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Challenges to the electricity sector under decarbonisation

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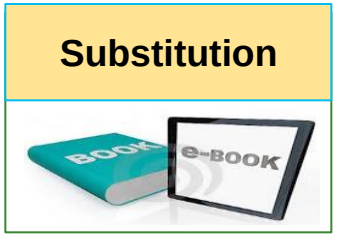
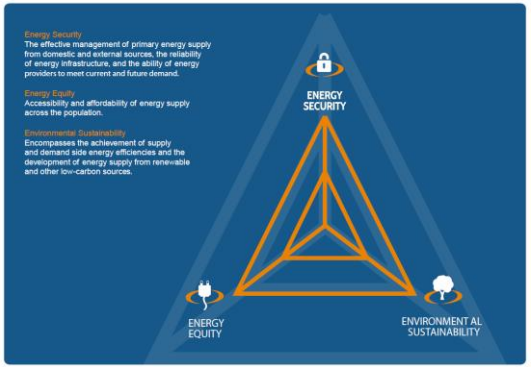
ÊTRE UTILE AUX HOMMES

Is the decarbonisation of the electricity sector the key question ?

- **Decarbonisation of the electricity sector cannot be disconnected from the global decarbonisation issue** (transport, final consumption) which will lead to an increase in electricity consumption
- **Environmental issues cannot be adressed separately from other electricity issues : energy security and energy equity**. According to WEC (2013 energy sustainability index), countries with poor ranking on the energy equity and energy security issue also have a poor ranking on environmental energy concerns





