Role of Innovation in Long-Term GHG Emissions Reduction

Long-Term Temperature Target under Paris Agreement

Article 2

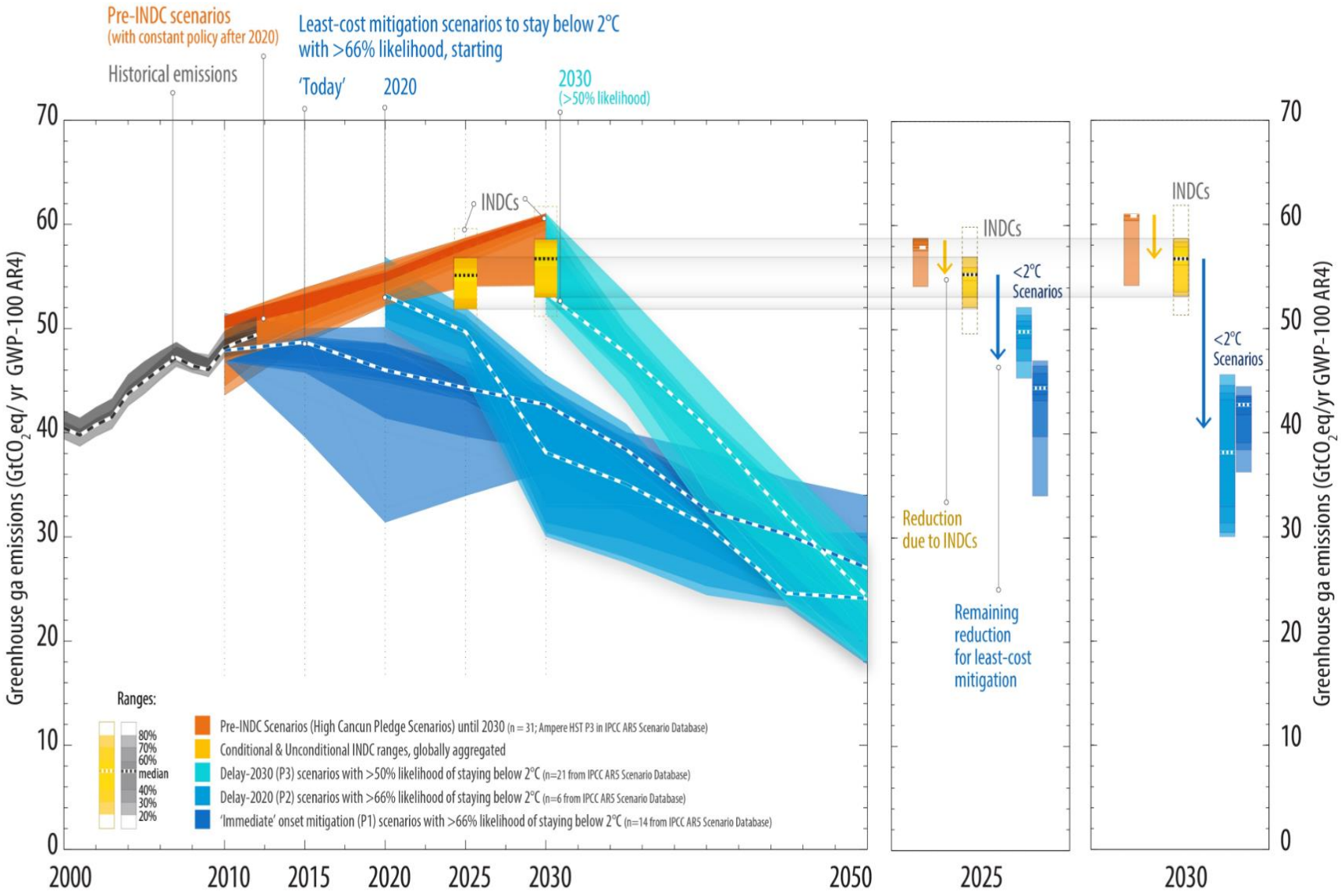
This Agreement, in enhancing the implementation of the Convention, including its objective, aims to strengthen the global response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty, including by:

