

# **Renewable Energy : A New Paradigm**

**Hélène Pelosse, ex Interim DG IRENA  
(INTERNATIONAL RENEWABLE ENERGY AGENCY)**

## **Contents**

### **1. RENEWABLE ENERGY: A NEW ENERGY PARADIGM**

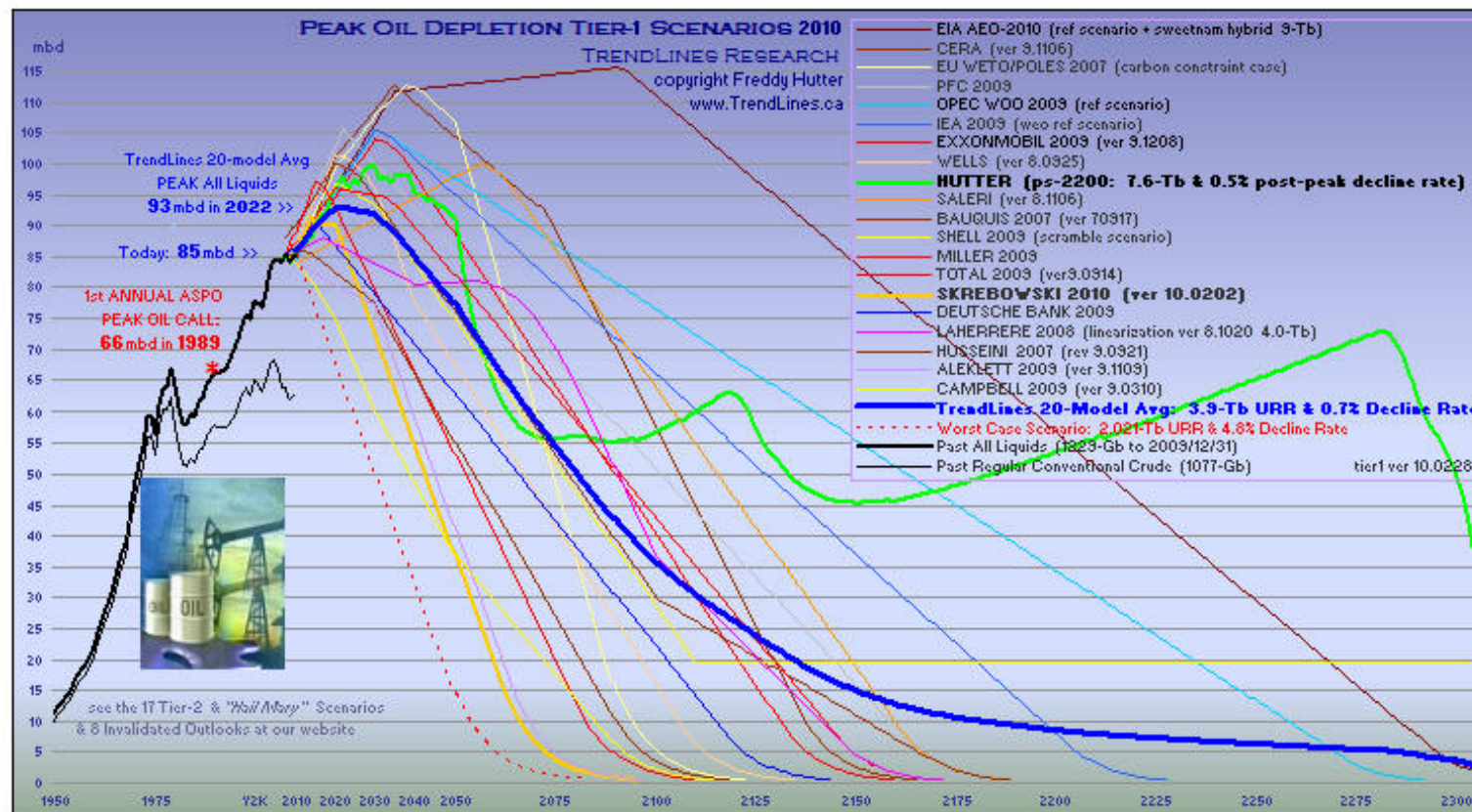
1. Shift in potentials
2. Shift in technologies
3. Shift in systems