Summary

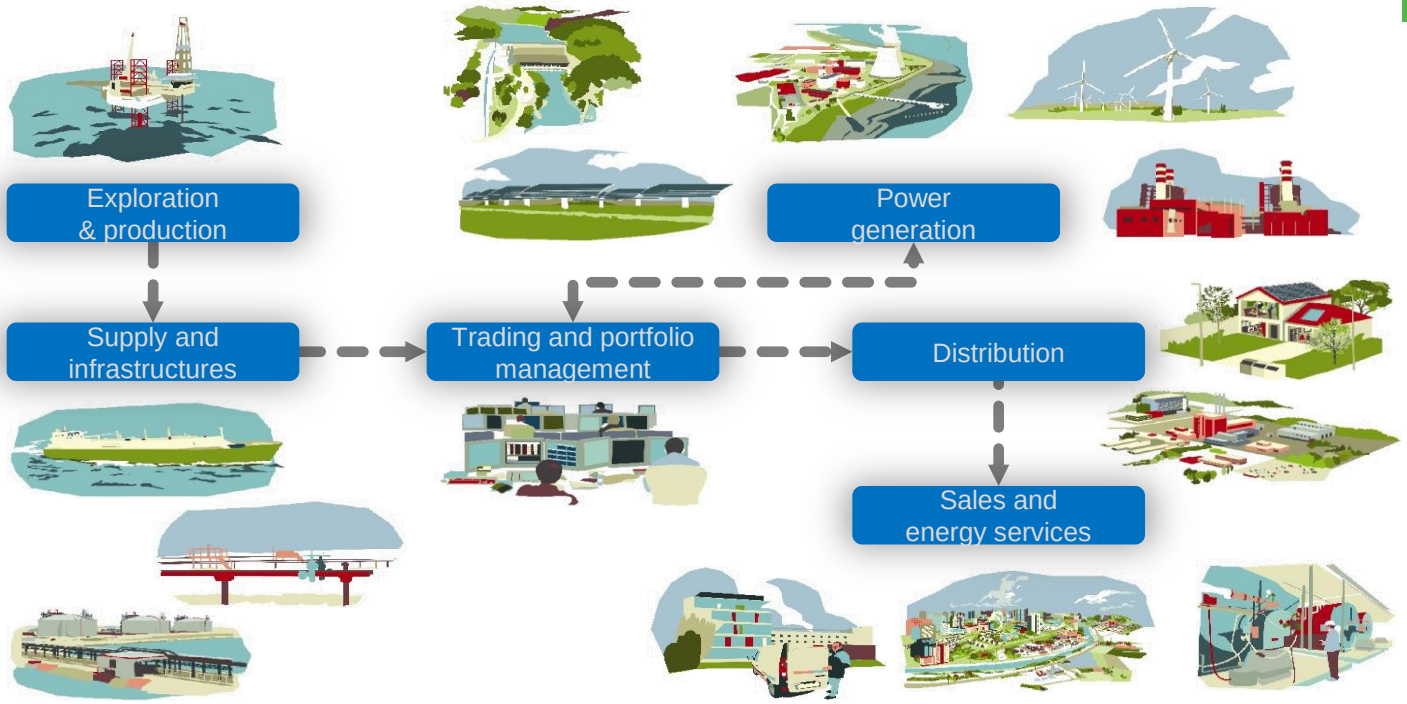
GDF SUEZ PRESENTATION

WORLDWIDE ENERGY OVERVIEW: STRUCTURING TRENDS

DIFFERENT MARKET DESIGNS CORRESPONDING TO DIFFERENT NEEDS

HOW CAN WE FIX THE DIFFERENT MARKET DESIGNS IN ORDER TO ENSURE AN EFFECTIVE DECARBONATION OF ELECTRCITY ?

GDF Suez : a presence across the energy value chain



TWO AMBITIONS

1. **Be the benchmark energy player in fast-growing countries**
2. **Be leader in the energy transition in Europe**

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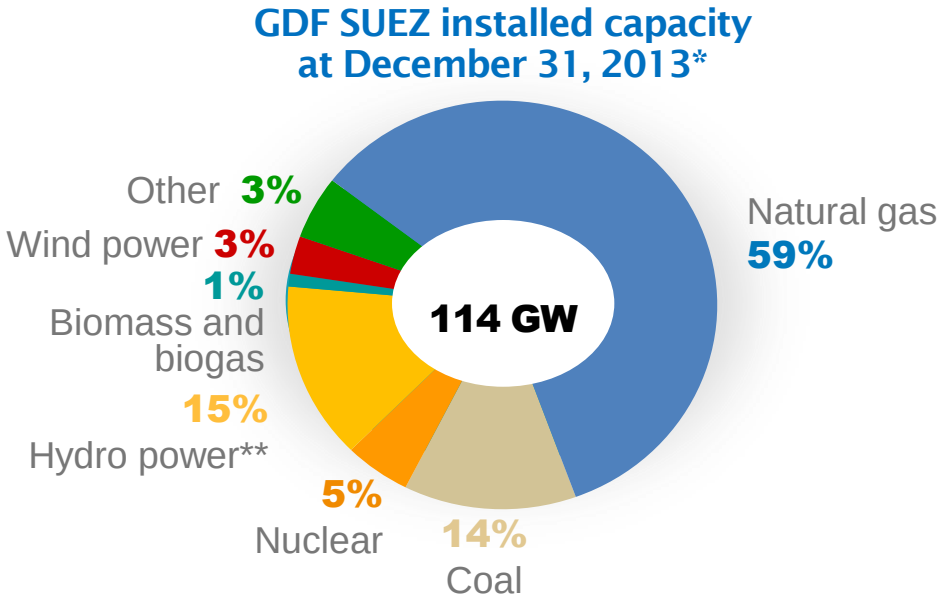
GDF SUEZ : a low CO_2 power-production mix

- **Flexible**, high-performance generation capacity with low carbon emissions (85%).
- **> 2 200 people** working in renewable in Europe
- **CO_2 specific emissions:** To be reduced by 10% in 2020 compared to 2012 (emission ratio per power and energy production)



