

# Integrating variable renewables in the grid

## Planning and policy measures




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ATA Insights Webinar  
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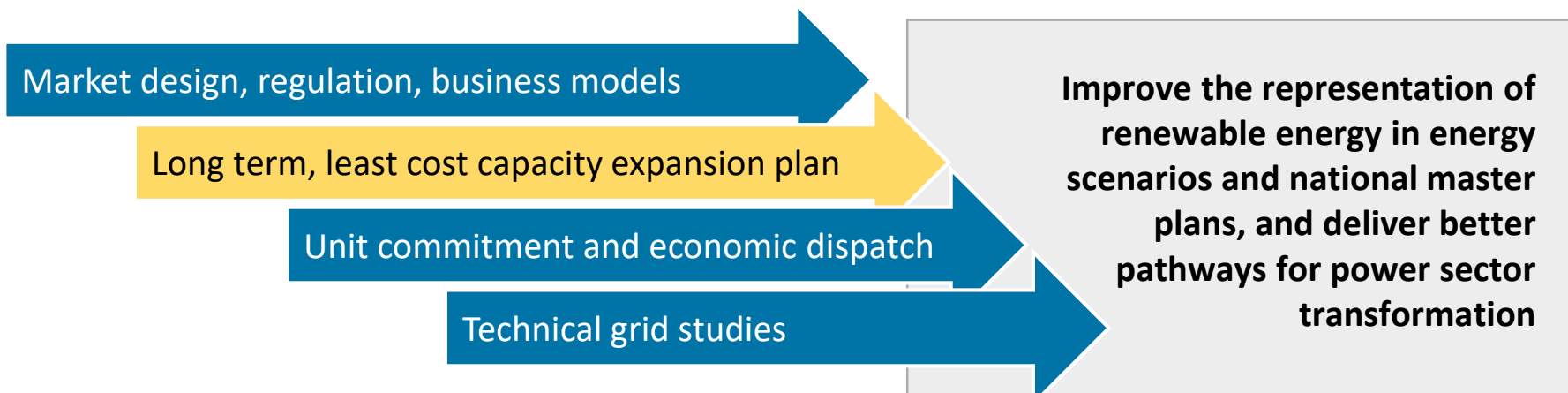
## International organization supported by governments of member countries

- » **HQ:** Abu Dhabi, UAE
- » **Members:** 182 countries (159 ratified)
- » **Mandate:** Sustainable deployment of six RE resources (Biomass, Geothermal, Hydro, Ocean, Solar, Wind)

## Programme of Work:

- » **1. Centre of Excellence for Energy Transformation**
  - Transformation pathways  **Including planning for VRE**
- » **2. Global Voice of Renewables**
- » **3. Network Hub**
- » **4. Source of Advice and Support**

# Power sector transformation at IRENA



- » **Work with countries to conduct planning studies with renewables using power sector modelling tools**
- » **Develop guidelines and tools to support better planning practices and disseminate them**

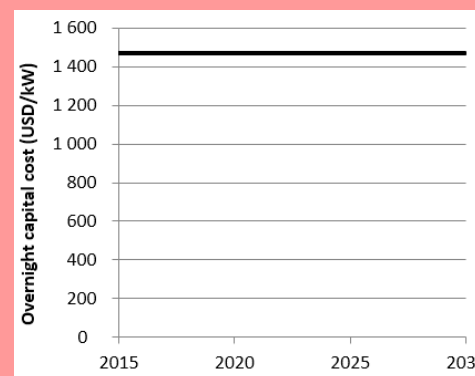
# Why IRENA? Some background...

## Thermal plant

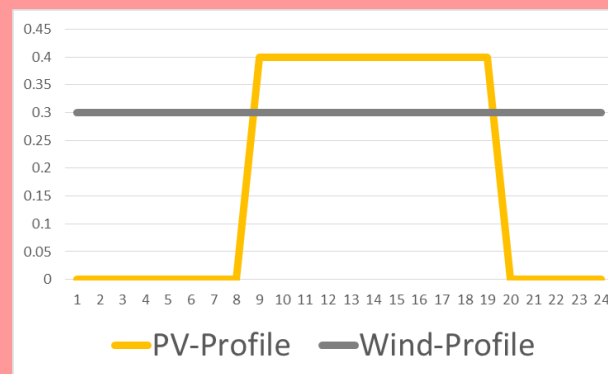
- » Models contained a pipeline of detailed, specific projects
  - » Specific costs
  - » Specific technical parameters
    - » Capacity
    - » Fuel type
    - » Efficiency
    - » Forced outage
    - » Capacity factor
  - » Site-specific transmission and stability requirements
  - » Etc.

