# Energy and Environment

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***International Ministerial Conference on Nuclear Power in the 21st Century***

***Saint Petersburg, Russian Federation***

***27 – 29 June 2013***

# The energy tri-lemma

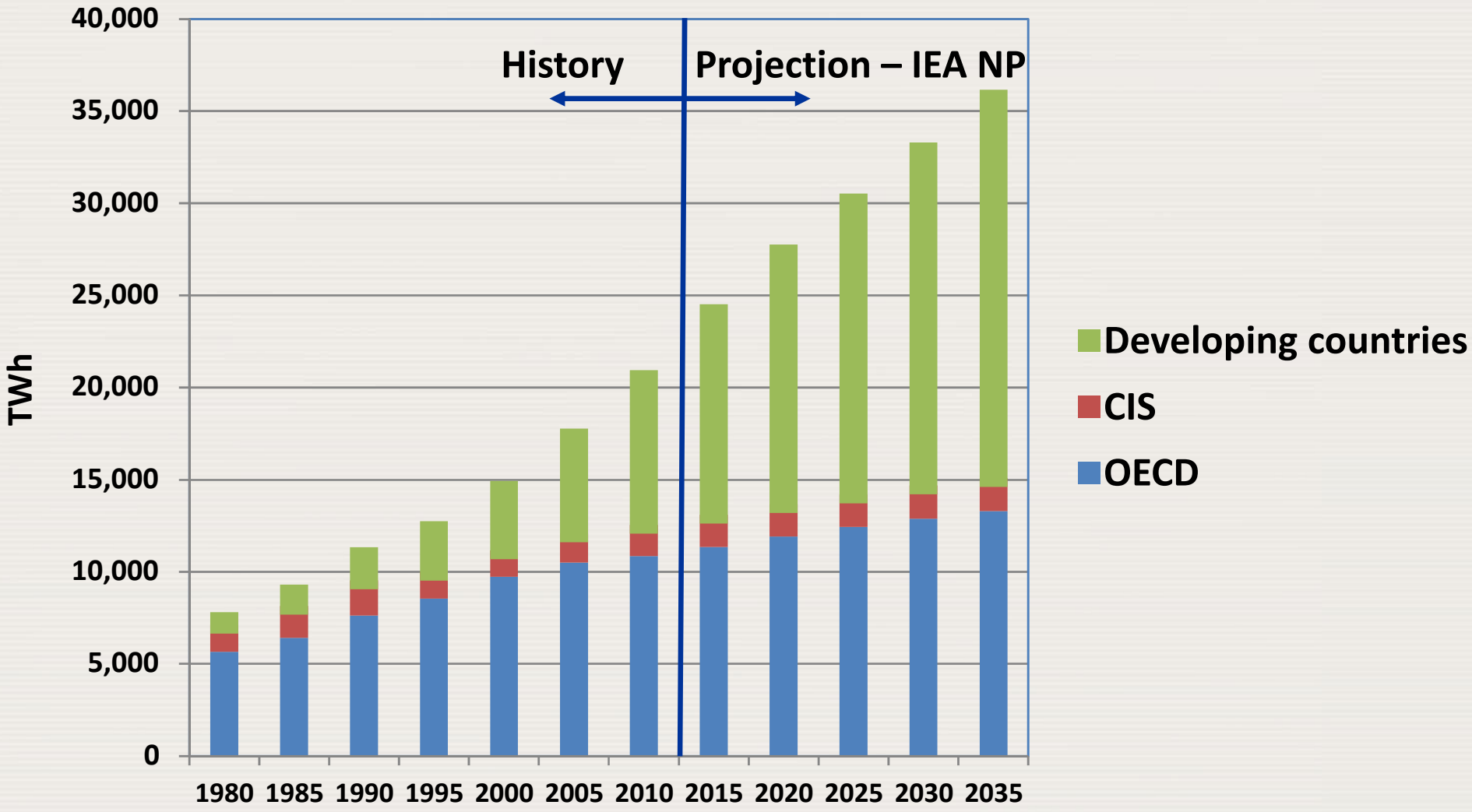
- **Energy security**
  - Supply security – Reliability - Access
- **Competiveness**
  - Generating costs – Finance - Affordability
- **Environmental considerations**
  - Climate change - Local and regional pollution

**under mounting pressures from demand growth**

# Nuclear power and the energy tri-lemma

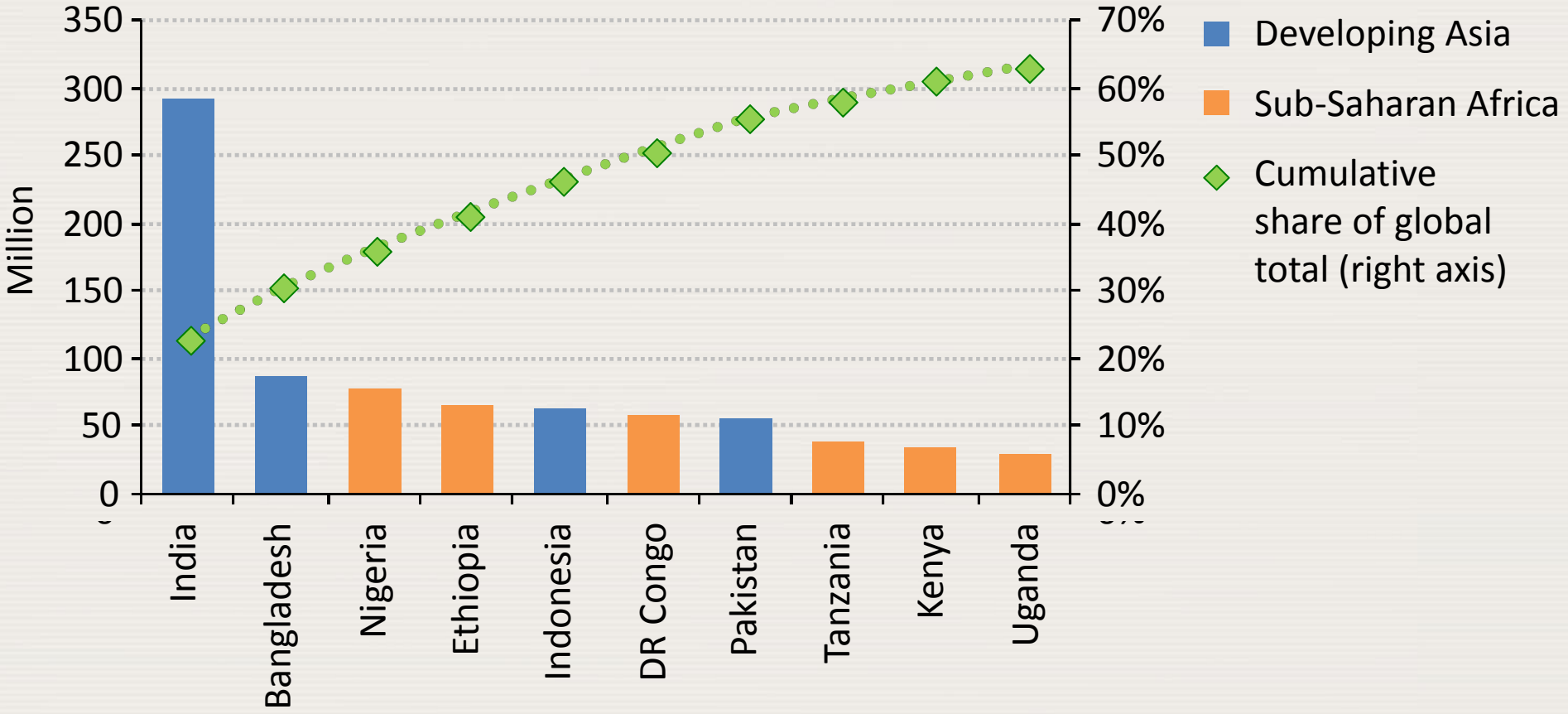
- **Global energy demand is set to grow** ➡
  ***Nuclear power expands supply options***