### **2. HOW IRENA COULD SUPPORT THE TRANSITION TO THIS NEW ENERGY PARADIGM**

## **1. RENEWABLE ENERGY: A NEW ENERGY PARADIGM**

- **Shift in potential**
- **Coal, Oil are on the downturn: How many years left for fossil fuels even if shale gas and oil are increasing reserves ?**
- **3 main drivers for RE : economic growth, climate change, energy security**

# 1. RENEWABLE ENERGY: A NEW ENERGY PARADIGM



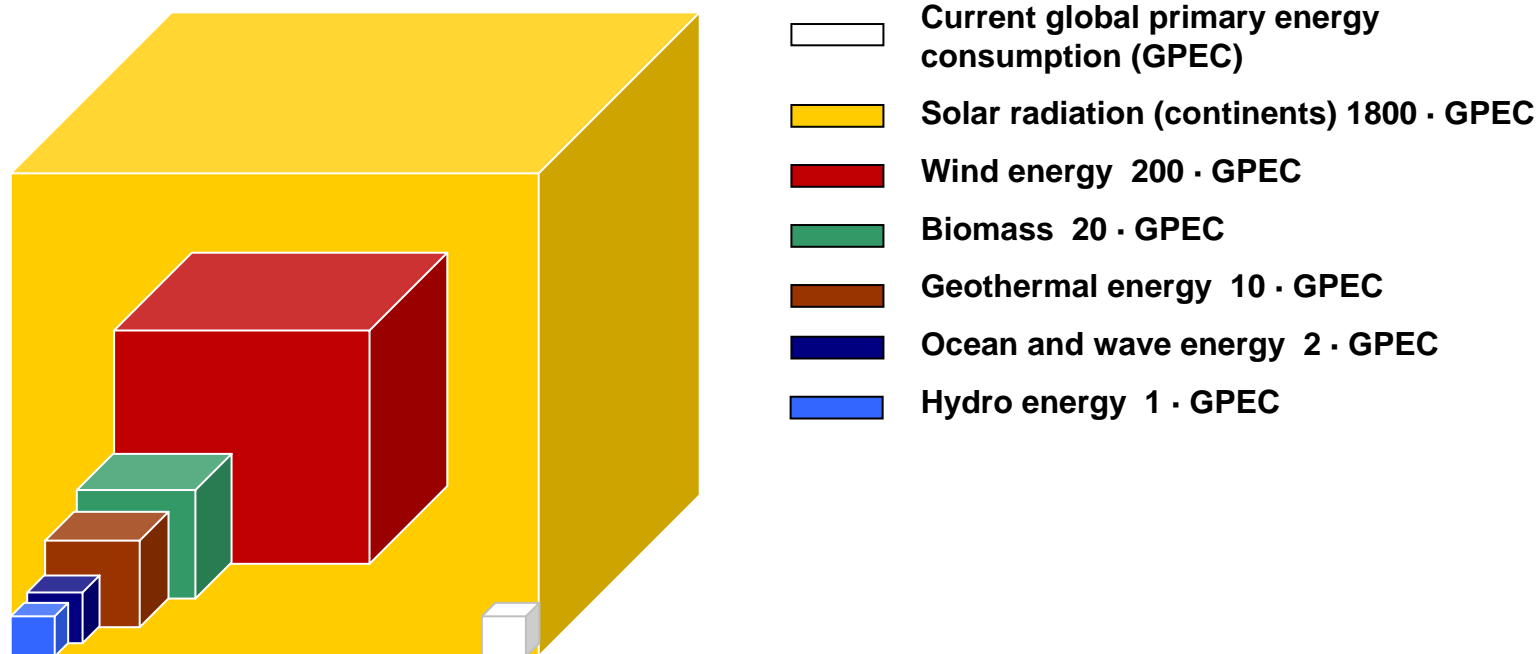
# **1. RENEWABLE ENERGY: A NEW ENERGY PARADIGM**

- **Six main sources of RE**
  - Bioenergy (agricultural and industrial residues, waste, forests, energy crops)
  - Geothermal
  - Hydropower (large and small)
  - Ocean (wave, tidal, osmosis, thermal)
  - Solar (photovoltaic, solar thermal)
  - Wind (on-shore and off-shore)