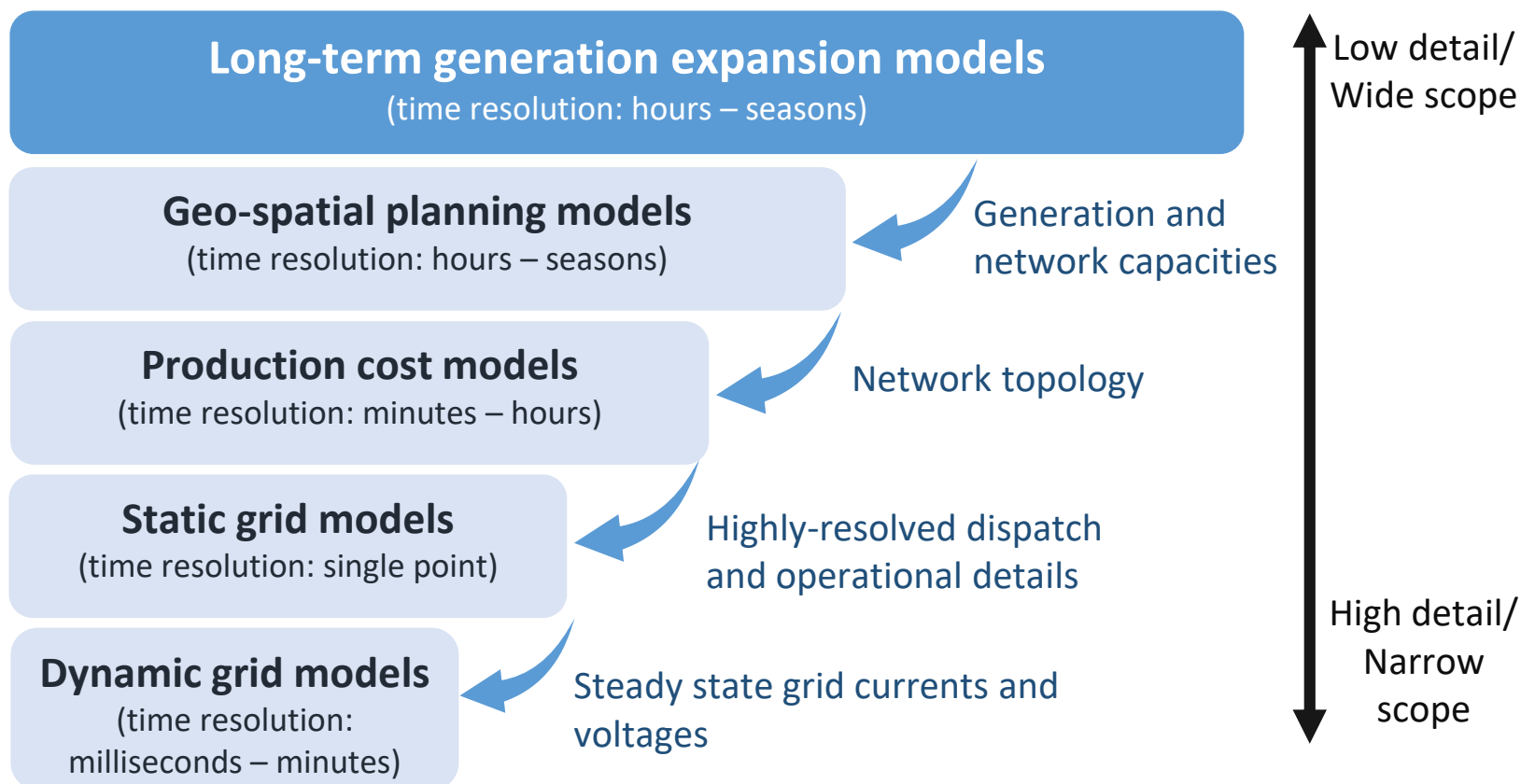
## Wind & Solar PV (variable renewable energy, or VRE)