# Electricity demand




Source: IEA, WEO 2012)

# Countries with the largest population without access to electricity, 2010



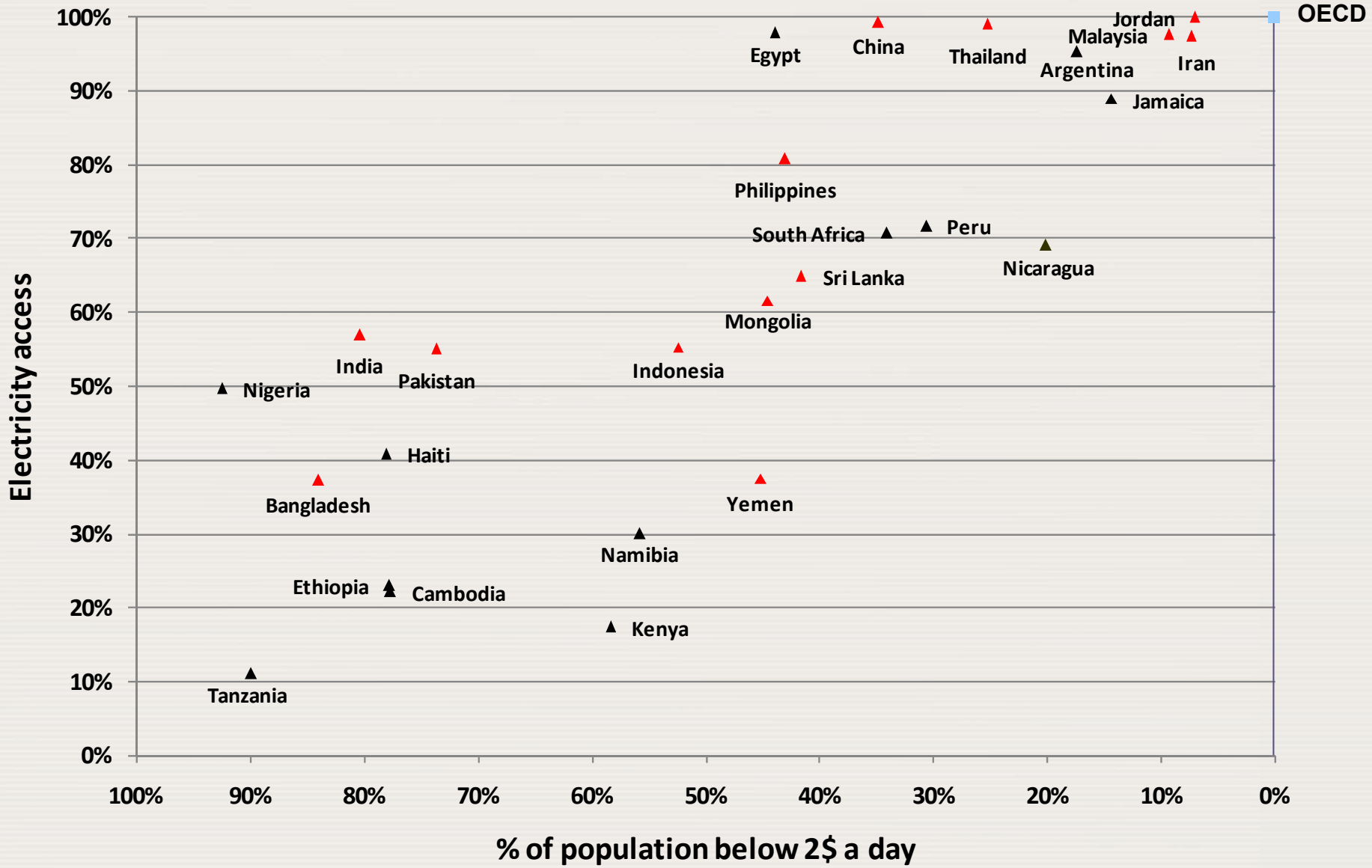

**Some 1 260 million people have no access to electricity**

**Over 95% of those without electricity are in developing Asia or sub-Saharan Africa & nearly two-thirds are in just ten countries**