## **1. RENEWABLE ENERGY: A NEW ENERGY PARADIGM**

- **RE currently amounts to 18% of the global final energy consumption.  
Statistics not so reliable (biomass, off grid...)**
  
- 2009 Capacity:
  - Large hydropower 920 GW
  - Wind 159 GW (offshore 2GW)
  - Small hydropower 85 GW
  - Biomass power 54 GW
  - Solar PV grid connected 21 GW (off grid 4 GW)
  - Geothermal power 11 GW
  - CSP 0,7 GW
  - Tidal power 0,3 GW

## The potential of renewable energy is huge



Source: Nitsch, F.: Technologische und energiewirtschaftliche Perspektiven erneuerbarer Energien. German Aerospace Center. 2007.

## **1. RENEWABLE ENERGY: A NEW ENERGY PARADIGM**

### **Ensure a Global Green Growth**

**2004-2008:** Fourfold increase in RE investments

**RE Investments 2009:** 162 billion US\$

### **Jobs in the Renewable Energy Sector, Worldwide**

**2008:** 2,332,000

**2030:** 20,000,000 additional jobs



## **Renewable Energy in the world**

**There could be 50% RE in the energy mix in 2050**

- Double digit growth rates for PV and Wind over the last years
- 60% of new capacity in Europe come from renewable energy
- Solar PV capacity : +600% 2004-08 to 16 GW, +50% in 2009 (21GW)
- Wind capacity : + 30% in 2009, to 159 GW
- 85 countries with policy targets, 75 countries with feed-in tariffs (Ontario)

# **1. RENEWABLE ENERGY: A NEW ENERGY PARADIGM**

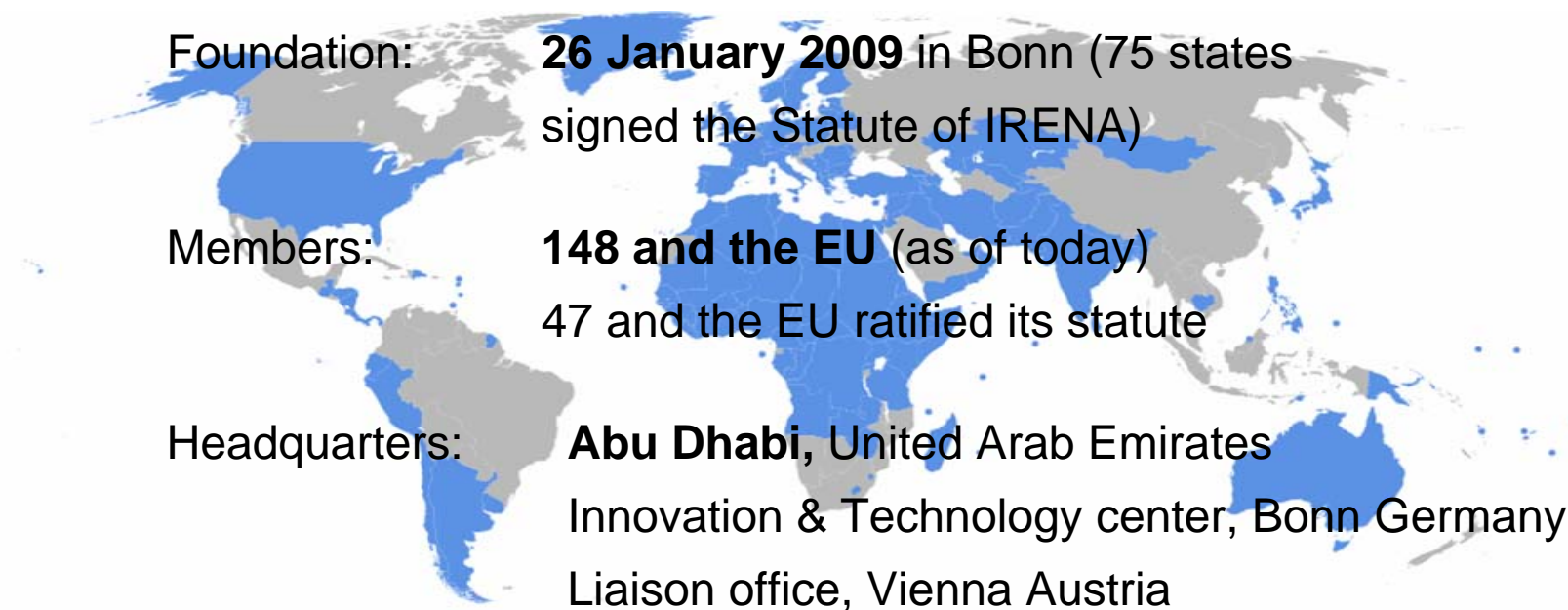
- **Shift in technologies**
- **Renewable Energy technologies are available from all six RE sources and for the three uses:**
  - **Electricity**
  - **Heating and Cooling**
  - **Transportation (EV, biofuels & aviation)**