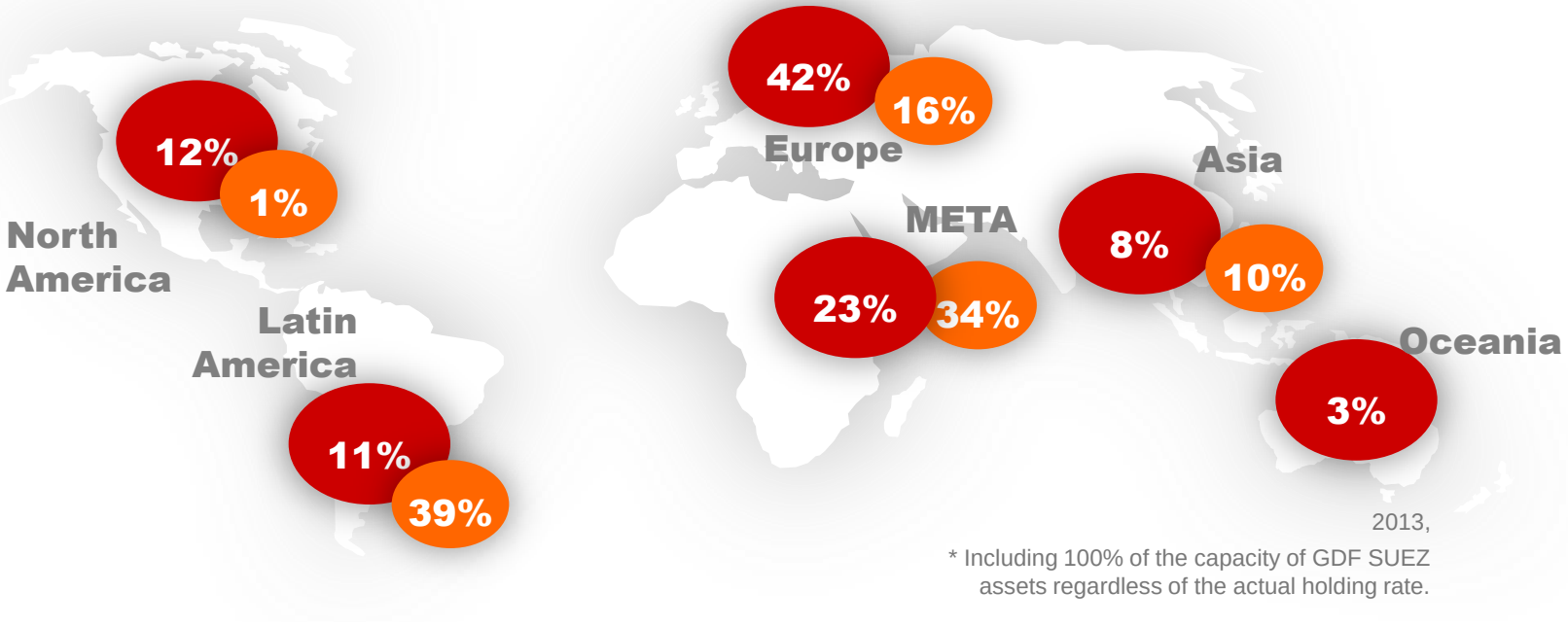
* Including 100% of the capacity of GDF SUEZ assets regardless of the actual holding rate.

** Including pumped storage.

GDF Suez : No.1 Independent Power Producer (IPP) in the world.

Breakdown of generation capacity by region

Capacity: **114 GW** installed
// **10 GW** under construction*



2013,

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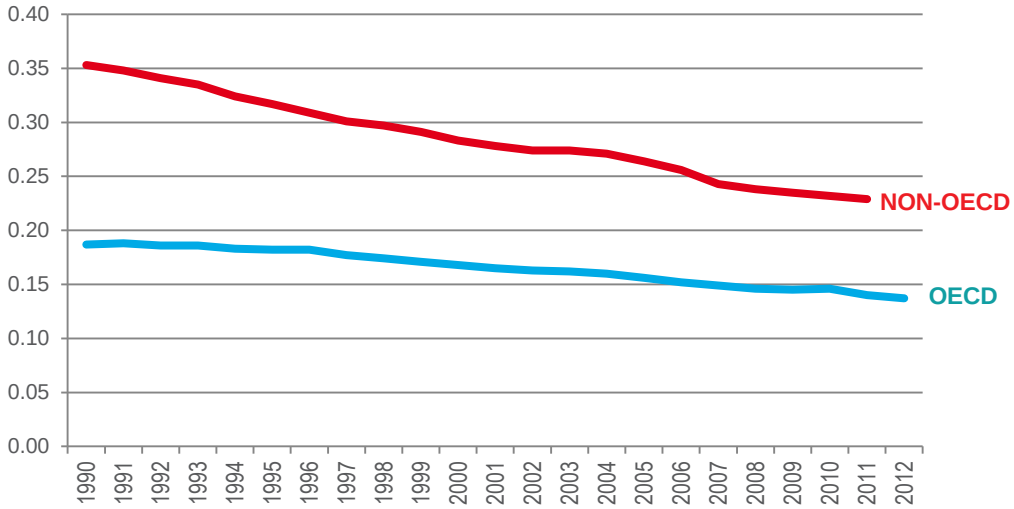
Energy transition: a worldwide and sustainable evolution