**Source: IEA, WEO 2012)**

# Link between poverty and electricity access

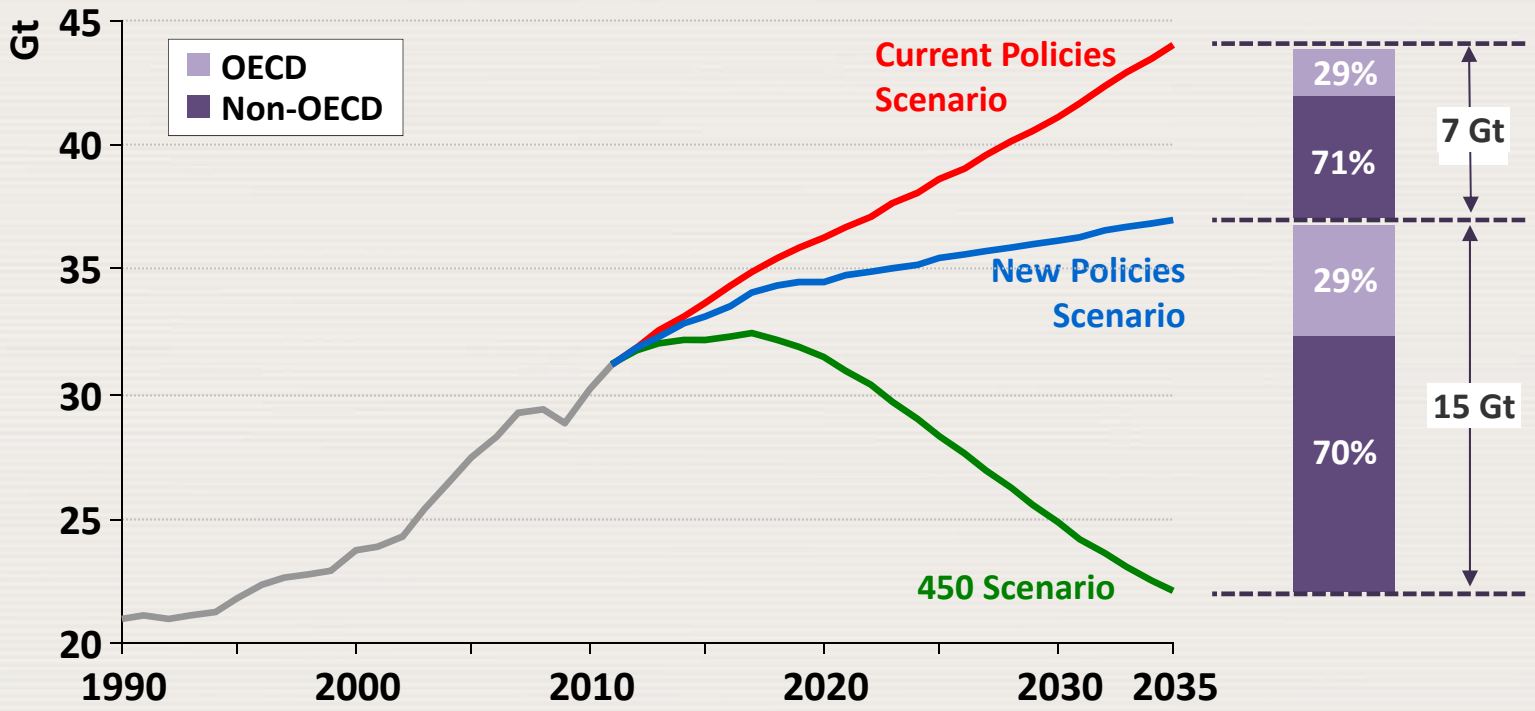
Source: UNDP – Human Development Report 2007/8



# Nuclear power and the energy tri-lemma

- **Global energy demand is set to grow** ➡
  ***Nuclear power expands supply options***
- **Environmental pressures are rising** ➡
  ***Nuclear power has low life-cycle GHG emissions***