- » One generic, constant cost

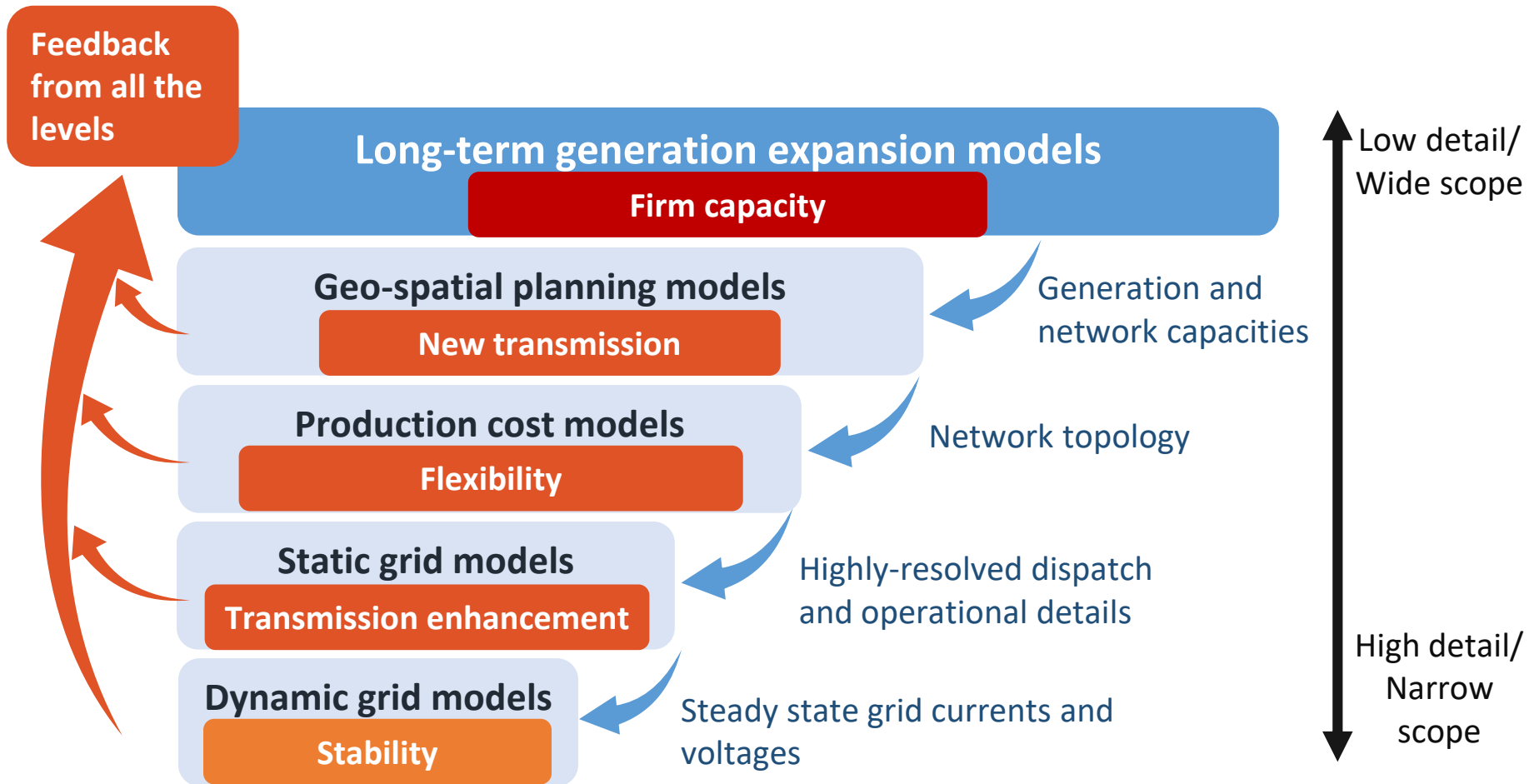


- » One generic type, no capacity limits



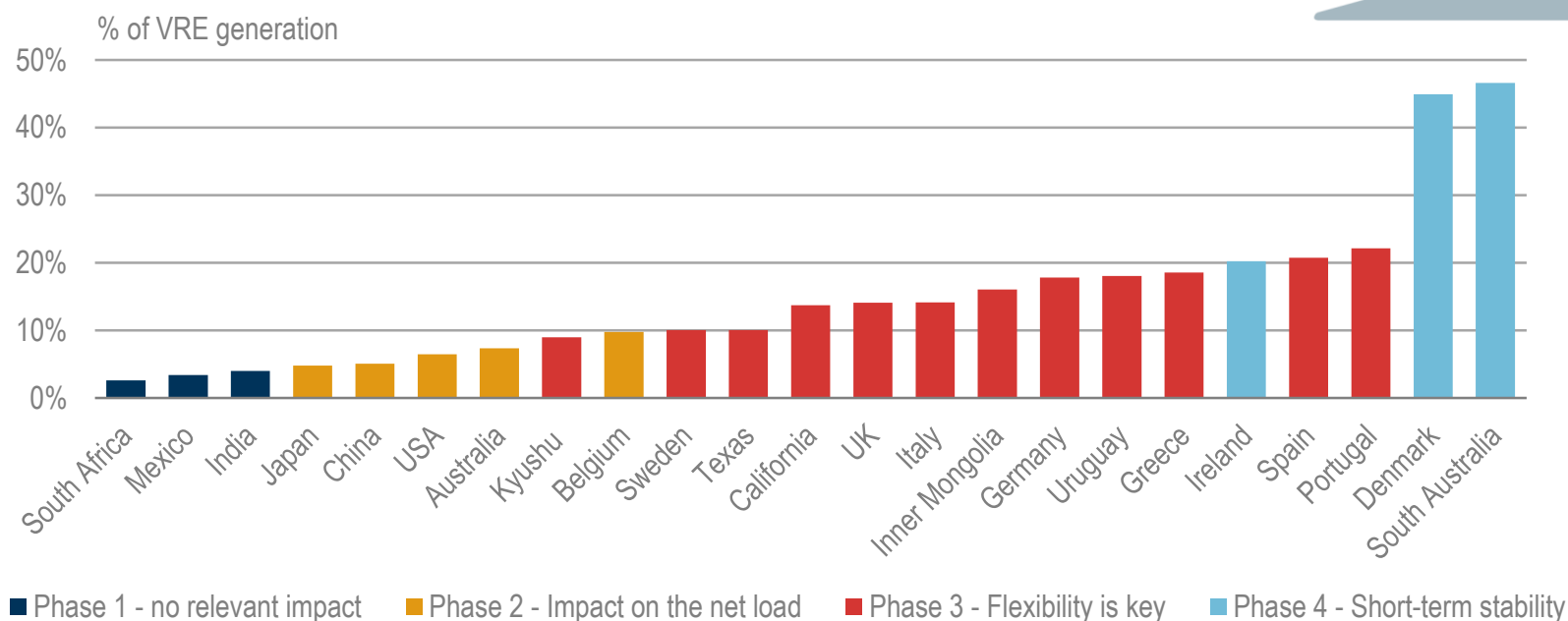


# The planning/modelling process needs to become