(a) Holding the increase in the global average temperature to well below 2 ° C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 ° C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change;

Article 4

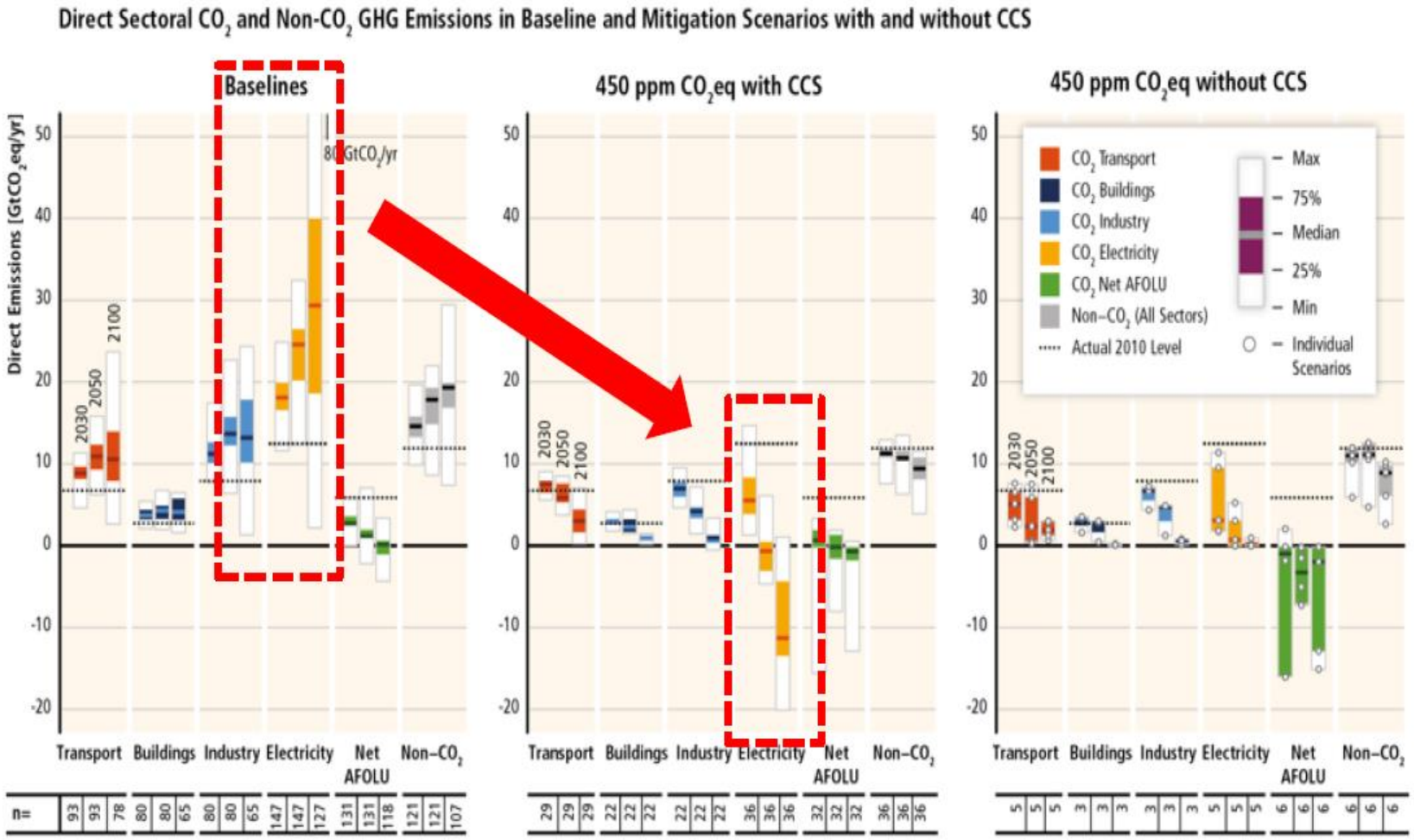
In order to achieve the long-term temperature goal set out in Article 2, Parties aim to reach global peaking of greenhouse gas emissions as soon as possible, recognizing that peaking will take longer for developing country Parties, and to undertake rapid reductions thereafter in accordance with best available science, so as to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century, on the basis of equity, and in the context of sustainable development and efforts to eradicate poverty.