# Global energy-related $CO_2$ emissions by scenario

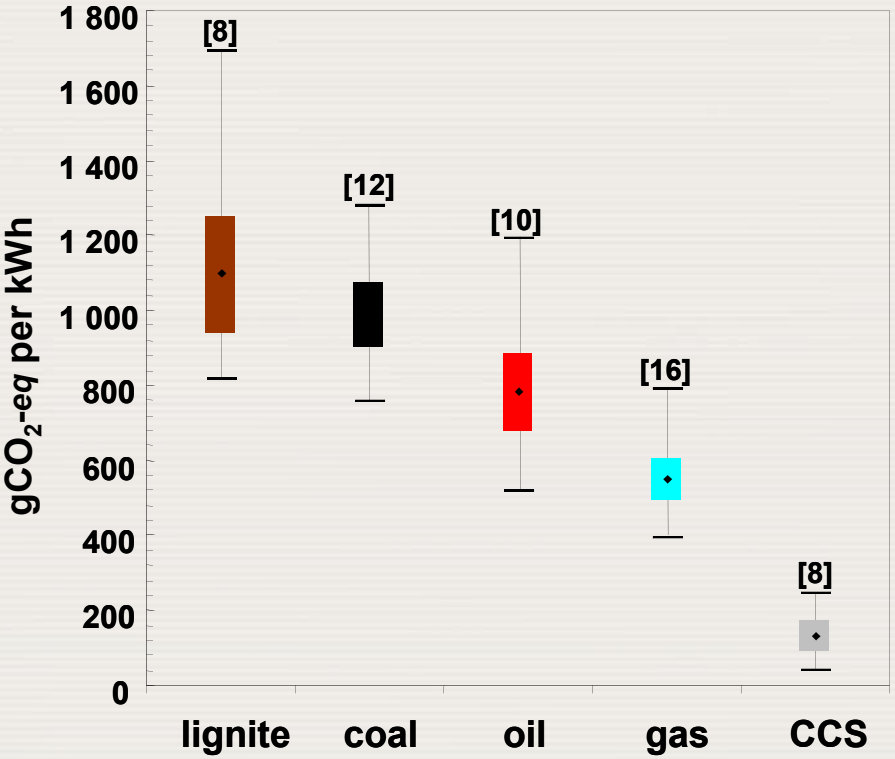


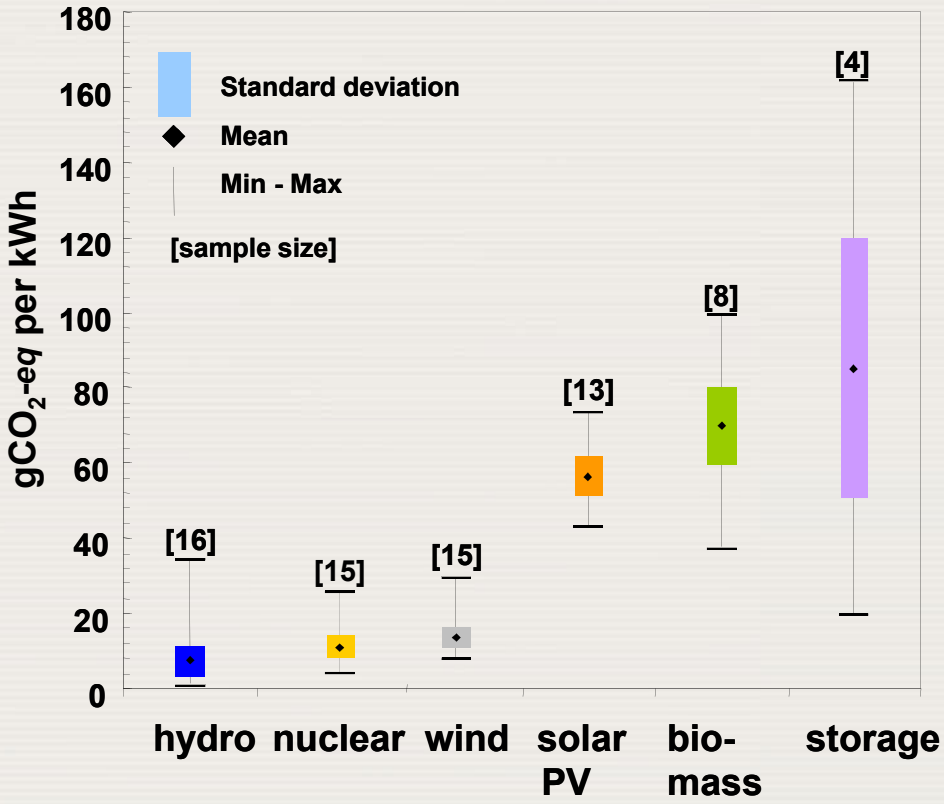

*$CO_2$ emissions rise to 44.1 Gt in the Current Policies & 37 Gt in New Policies Scenario by 2035. 450 Scenarios require levels of 22.1 Gt*

Source: IEA, WEO 2012)

# Mitigation – Role of nuclear power

## Life cycle GHG emissions of different electricity generating options




**Nuclear power: Very low life cycle GHG emissions make the technology a potent climate change mitigation option**

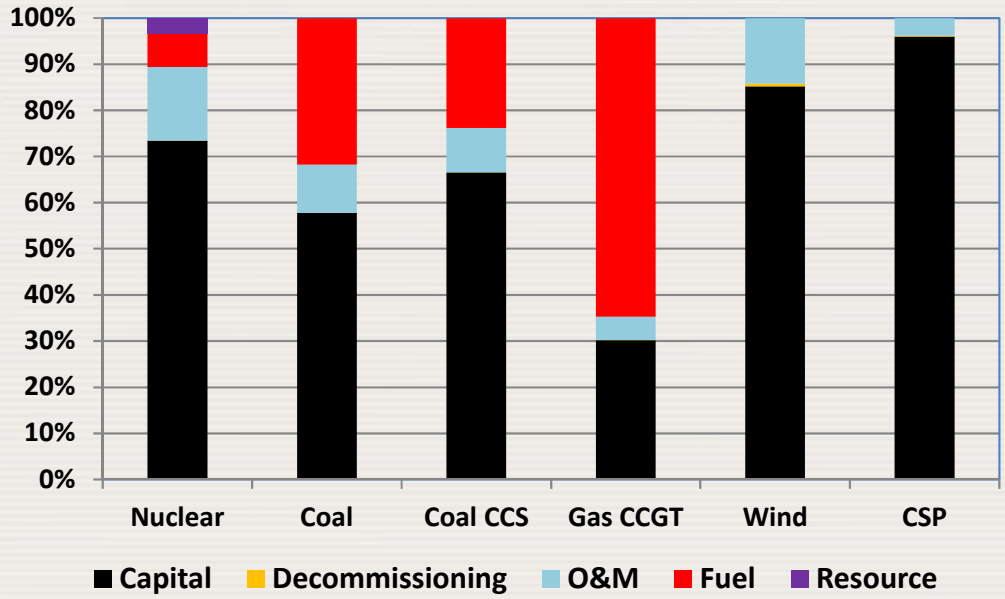
# Nuclear power and the energy tri-lemma

- **Global energy demand is set to grow →**
  ***Nuclear power expands supply options***
- **Environmental pressures are rising →**
  ***Nuclear power has low life-cycle GHG emissions***
- **Energy supply security back on the political agenda →**
  ***Nuclear power contributes to energy security***

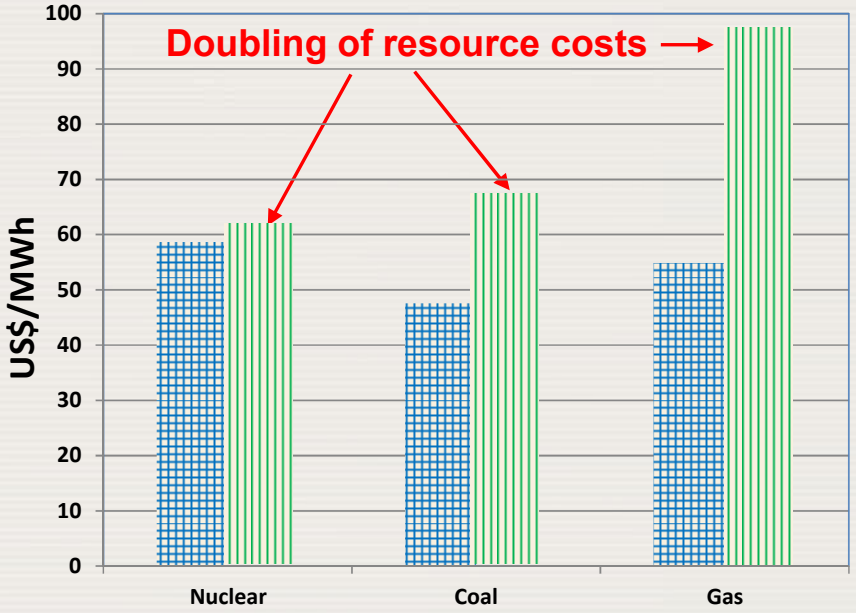
# Nuclear power and energy security

- Small fuel volumes
- Long refueling cycles
- Resource a small share in generating costs
- Uranium resources are plentiful
- Base load technology