# 1. RENEWABLE ENERGY: A NEW ENERGY PARADIGM

## ▪ Shift in systems

- Smart grids: ITC + Electric Network
  - smart metering
  - smart operations
  - smart homes
  
- Move from hierarchical network and one dimension networks to decentralized and bi-directionals:
  - coupling sources
  - intelligent “prosumers”

## 2. HOW IRENA WILL SUPPORT THE TRANSITION TO THIS NEW ENERGY PARADIGM



## **2. HOW IRENA COULD SUPPORT THE TRANSITION TO THIS NEW ENERGY PARADIGM**

- Mandated by governments worldwide, IRENA aspires to become the main **driving force** for promoting a **rapid transition** towards the widespread and sustainable **use of renewable energy** on a global scale.
- Acting as the **global voice for renewable energies**, IRENA envisages providing practical advice and support for both **industrialized and developing countries**, thereby helping to **improve frameworks** and **build capacity**.

## **2. HOW IRENA COULD SUPPORT THE TRANSITION TO THIS NEW ENERGY PARADIGM**

### **1- Knowledge (science/technology/policies)**

- map the RE potential worldwide, analysis of potential and scenarios
- R&D policy:
  - Fill the gaps
  - IPCC SRREN in 2011
  - Network of researchers
- Technology for each need
- Data base on policies and Policy advice (Tonga RE road map/off grid piece) >> to be expanded to AOSIS countries

## **2. HOW IRENA COULD SUPPORT THE TRANSITION TO THIS NEW ENERGY PARADIGM**

### **1- Knowledge (science/technology/policy)**

- **Intelligent and flexible system requirements**
- **Energy storage and coupling sources**
- **Shift from base load to flexible energy production**

## **The Challenge of integrating RE into the grid**

### **Key Facts:**

- Distinguish (intermittence/variability) between Wind, Wave, Solar, Tidal, Run of the river hydropower and Geothermal/Biomass, Reservoir Hydropower, CSP
- Global flexibility of a system depends from many factors:
  - Number of plants (combining geographically disperse intermittent resources for the same type and/or different RE with complementary intermittencies)
  - Level of “intelligence” for the tools to monitor and operate the grid
  - Interconnections
  - Storage capacities



