of production to competition
- Law 47-09 on enregetic efficiency of equipments and buildings



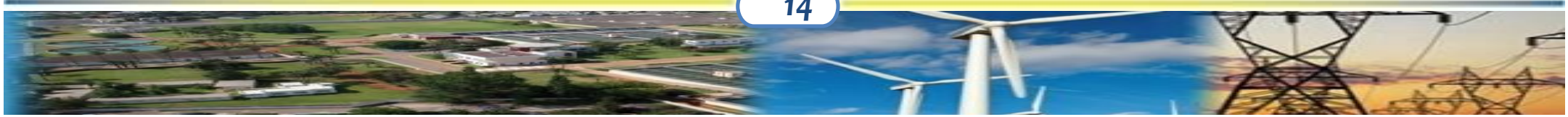
DEVELOPMENT OF THE OUM-ER-RBIA BASIN : A SUCCESSFUL CASE OF NEXUS

The planning of the OeR basin development include six hydroelectric complexes to ensure :

- Needs of energy ;
- Irrigation of the great perimeters (Beni Moussa, Beni Amir and the Doukkala) ;
- Water supply to the population of the region.

➔ Hydroelectricity was an essential component in the planning of hydraulic infrastructure :

- ✓ The size of dams is planned to maximize energy production
- ✓ Construction of compensation dams
- ✓ Use of hydroelectric plants at full capacity : compensation of turbine volumes for drinking water and irrigation uses

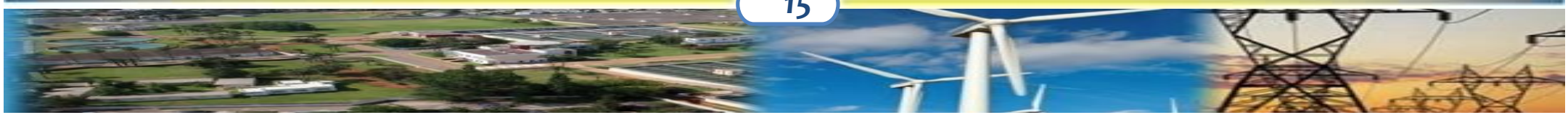


NEXUS WATER – ENERGY : BEST PRACTICES

Hydroelectric power in Morocco :

- Enhancement of the hydroelectric park within the framework of the policy of large dams launched since the years 1960 ;
- Introduction of STEPs for the regulation of the operation of the energy park particular based on ER;
- Enhancement of private investment in micro-hydropower plants.

SOCIETE	PROJET	CAPACITE (MW)	DATE DE MISE EN SERVICE
Energie J2 Terre	Flilou	1,53	2014
	Sidi Said	1,98	2016
	Sidi Driss	3,15	2016
	Hassan II	11,7	2016
SGTM	Asfalou	11,7	2016
	Ouljet Essoltane	10	2017
Platinum Power	Boutferda	12	2016
	Tilougguit 1	12	2016
	Tilougguit 2	12	2016
	Bab Ouender	12	2017
	Tamajout	12	2017



OPTIMIZATION OF THE ENERGY REQUIRED FOR DESALINATION

Récupération d'énergie

- ✓ **Desalination pumps are high efficiency with very low losses.**
- ✓ **Implementation of an innovative energy recovery system: the specific consumption of OI desalination processes has been reduced from 7 Kwh/m3 to less than 3 Kwh/m3.**