**Cost components in total generating costs at a 10% discount rate**




**Doubling of resource costs**

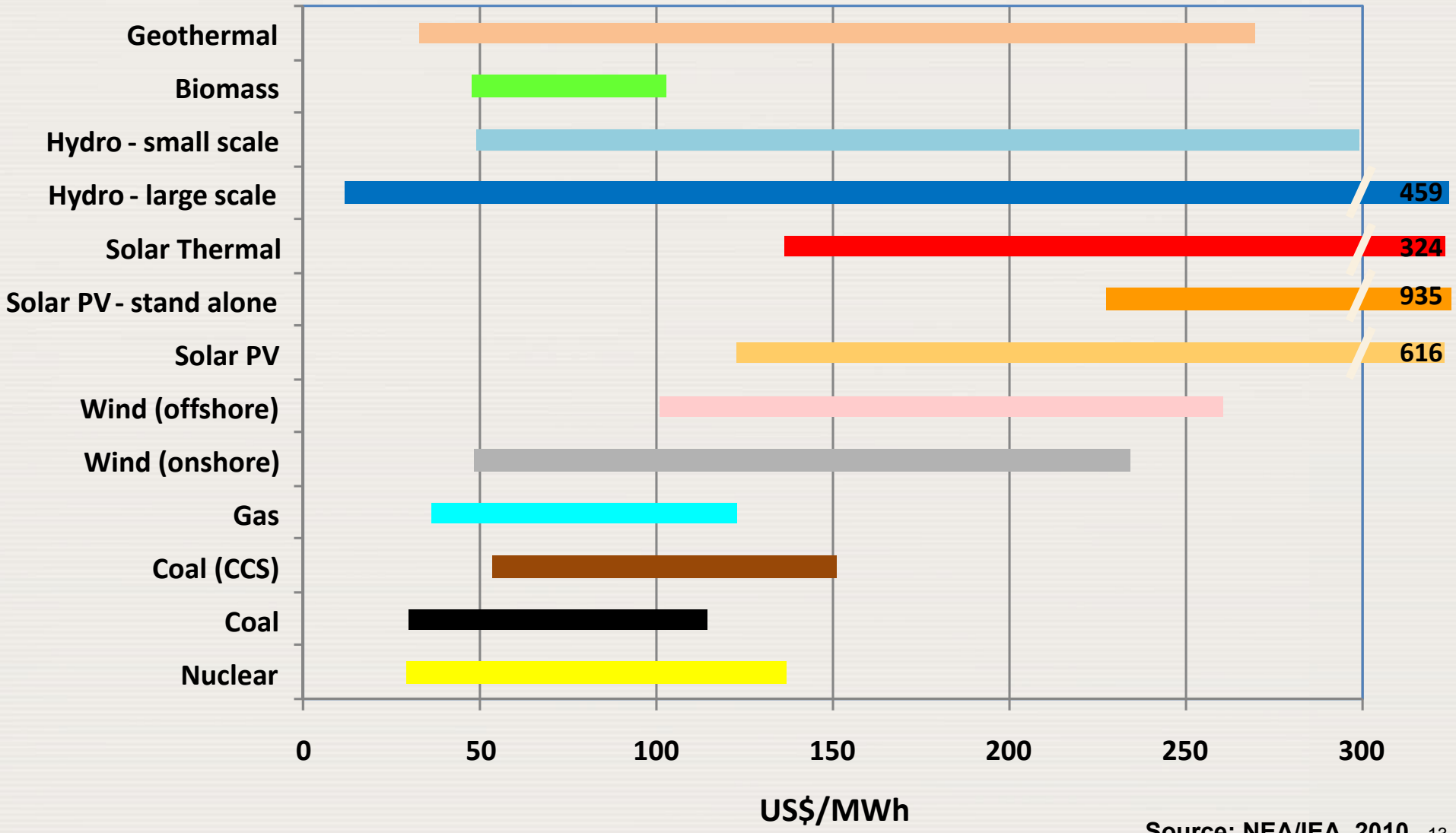



Adapted from IEA/NEA 2010 and NEA 2003

# Nuclear power and the energy tri-lemma

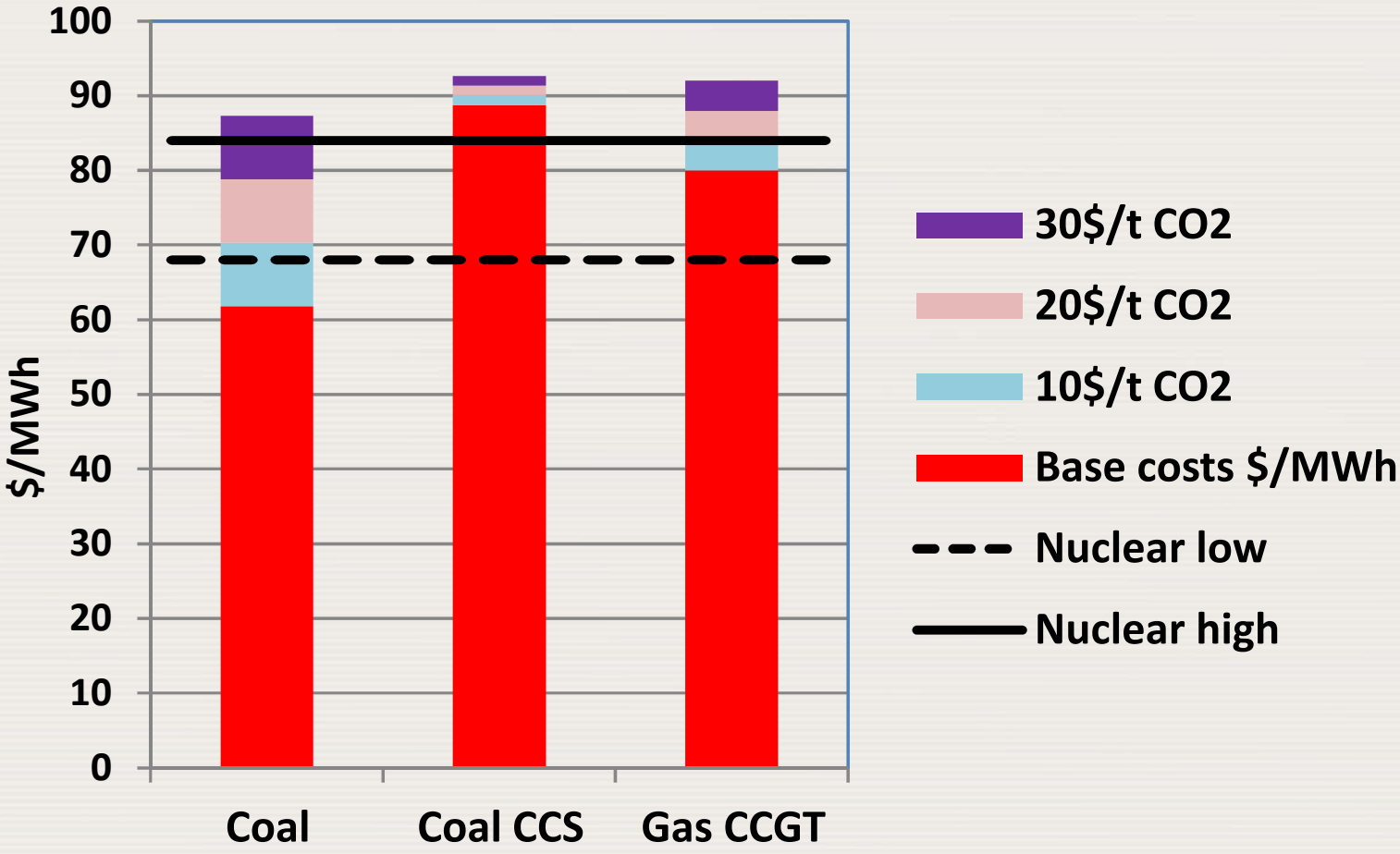
- **Global energy demand is set to grow** ➡
  ***Nuclear power expands supply options***
- **Environmental pressures are rising** ➡
  ***Nuclear power has low life-cycle GHG emissions***
- **Energy supply security back on the political agenda** ➡
  ***Nuclear power contributes to energy security***
- **Reliable base load electricity at predictable and affordable costs for meeting MDGs** ➡
  ***Nuclear power offers stable and predictable generation costs based on low resource costs***