Huge Gap between INDCs and 2 Degree Target



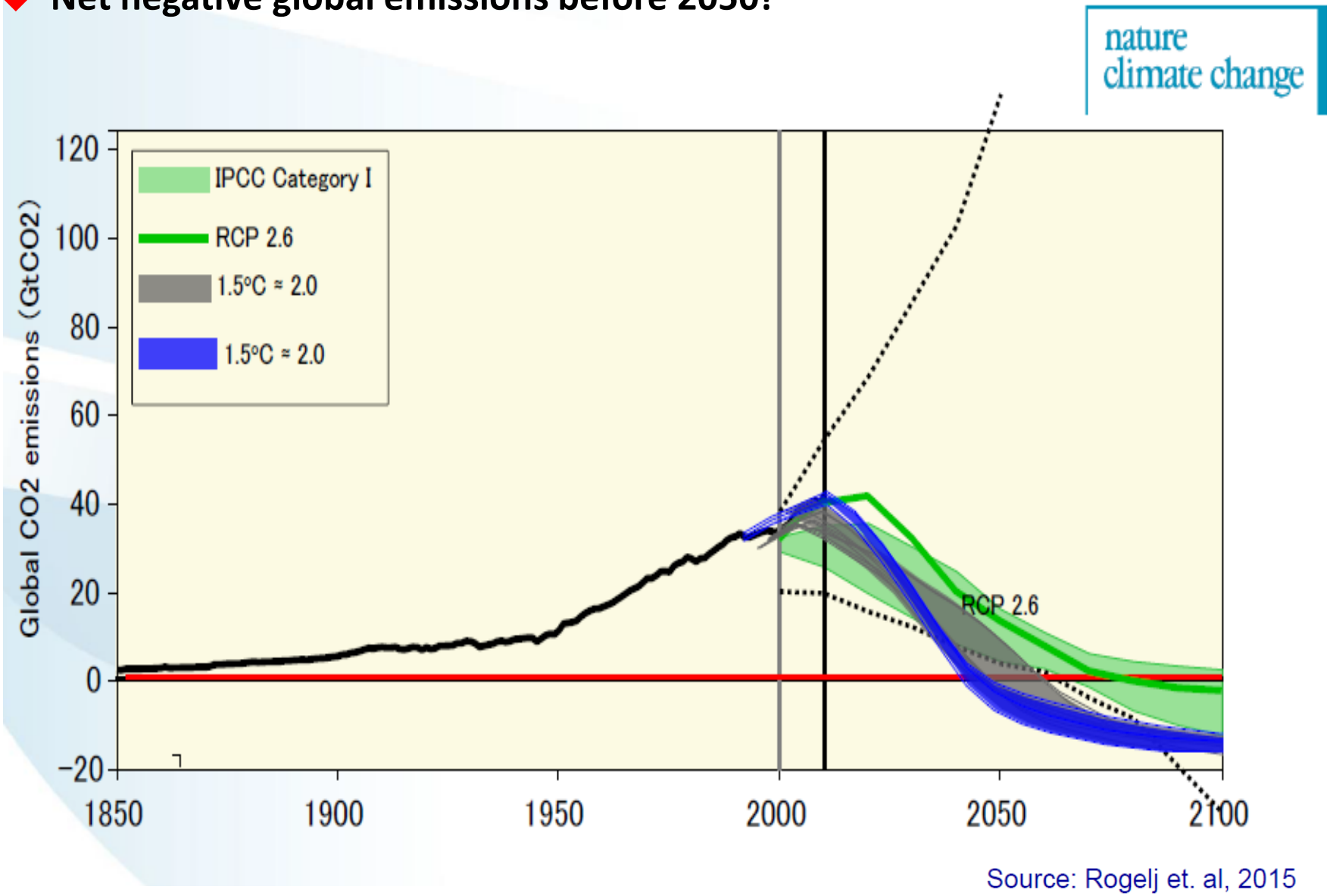
To achieve 450 ppm Scenario….