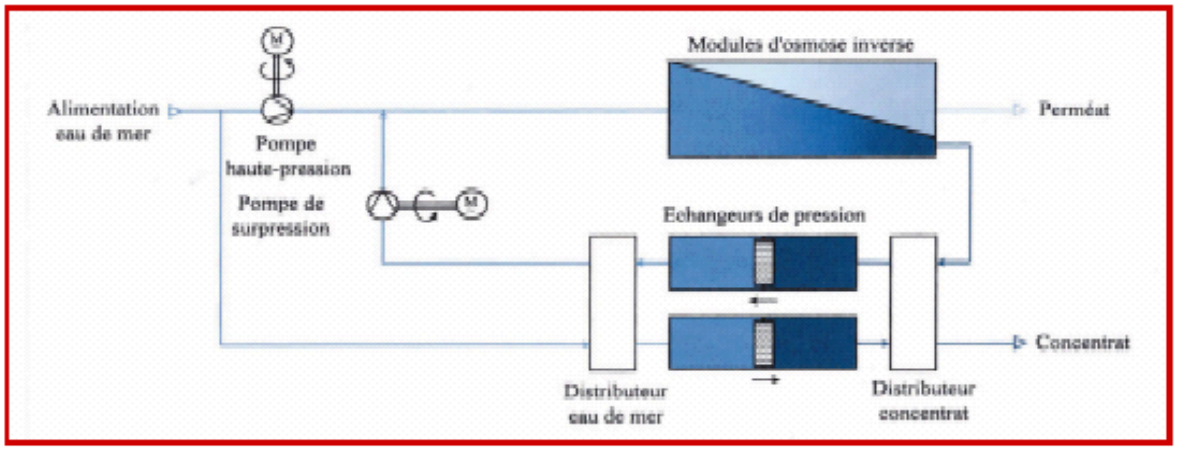


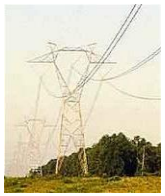
Figure 5 : Système de récupération directe de l'énergie du concentrat par échangeurs de pression.

Turbine Pelton

Pressure exchanger

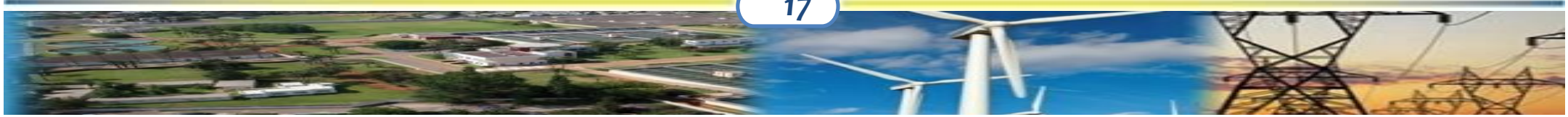
NEXUS WATER –ENERGY : Coupling Water -RE

Couplage avec les Energies Renouvelables



- ✓ **Desalination is necessry at Guelmim (Water-scarce region) ➔ High energy demand**
- ✓ **The region has a significant potential in wind and solar.**
- ✓ **The use of renewable energies will make it possible to secure water needs by introducing alternative energy, optimizing operating costs.**
- ✓ **The project may benefit from the incentive tools, particularly in technical and financial cooperation.**

A study is underway for the coupling of water desalination with Renewable energy



ENERGY EFFICIENCY OF DRINKING WATER INSTALLATIONS

Monitoring:

- Monitoring of the energy consumption ratio (KWh / m3) and make comparative analysis.
- Conducting energy audits study of the production facilities (adduction, ...) : specialized consulting firms.
- Implementation of remote management in adductor systems
- Measurement of GEP performance

Encountered difficulties :

- Lack of data concerning the life cycle of GEPs (manufacturers' curves, maintenance history, etc.).
- Variation in the operating point of certain pumping systems (operating conditions, level of groundwater, etc.).
- Insufficient skills in the field of energy efficiency.

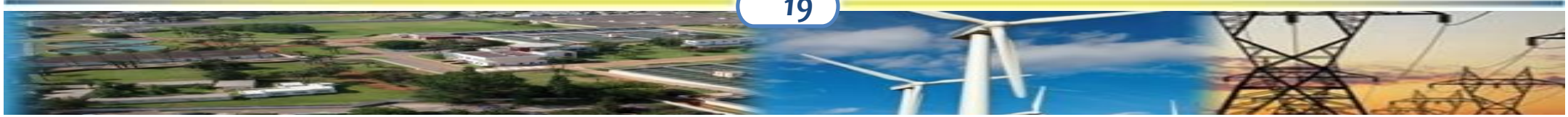
ENERGY EFFICIENCY OF DRINKING WATER INSTALLATIONS (next)