more dynamic



# Context for solutions: Different phases of system integration of VRE

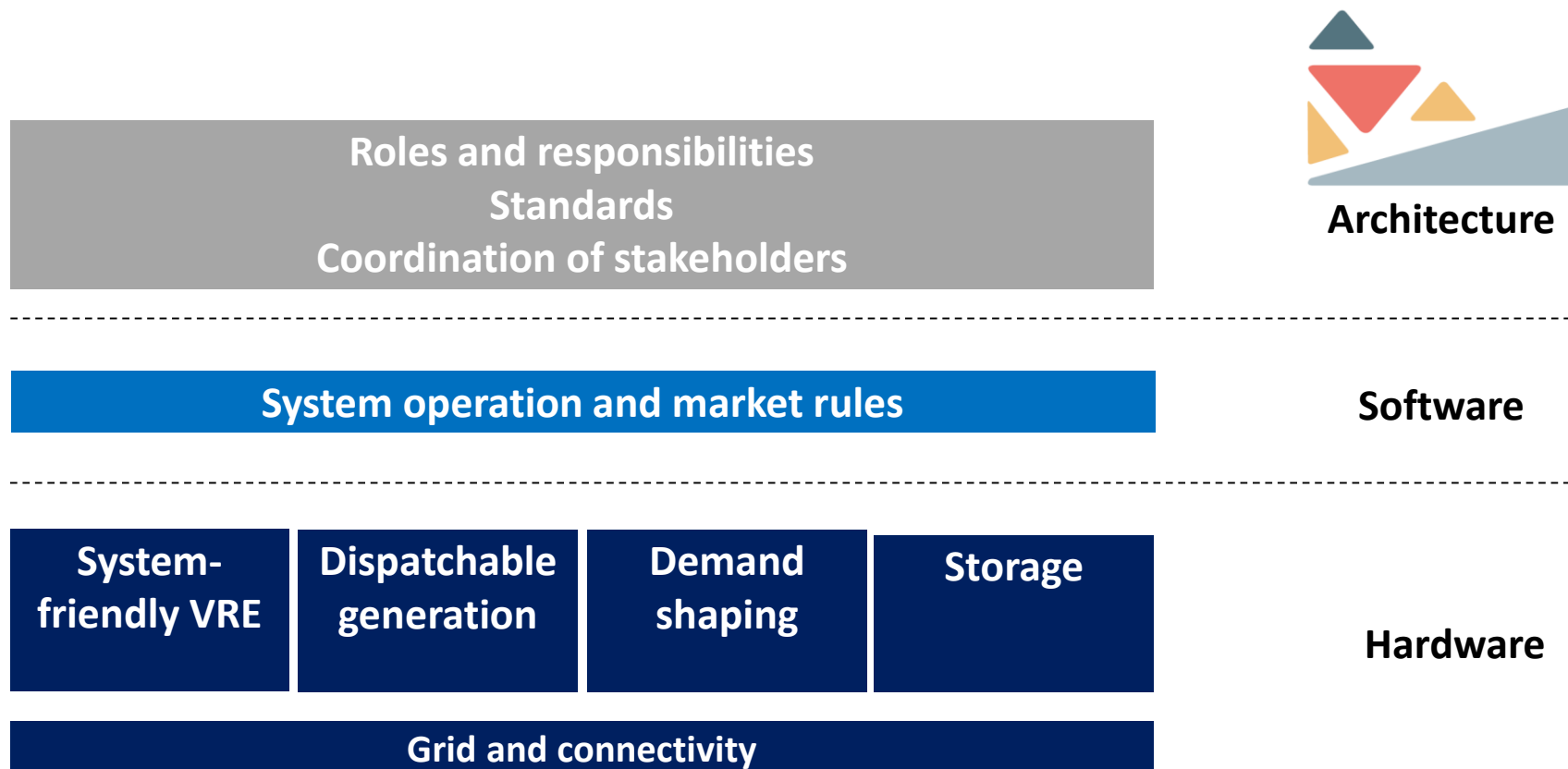
## Annual shares of variable renewables in electricity generation (2016)