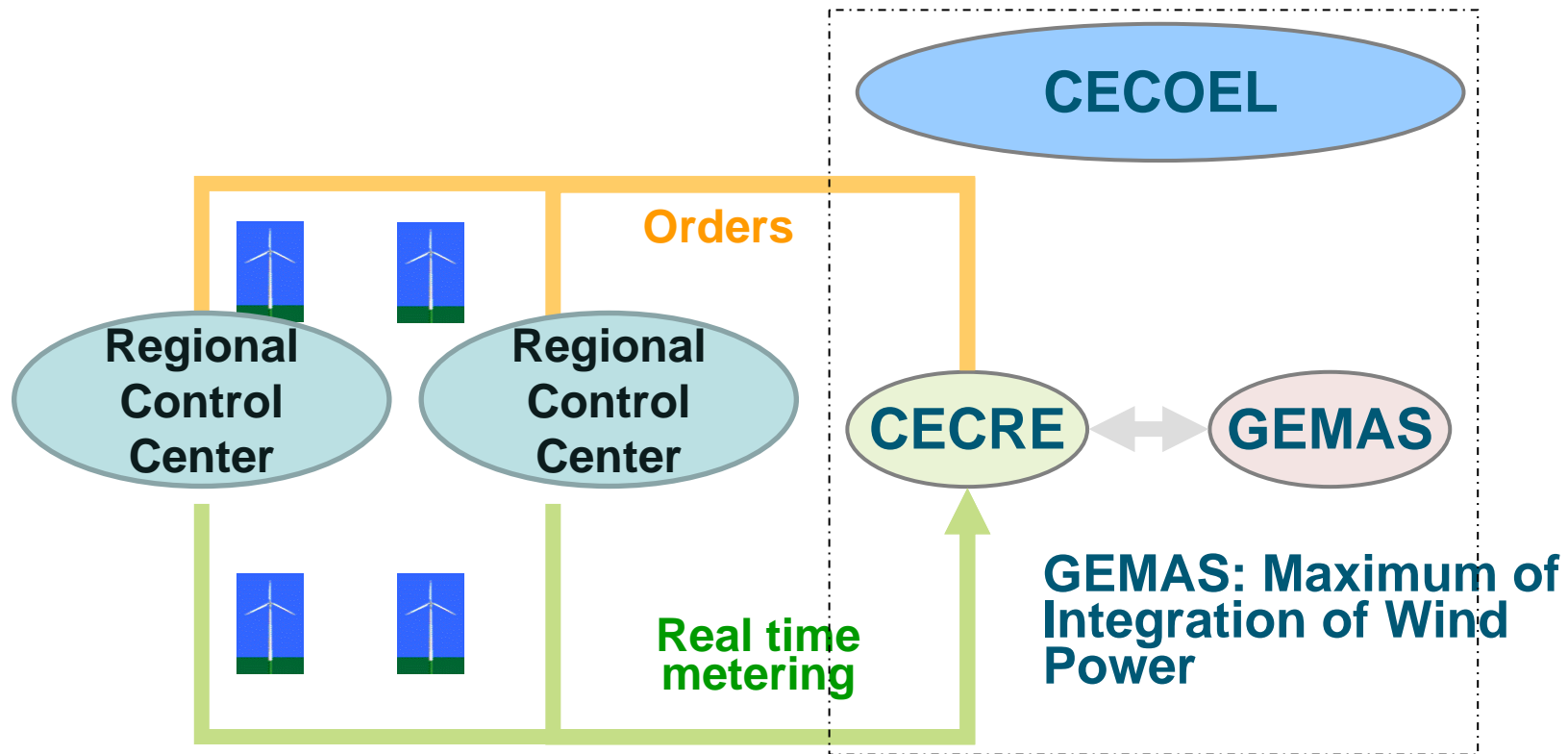
## **The Challenge of integrating RE into the grid**

### **The Spanish success story**

- 20% in 2020 (Wind 50%)
- Technical features of the Wind installations (voltage and frequency)
- Intelligence: forecasting (Sipreolico), methods for reserve sizing, additional hydro storage and interconnection (electrical island)
- A dedicated Center: Centro de Control del Regimen Especial (CECRE)>> GEMAS (Maximal Wind Production Admittible)
- 15 GW production has been integrated

## The Challenge of integrating RE into the grid

Monitoring and command on line of renewable electricity.