- In 2100, huge amount of “negative emissions” through BECCS is required in the power sector.
- Top-down picture without due regard to economic/political feasibility



To achieve 1.5 degrees….

- **Net negative global emissions before 2050!**



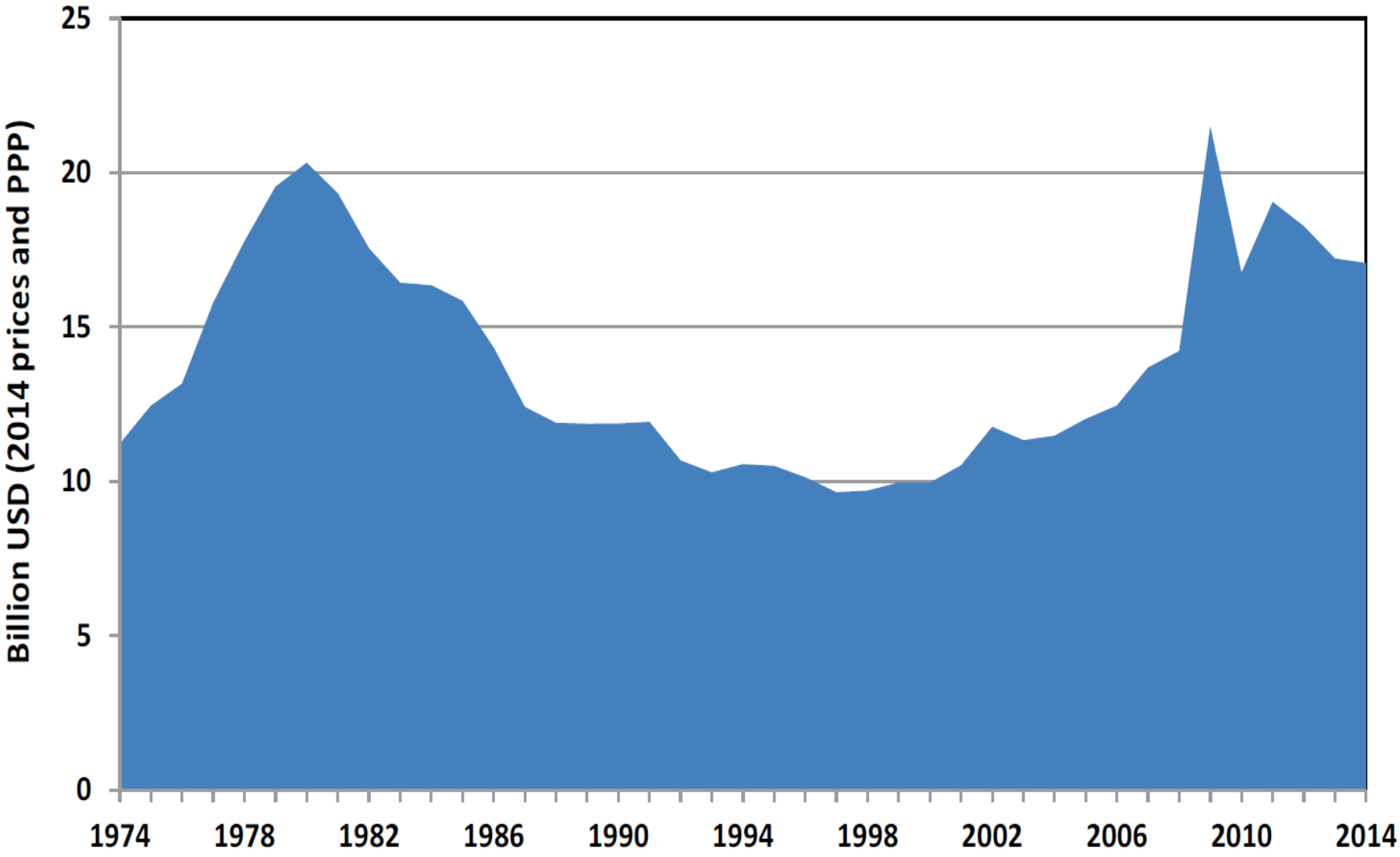
Source: Rogelj et. al, 2015

Paris Agreement and Innovation

Article 10.5

Accelerating, encouraging and enabling innovation is critical for an effective, long-term global response to climate change and promoting economic growth and sustainable development. Such effort shall be, as appropriate, supported, including by the Technology Mechanism and, through financial means, by the Financial Mechanism of the Convention, for collaborative approaches to research and development, and facilitating access to technology, in particular for early stages of the technology cycle, to developing country Parties.