Program :

Implementation of performance improvement programs: PAP I, PAP II, BAD 13, PAP III, EIB 6 with main components :

- Improved hydraulic efficiency
- Increased storage autonomy
- Replace pumps, low efficiency motors
- Remote management

In addition, operators are recommended to use low-Kwh/m3 resources in priority,



NATIONAL SOLAR PUMPING PROMOTION PROGRAM IN IRRIGATION

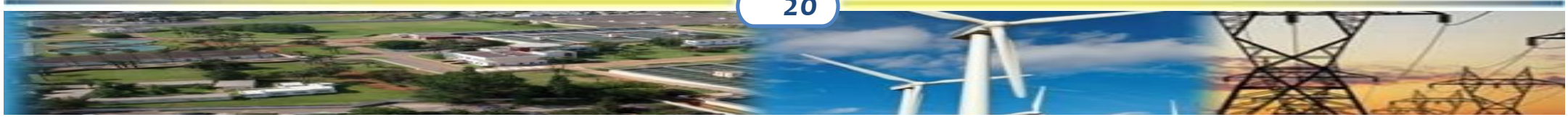
Target : Farms smaller than 5 ha

- Promoting the use of solar pumping systems in irrigation water projects
- Reduction of the energy costs of farms and the water consumption for irrigation

- Investment subsidy of 50% of the PV panels up to 75000 DH/farm
- Credit granted by the bank for the remainder of the financing

Project progress :

- Signed partnership agreement (Ministries, ...)



NEXUS WATER –ENERGY : WASTEWATER

MARRAKECH : The wastewater treatment plant, produces 30000 kWh/day from biogas, which are reused for Needs of the station.

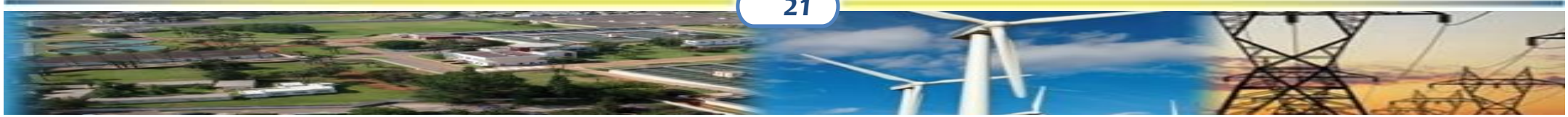
FES : Wastewater treatment plant produces 50% of its own energy needs.

Energy recovery of biogas

Production of more than 30% of the electricity requirements of urban wastewater treatment plants : Several projects (Agadir, Meknes, Khouribga, Ben Guerir, Youssoufia, Laayoune, ...)

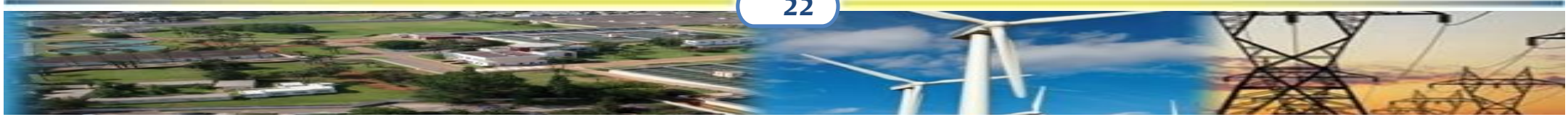
Use of solar photovoltaic energy

Coverage of the electricity supply requirements of aerators of aerated lagoon type STEPs : Two pilot projects in Ouarzazate and Errachidia (under study)



Recommendations of the implementation of the nexus

- ✓ Strengthened planning and coordination between water and energy sectors;
- ✓ Promote energy efficiency in the water sector and implementation of energy efficiency measures ;
- ✓ Capacity building of the different actors;
- ✓ Work on practical examples to show how the nexus can help Morocco achieve water and energy security;
- ✓ Enhance the research and development of mutualisation technology.



THANKS