## **The Challenge of integrating RE into the grid**

### **The Danish success story**

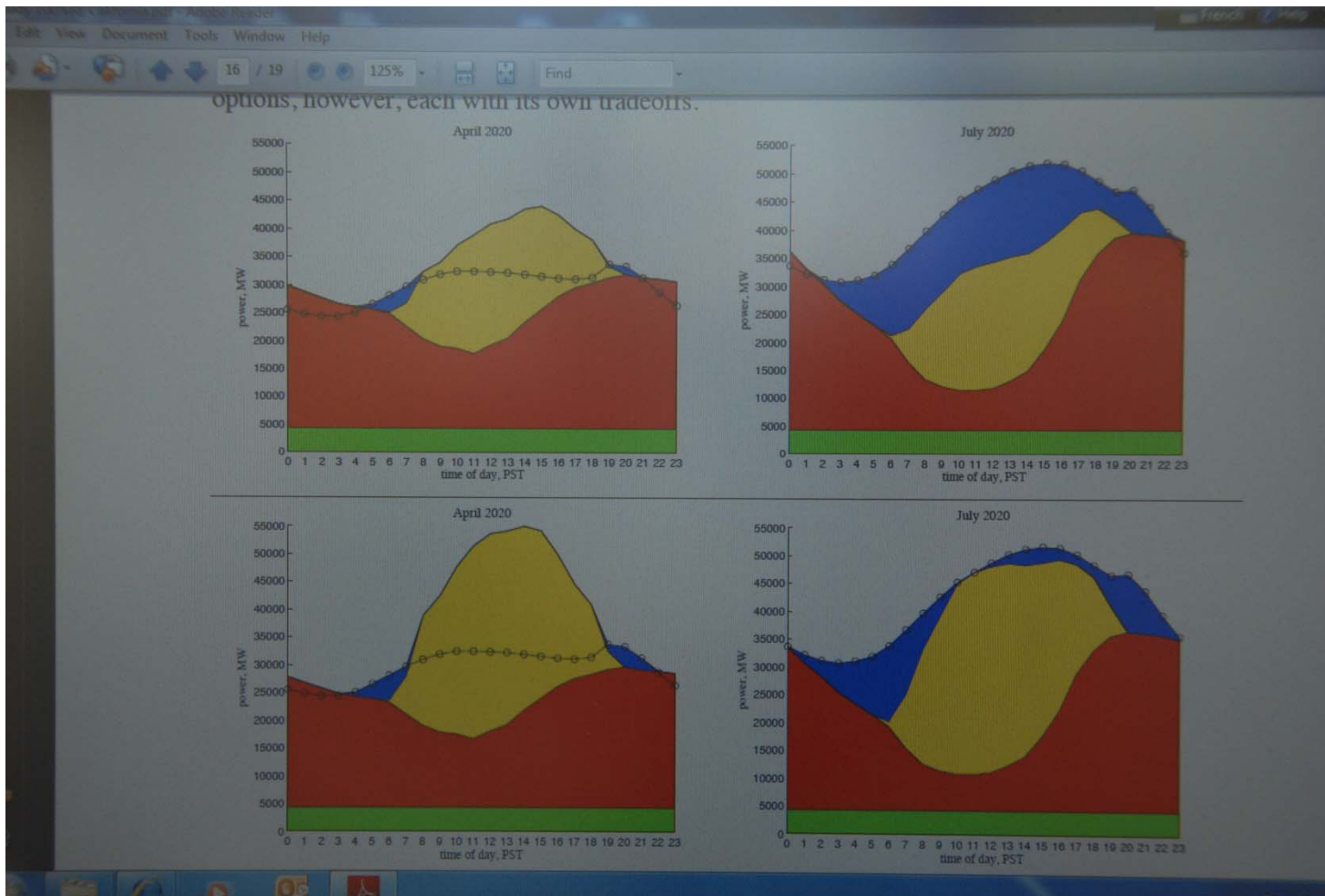
- 2025: 50% RE sources and intelligent control of the power system
- Focus on wind and 3 means (transmission grids and interconnectors, smart grids and local management of distributed resources, demand-side measures like EV, H&C..)
- Investment in the grid
- Interconnections within the Nordic European Market

## **The Challenge of integrating RE into the grid**

### **The Californian scenario: 100% electricity from RE in 2020 (Case study from Stanford University)**

- 2020 Bill (10%) : RPS >> 20% in 2010 33% in 2020
- Large RE source (hydro, wind, solar and geothermal)
- Consumption patterns: 2/3 variation during the day in July and during the year (January/July)
- Design a scenario to optimize combination of sources:
  - base load geothermal (4,7 GW)
  - and wind (40 GW)
  - solar to accommodate for the peak hours (28 GW)
  - and hydro on top
- Complementary intermittency of solar and wind

## 100% of renewable energy : California in 2020



## **2. HOW IRENA COULD SUPPORT THE TRANSITION TO THIS NEW ENERGY PARADIGM**

### **2- Financing**

**Cooperation with Abu Dhabi Fund for Development**

**Stocktaking all instruments and mechanisms of finance, including those existing under the Kyoto regime and those emerging from the Copenhagen Summit**