Energy R&D Budget of IEA Countries

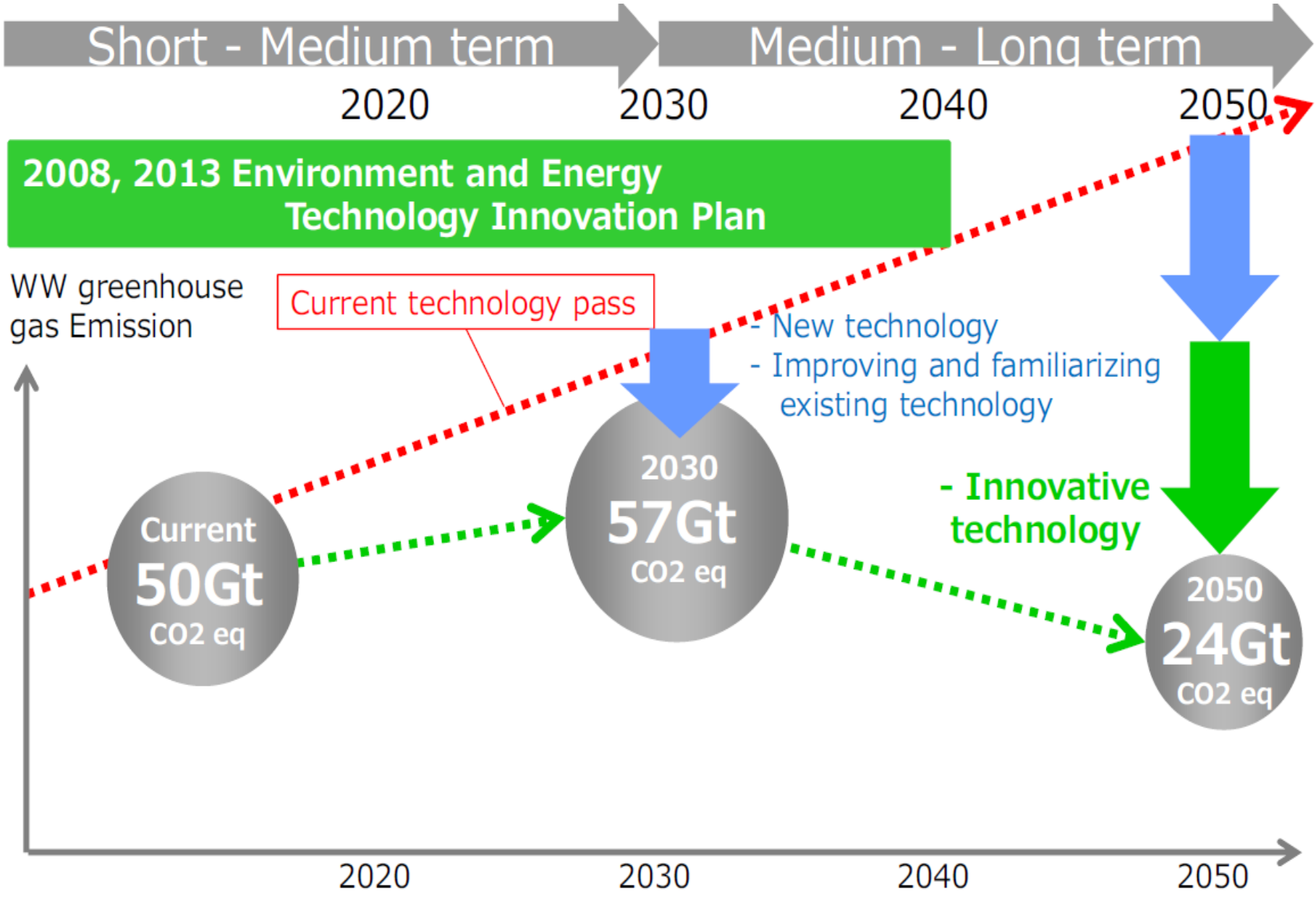


Source: IEA

Mission Innovation (30 Nov 2015)

- **Doubling Governments' R&D Expenditure for Clean Energy**
- **Welcome "Breakthrough Energy Coalition" by private investors**
- **Implementation**
  - Make available data, technology expertise, and analysis in order to promote commercialization and dissemination of clean energy technologies
  - Build and improve technology innovation roadmaps
  - Pursue joint research efforts through public-private partnerships as well as joint research
  - Enhance global clean energy innovation capacity
- **Annual Information Sharing**

Energy and Environment Innovation Strategy (April 2016)



Energy and Environment Innovation Strategy (April 2016)

Criteria for Selecting High Priority Area

- Disruptive and innovative technologies with big impact, which are not extrapolated from current technologies
- Technologies which could be deployed in large scale and have big emissions reduction potential
- Technologies which require mid-long time for commercial deployment and demand concerted efforts by industrial, academic and government sectors
- Technologies where Japan could take a lead and exercise competitive advantage

Energy and Environment Innovation Strategy (April 2016)