Source: Renewable Energy Policies in a Time of Transition 2017

**Challenges depend on wind and solar PV shares and country/region power system characteristics. Policies and measures should adapt accordingly**

# A system-wide approach to solutions

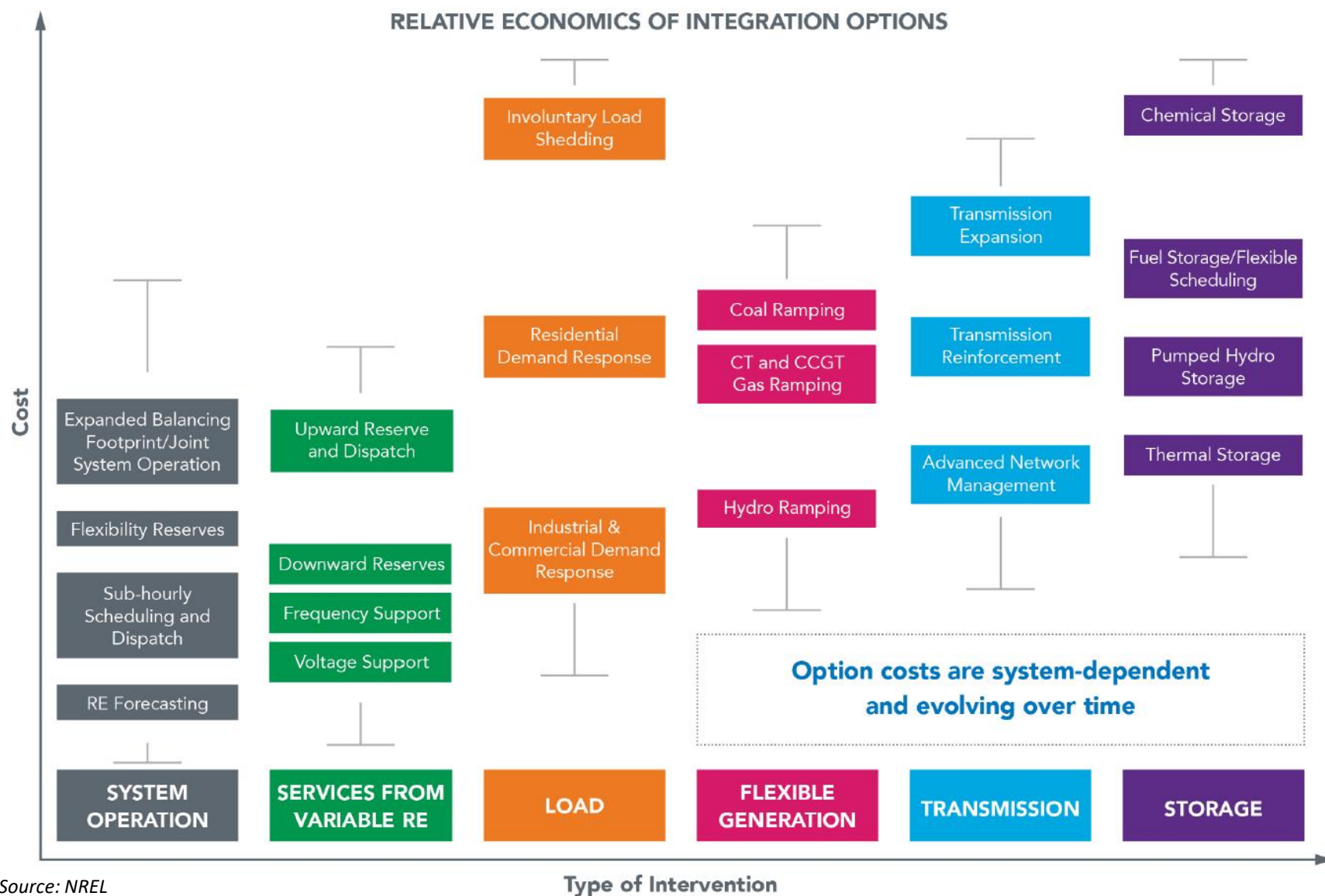