# Range of levelized generating costs of new electricity generating capacities




Source: NEA/IEA, 2010

# Impact of carbon prices



# *Economics – Nuclear power*

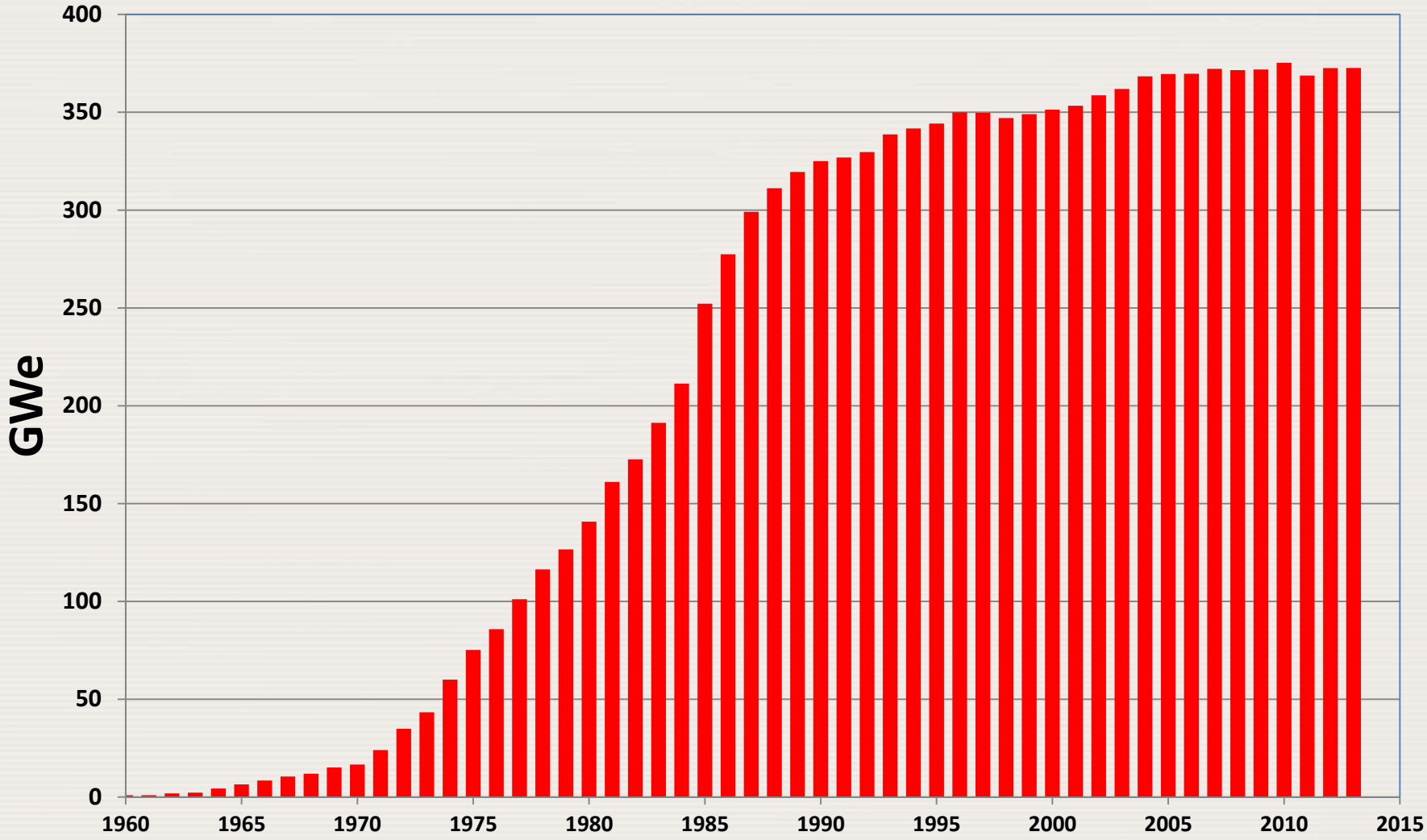
## Advantages

- Nuclear power plants are cheap to operate
- Stable & predictable generating costs
- Long life time
- Supply security (insurance premium)
- Low external costs (so far no credit applied)