Energy System Integrating Technology

AI	Big data	IoT

Constructing Core technology

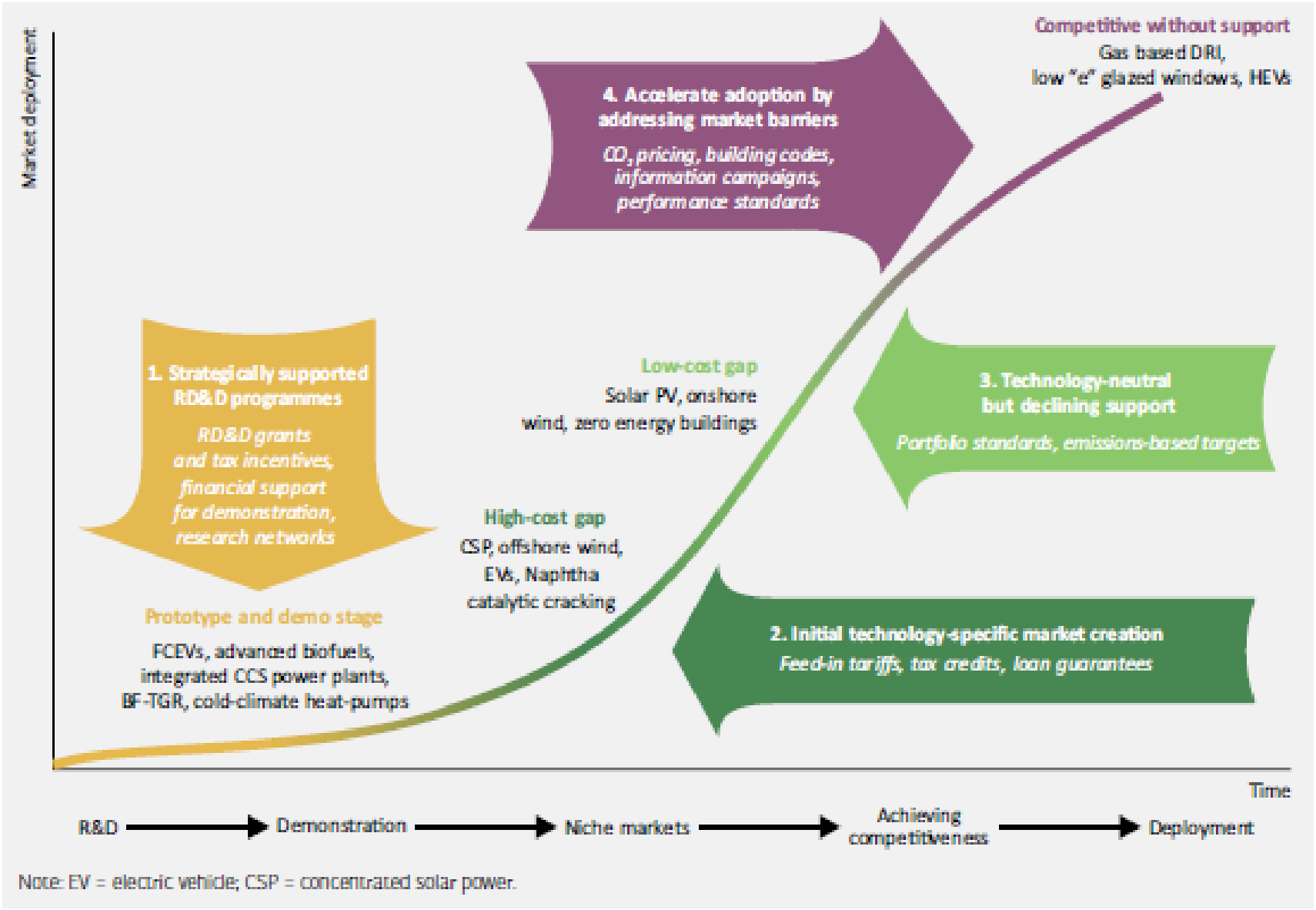
Next generation Power electronics	Superconductivity	Sensor

Energy Saving	Energy Storage	Energy Generation	CO2 Fixation
Catalyzer, Membrane disintegration	Hydrogen energy	Next generation geothermal power generation	CCS (Carbon capture and storage)
Ultra light, ultra heat resist Structural material	Next generation battery	Next generation solar photovoltaic power generation	

- Consolidated government R&D efforts under CSTI
- Creation/exploration of new seeds
- Promotion of R&D investment in private sector
- Promotion of international partnership/joint development