*Source: Renewable Energy Policies in a Time of Transition 2017*

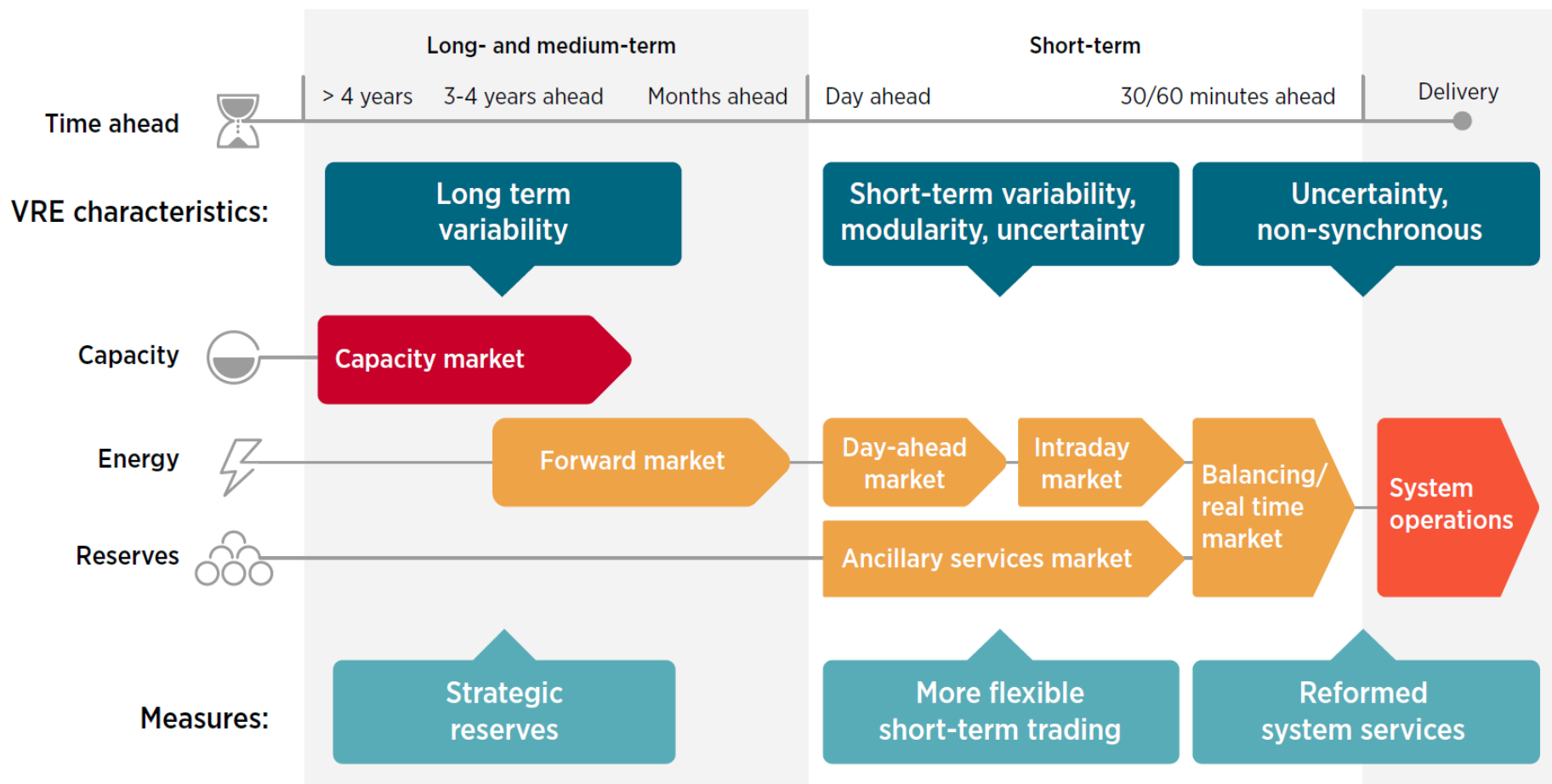
**Technical, economic and institutional policy layers mutually influence each other and have to be addressed in consistent way.**