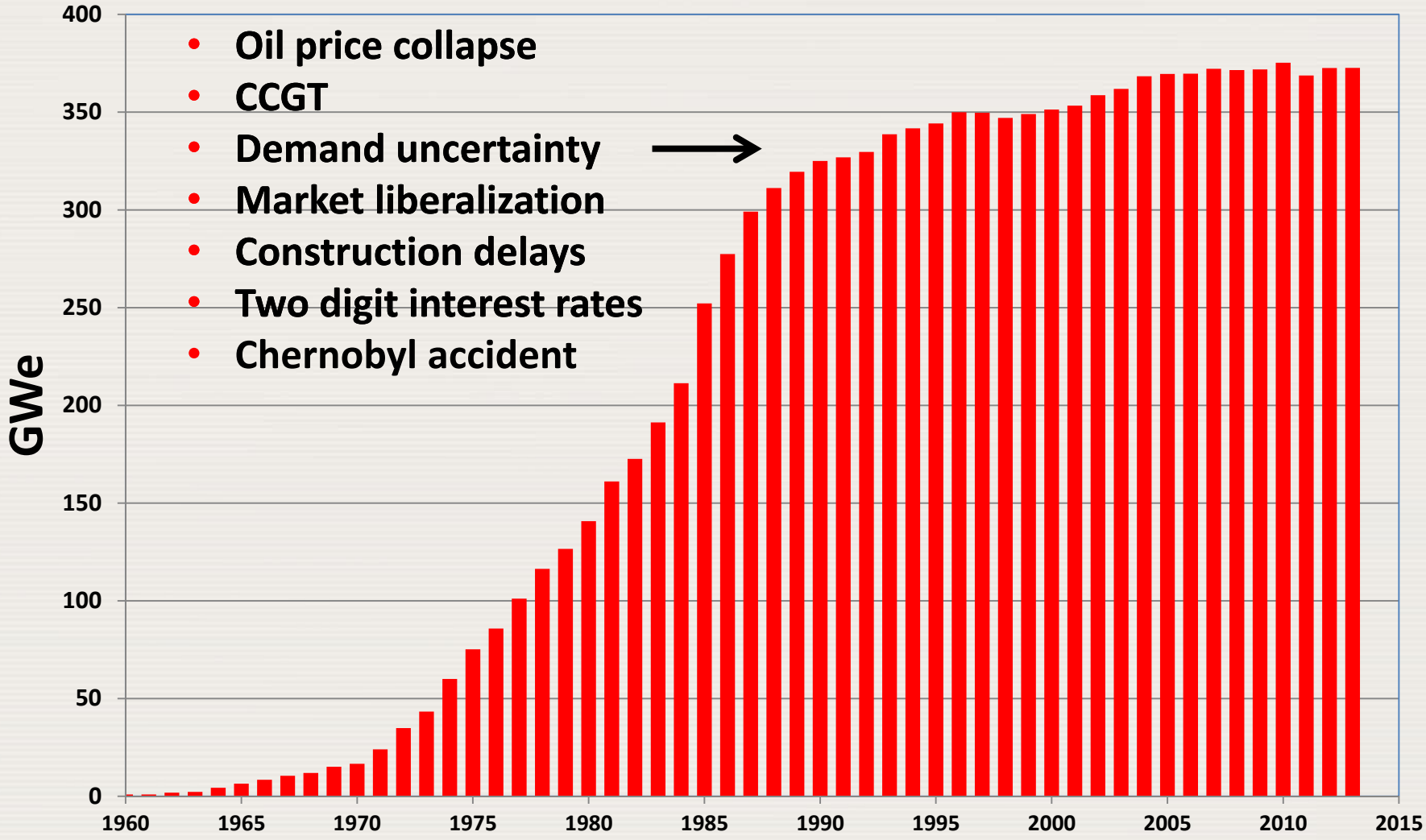
## But…

- High upfront capital costs
- Finance
- Sensitive to interest rates
- Long lead times Long payback periods
- Market risks
- Regulatory/policy risks

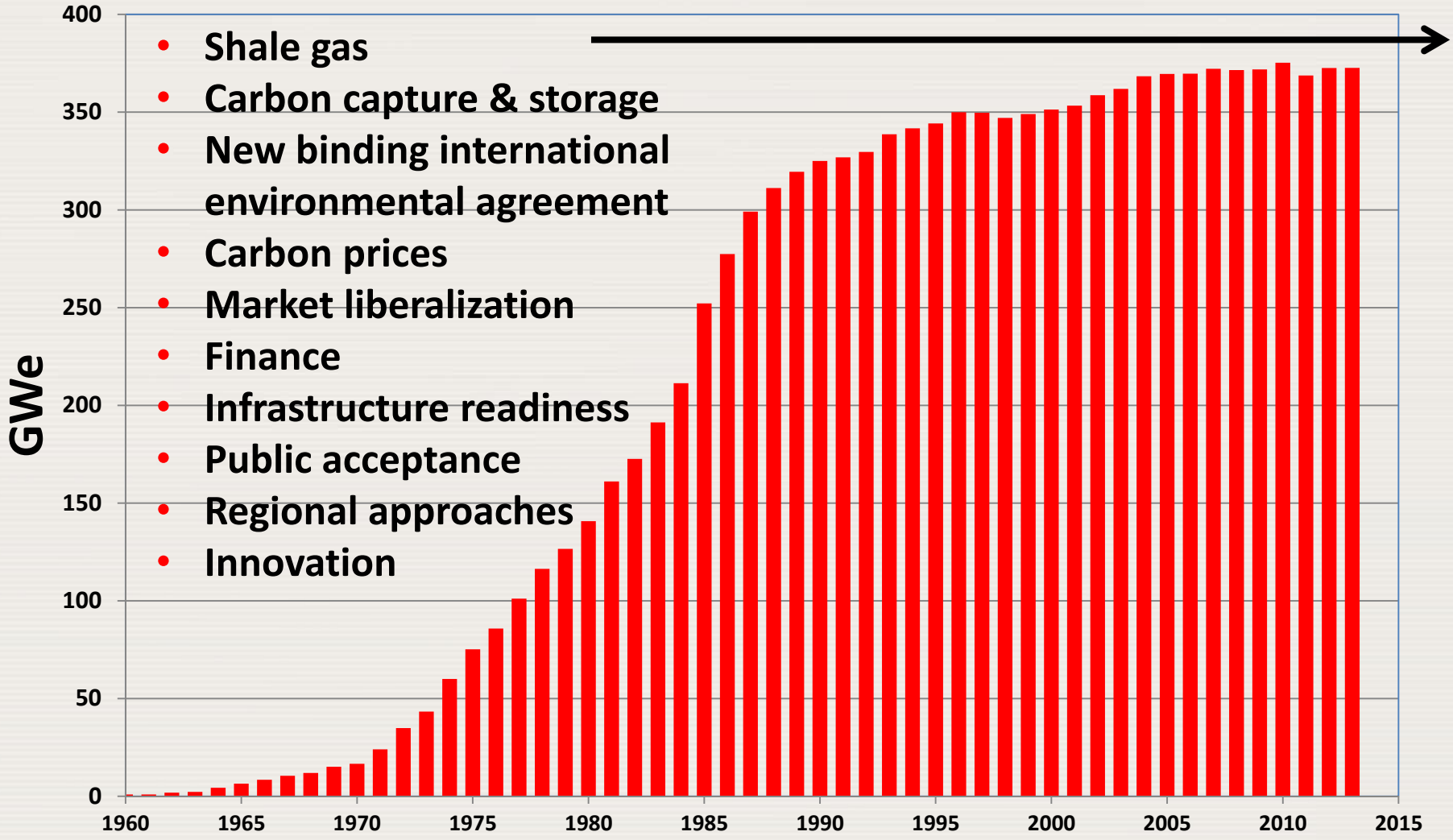
# Historical development of global nuclear power generating capacity