**Stocktaking successful business models to scale up RE**

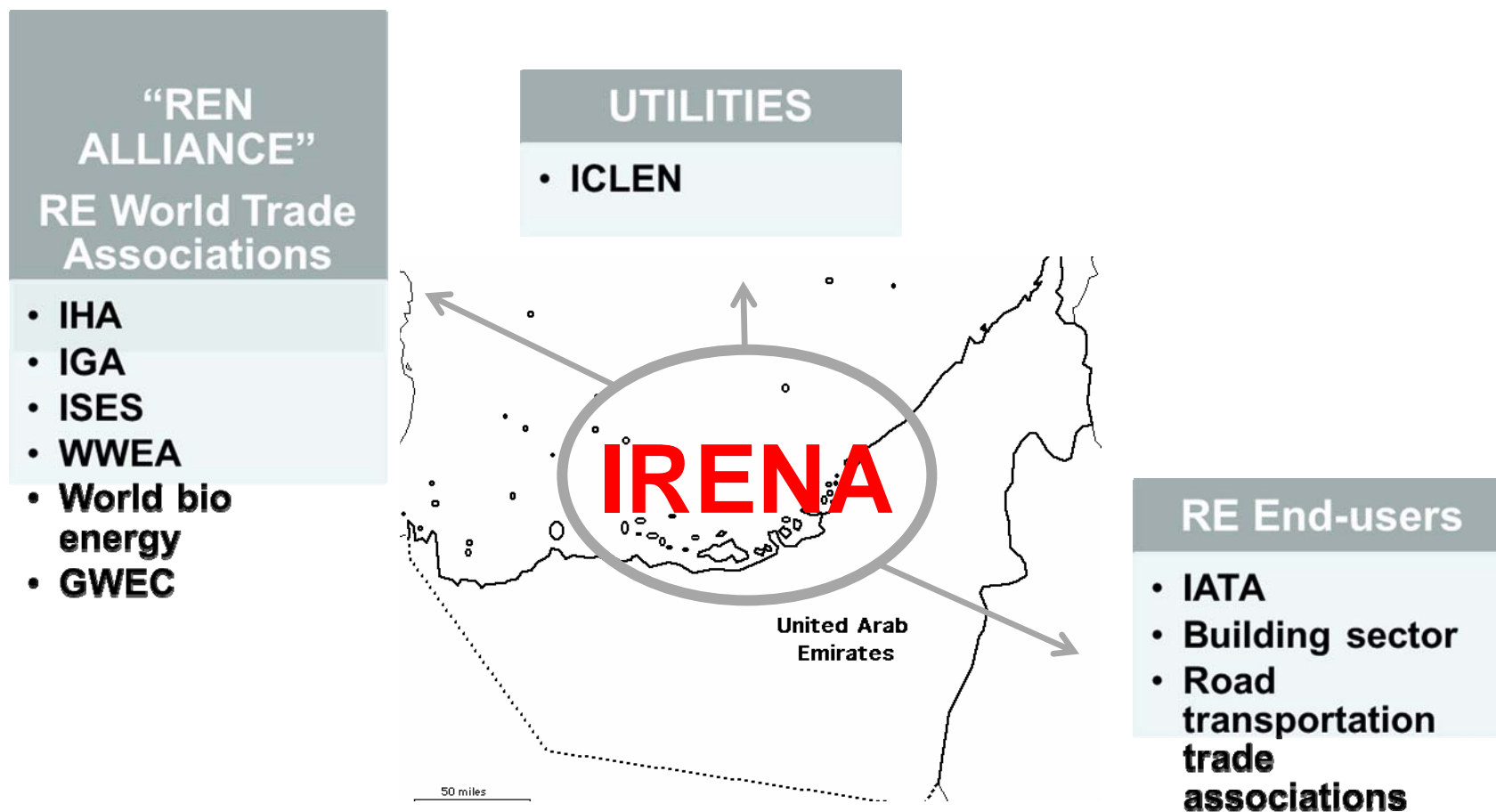
**Financial and implementation advice for rural electrification using renewable energy**