Energy efficiency and environmental concern

- **Carbon markets expand**:
  17 carbon markets currently,
  5 carbon credit markets planned after 2014

- **Greater awareness**: public policies on energy efficiency could already impact energy demand in mature and emerging economies

GDP energy intensity at purchasing power parity 1980-2012 ***(Kep/$05p*)***



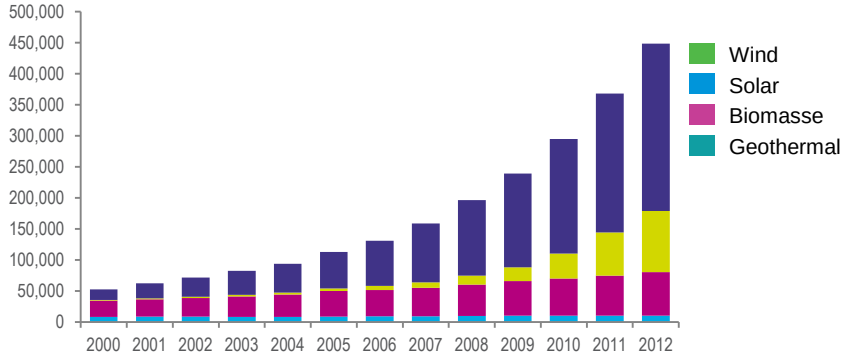
* Koe/$05p: kilogramme oil equivalent per dollar of 2005 in purchasing power ratio

Source: Enerdata

Energy transition: a worldwide and sustainable evolution

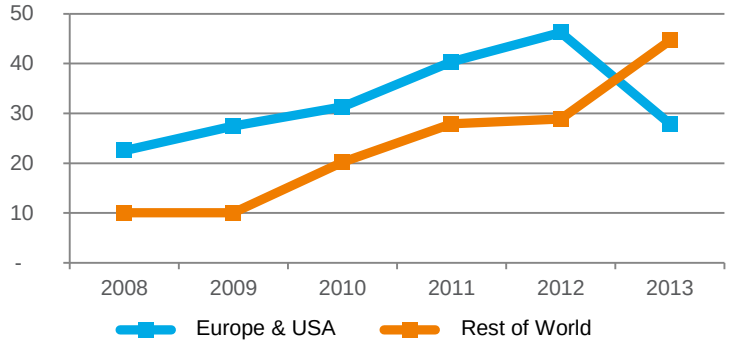
Renewables development

Worldwide renewable installed capacity 2000-2012, excluding hydro *(MW)*



Source: AIE, World Energy Outlook

RES annual additional installed capacity *(GW)*

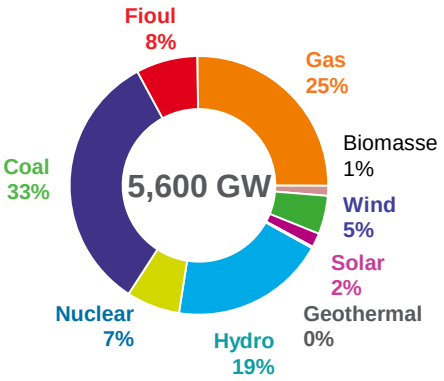


Source: Enerdata, EPIA, GWEC

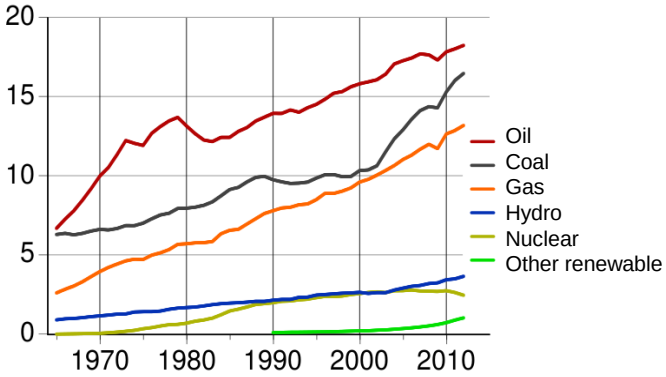
- RES **soon-to-be economically competitive** (wind, solar) in countries with abundant resources
- Acceleration in **solar energy roll-out** (PV and CSP), centralized and decentralized
  - **Environmental concern** leading emerging countries to support renewable energy: feed-in tariffs in Indonesia, Thailand, India; calls for tenders in Saudi Arabia … 127 pays ont des politiques de soutien des ENR, dont tous les pays internationaux où le Groupe est présent,
  - **Decreasing subsidies in Europe** leading to a slowdown of renewable energy roll out
- In 2013: the **majority of new installed capacities are located outside Europe and the US**