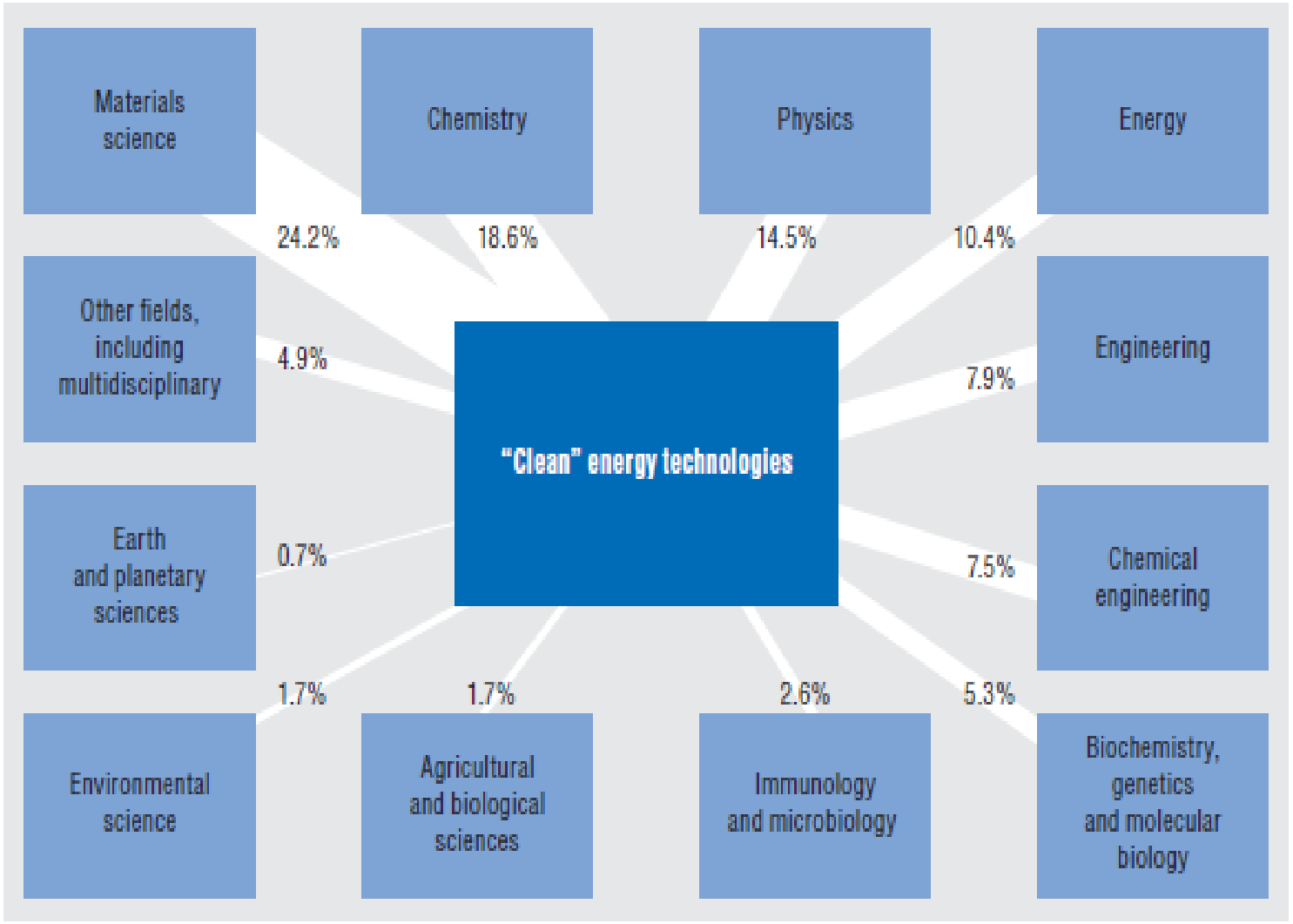
How?

Innovation Support reflecting Technology/Market Maturity



Source: IEA Energy Technology Perspective 2015

Innovation Science Link in Clean Energy Technologies



Source: OECD Science, Technology and Industry Scoreboard 2011

International Collaboration

- Potential benefit of “innovation club” is huge.
- There are many international collaborative initiatives, but main activities are information sharing.
- Obstacles to joint R&D
  - Cooperation vs Competition
  - Pursuit of “good technology in our country”
  - Difference of legal, policy, regulatory environment
  - Allocation of financial burden
  - Sharing outcome (IPR)
  - Bureaucracy
  - Trade barriers on energy and environment technologies

Issues for Discussion

- Mid to long term technology challenges for decarbonization
- Domestic R&D Policy
  - How to prioritize?
  - How to strike a balance between prioritization and pursuit of wide spectrum of seeds?
  - What governments could do to stimulate R&D of high-risk and innovative technologies in the private sector?
  - Non-technology specific policy support?
- International Collaboration
  - What is the strength and weakness of existing international collaborative initiatives (e.g., US-China Clean Technology Collaboration, GIF, ITER)?
  - Which technology area could be a good candidate for "innovation club"?
  - How to overcome various obstacles (e.g., competition vs cooperation, IPR, sharing of financial burden etc) to effective international collaboration?
  - Should clean technologies be regarded as "public good", which should not be monopolized?