# Integration options for VRE



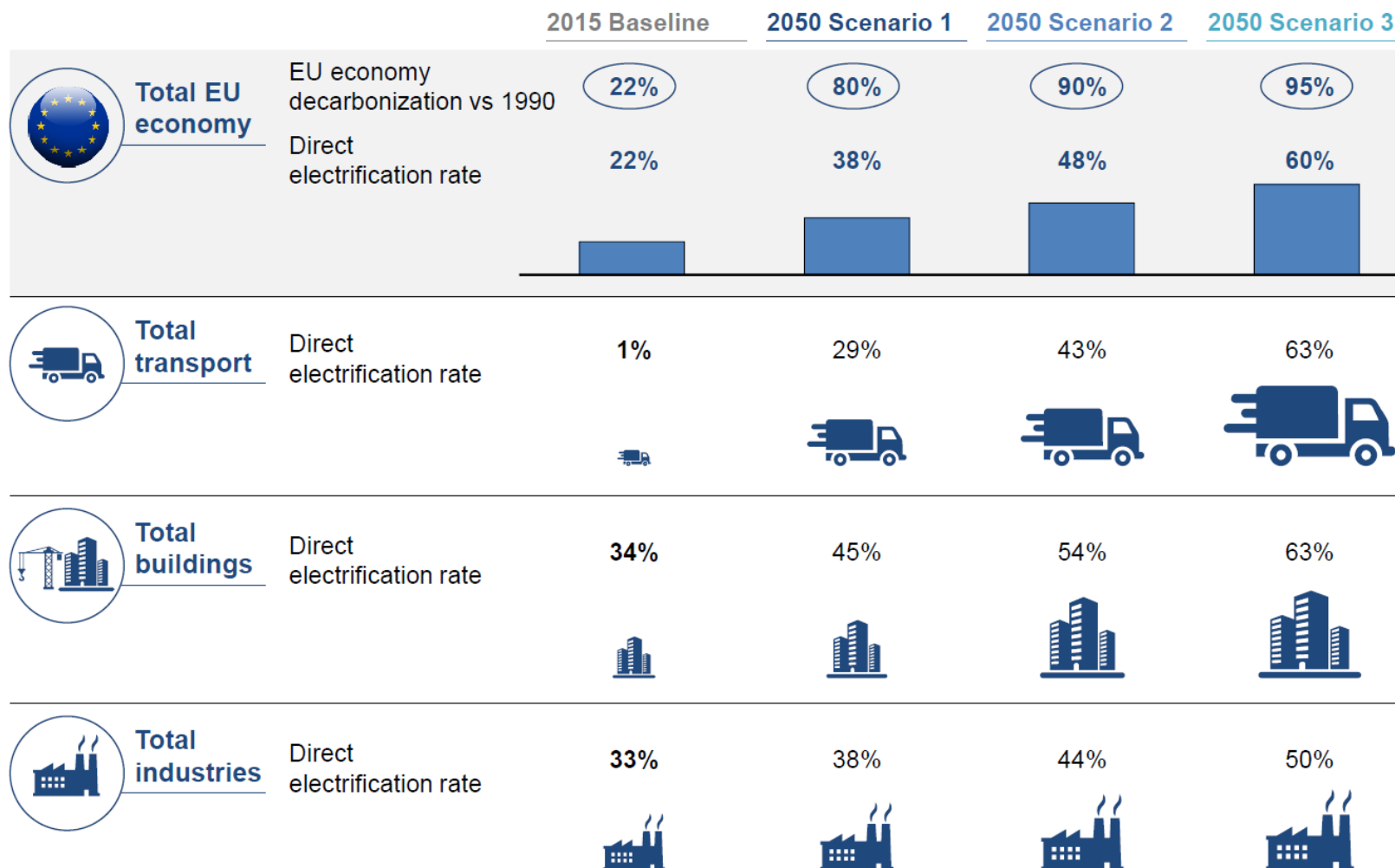
# Market design and VRE



Source: Renewable Energy Policies in a Time of Transition 2017

# Looking ahead: What future for RE-Electrification

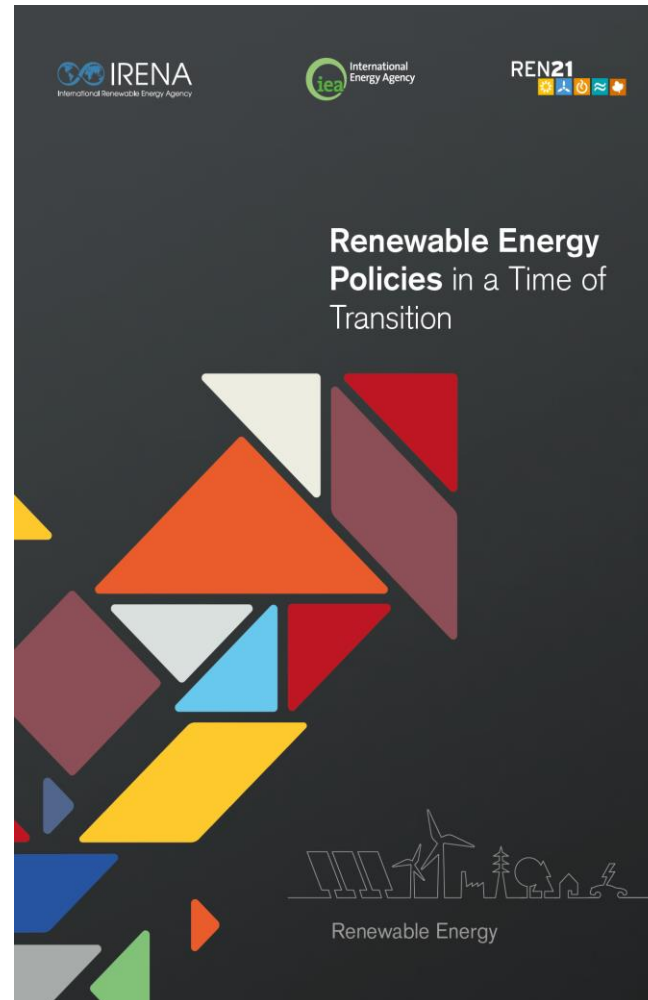
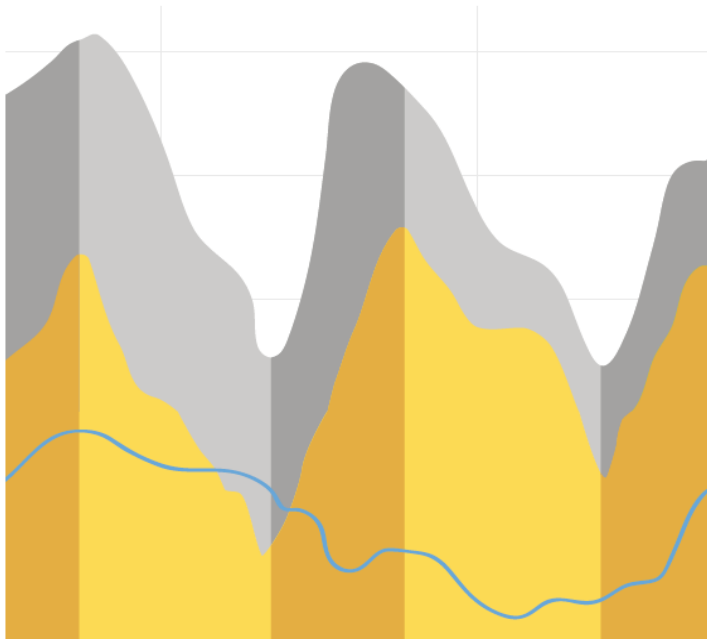
## Direct electrification results by scenario





## PLANNING FOR THE RENEWABLE FUTURE

LONG-TERM MODELLING AND TOOLS TO EXPAND  
VARIABLE RENEWABLE POWER IN EMERGING ECONOMIES







**IRENA**  
International Renewable Energy Agency

**Thank you**  
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