Uncertainty concerning coal in the global energy mix

Worldwide electricity capacity 2012
(%)



Worldwide energy consumption
(1,000 TWh/year)



- **Coal** could become the **leading primary energy source** in the world after 2020
- Coal consumption grew by **4% per year** between 2000 and 2011, driven by the increase in energy demand, in particular in the Asian electricity segment
- Depending on the IEA scenarios**, coal demand annual growth rate varies from -1.6% to +1.5% per year by 2035**

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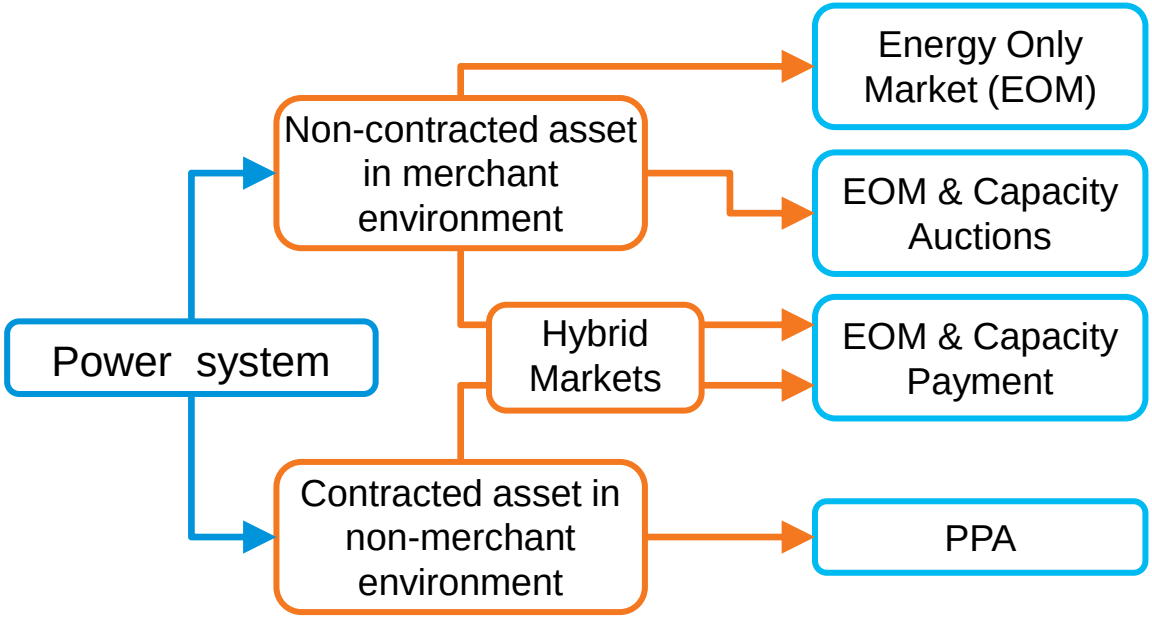
Different designs of power systems



Adapted to countries with fast growing residual demand. Price spikes driving economical investment

Adapted to sluggish residual demand. Capacity remuneration and price spikes driving investment in the eligible assets

Adapted to countries :
-still developing their power infrastructures,
- governmental guaranties required
- subsidies for power, when power is a driver of health/economic development
-Security of supply is a key issue

Risk that prices won't enable operators to recover their costs

Regulatory risk

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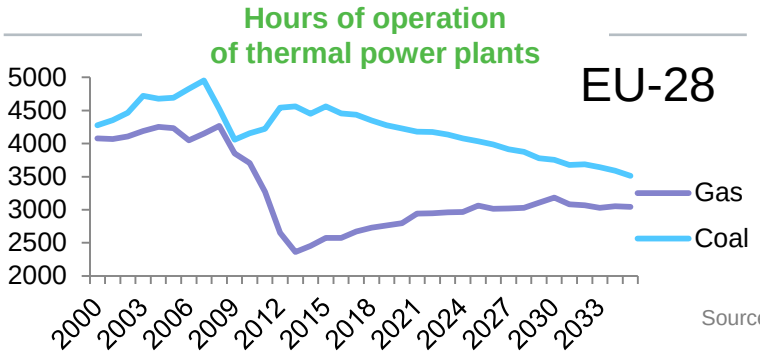
OECD Countries – example of Europe