**Financing advice**

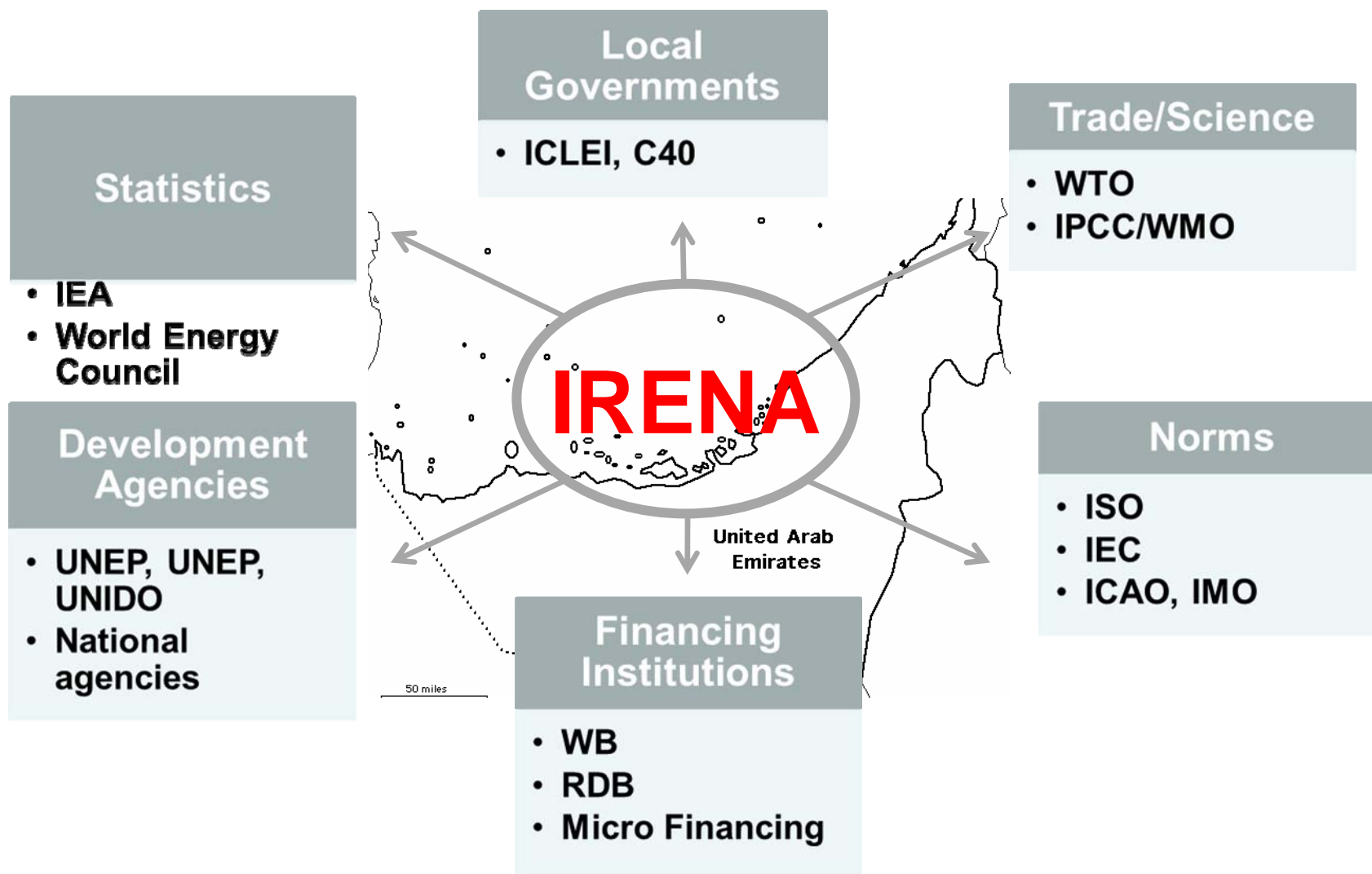
## **2. HOW IRENA COULD SUPPORT THE TRANSITION TO THIS NEW ENERGY PARADIGM**

### **3- Capacity building**

- **Capacity building needs analysis and strategy development**
- **Advise governments on national capacity building strategies**
- **Overview of existing virtual university and educational programmes for renewable: e-learning platform**







**Thank you for your attention!**