# Slow down in the mid-1980s

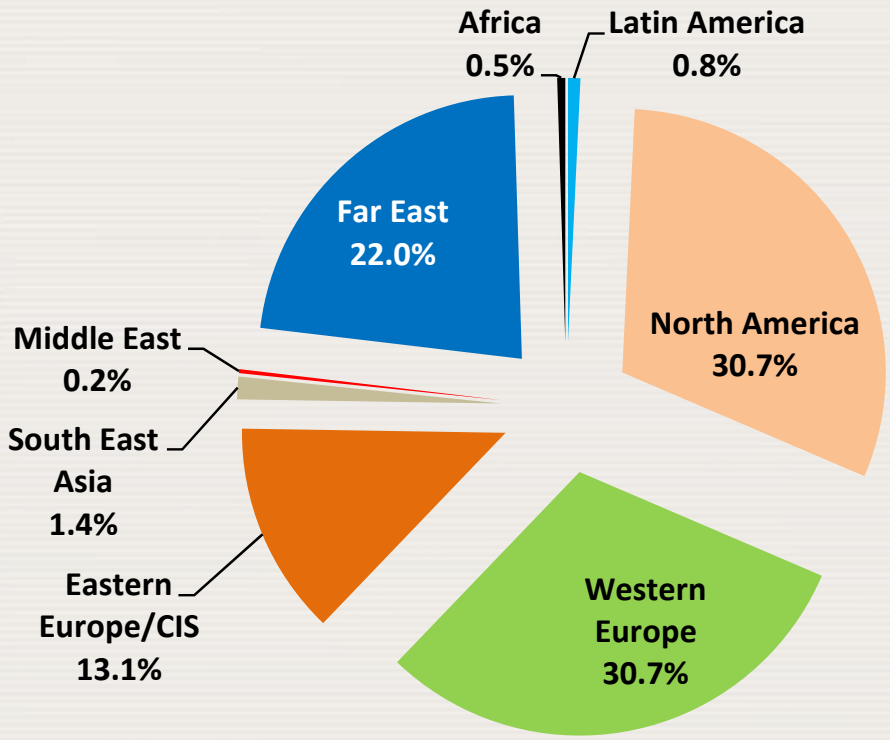


# Issues ahead

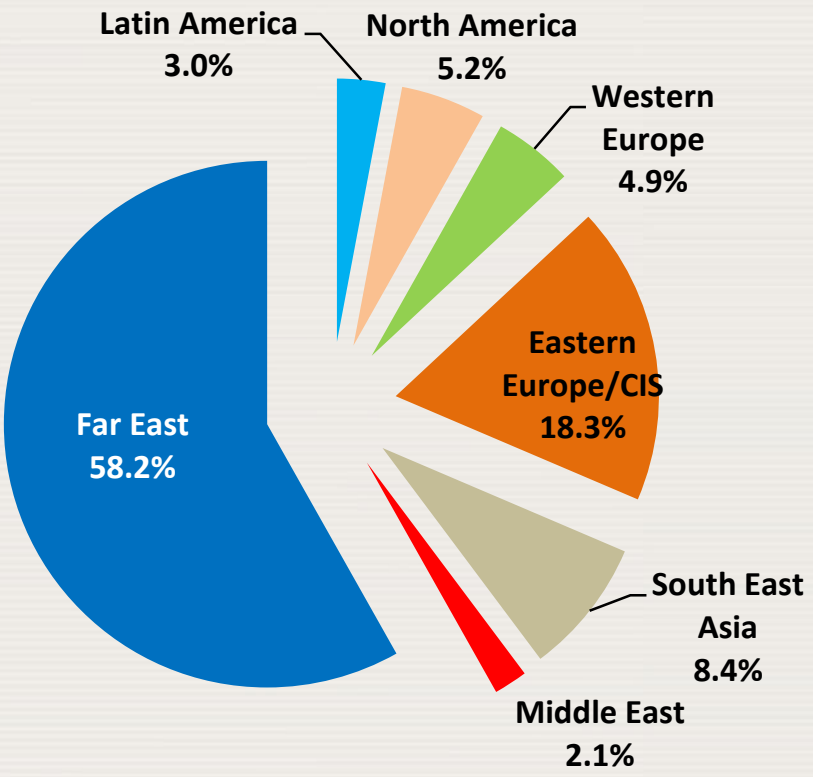


# Status global nuclear power – 26 June 2013

## Units in Operation: 434
## 370.5 GWe




## Units under construction: 69
## 65.3 GWe




Status 26 June 2013

# One size does not fit all

- Countries differ with respect to
  - Energy demand growth
  - Alternatives
  - Financing options
  - Weighing risks and preferences
    - accident risks, cheap electricity, air pollution, jobs, import dependence, climate change, air pollution
- Benefits > risks  or risks > benefits (perceived or real)
- Local conditions determine the optimal supply and technology mix
- Nuclear power is not the cure-all solution for all energy and environmental problems but it surely can be an integral component of any solution to the energy tri-lemma