A crisis in thermal power generation caused by the falling demand and increased by a failing regulation



Source: GDF SUEZ based on Cera data

- Excessively low **utilisation rate**: in Spain, the utilisation rate of CCGTs plummeted from 66% in 2004 to **10% in 2013**
- Unless **market design** changes, 130 GW do not cover their fixed costs (out of a European total electric fleet of 970 GW)

The triple failure of the EU policy

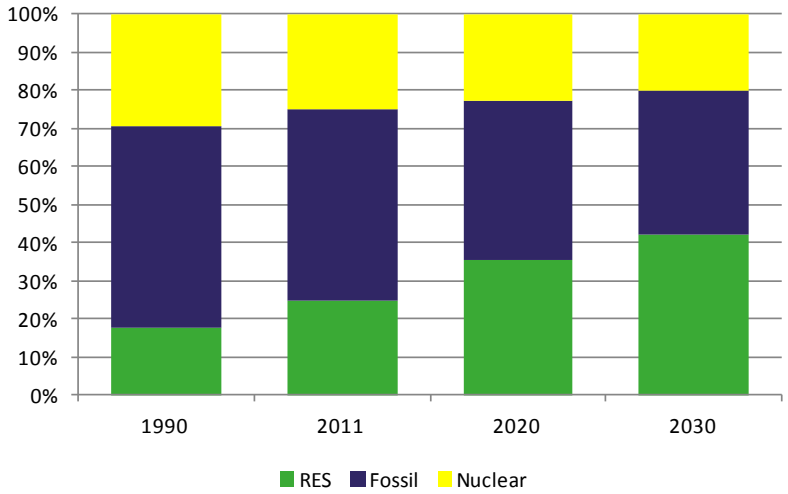
- **Subsidies for renewables:** a burden for public finances and consumers: more than 300G€ between 2010 and 2020 in Europe, of which 40% for Germany
- **An inefficient CO_2 market** (no price signal)
- **Security of supply** at risk

Priority in OECD countries:

Facilitate RES penetration

- **Address the technical issues of intermittency**:
- strong impact on grid management
- Increase regional cooperation
- **Make sure that the necessary back up investments come on line**
- Fix the EU ETS market
- Implement capacity markets, adapt the tariff structure
- Regulation should be stable, and harmonized at a European level
- Cancel inconsistencies in the market design (price caps…)

OECD Europe Generation mix
(% TWh)

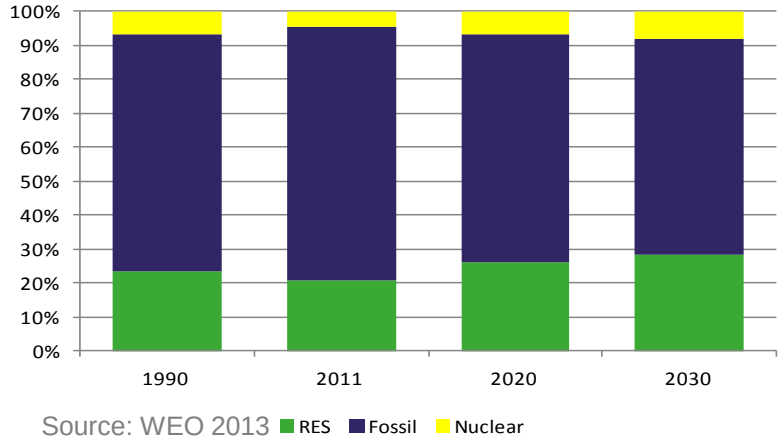


Source: WEO 2013

Priority in non-OECD countries:
Support demand growth

- **Fossil fuel power plants will remain dominant in the energy mix**:
- All technology will be required
- Develop the most efficient thermal power plants
- **Change of paradigm ?**
- Check that our thermal investments are resilient to a CO_2 price
- Develop energy efficiency services and renewable services
- Benefit from high potential for solar and wind in some regions

Non – OECD Generation mix
(% TWh)



Non-OECD final demand by fuel (%)