



# AMER6

The 6th Asian Ministerial  
Energy Roundtable

Doha | Qatar

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## Plenary Session 3:

*Delivering on the clean energy agenda: prospects and the role for policy.*

Background Paper

BCG  
ENERGY

IEF   
INTERNATIONAL ENERGY FORUM

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## Disclaimer

*The observations presented herein are meant as background for the dialogue at the 6<sup>th</sup> Asian Ministerial Energy Roundtable. They have been prepared in collaboration with the Boston Consulting Group and should not be interpreted as the opinion of the International Energy Forum or the Boston Consulting Group on any given subject.*

# Introduction (I)

## Asian market context and objectives for today's session

### Market context

- Growth in gross national incomes will drive the need for power infrastructure. Power sector priorities vary greatly across countries
- Clean energy in its different forms can help meet all of these objectives, including:
  - increasing access to power and supply
  - decarbonizing power generation
  - enhancing domestic resilience
- Clean energy costs continue to fall increasing the breadth of role it can play
- Policy makers now have various tools at their disposal to encourage clean energy deployment

### Session objectives

- To exchange perspectives on participants' outlook for clean energy and discuss opportunities presented by energy efficiency, lower renewable energy prices, and emissions reduction schema
- To explore how different market conditions across countries lead to different opportunities across different clean energy markets
- To discuss the policy levers available to decision makers and highlight their strengths and potential pitfalls

### Key Question:

**What policies can further the clean energy agenda?**

# Introduction (II)

Clean energy covers a broad range of technologies and uses

Type	Examples (non-exhaustive)	
Distributed renewables and storage	<ul style="list-style-type: none"><li>• Rooftop solar photovoltaics (PV)</li><li>• Micro wind</li><li>• Micro hydro</li></ul>	<ul style="list-style-type: none"><li>• Batteries</li><li>• Micro-grids</li></ul>
Large scale renewables	<ul style="list-style-type: none"><li>• Utility-scale hydro</li><li>• Utility scale geothermal</li><li>• Solar thermal</li></ul>	<ul style="list-style-type: none"><li>• Utility-scale solar PV</li><li>• Utility-scale biomass</li></ul>
Low emissions non-renewables	<ul style="list-style-type: none"><li>• Carbon capture and sequestration (CCS)</li><li>• Coal plants</li></ul>	<ul style="list-style-type: none"><li>• Nuclear</li></ul>
Energy efficiency measures	<ul style="list-style-type: none"><li>• Energy efficient appliances / lighting / buildings / insulation</li><li>• Industrial energy efficiency</li></ul>	<ul style="list-style-type: none"><li>• Electric system loss reductions</li></ul>

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## Key observations

How clean energy can support electricity priorities of Asian countries

Progress in deployment of clean energy

Use of policy levers to support clean energy deployment

Questions and discussion

# Key observations

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- Electricity development needs vary across Asian countries:
  - Grow access to electricity
  - Increase supply
  - Enhance domestic supply resilience
- Different types of clean energy can play role across all these objectives
- Many Asian countries have established targets for clean energy. Progress is being made, but there is still much to do.
- A large range of policy levers can be used to drive deployment of clean energy and energy efficiency. We see all of these being used within Asia
  - Feed-in tariffs, tradeable certificate schemes, renewable portfolio standards,
  - Direct support mechanisms
  - Carbon pricing mechanisms

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Key observations

**How clean energy can support electricity priorities of Asian countries**

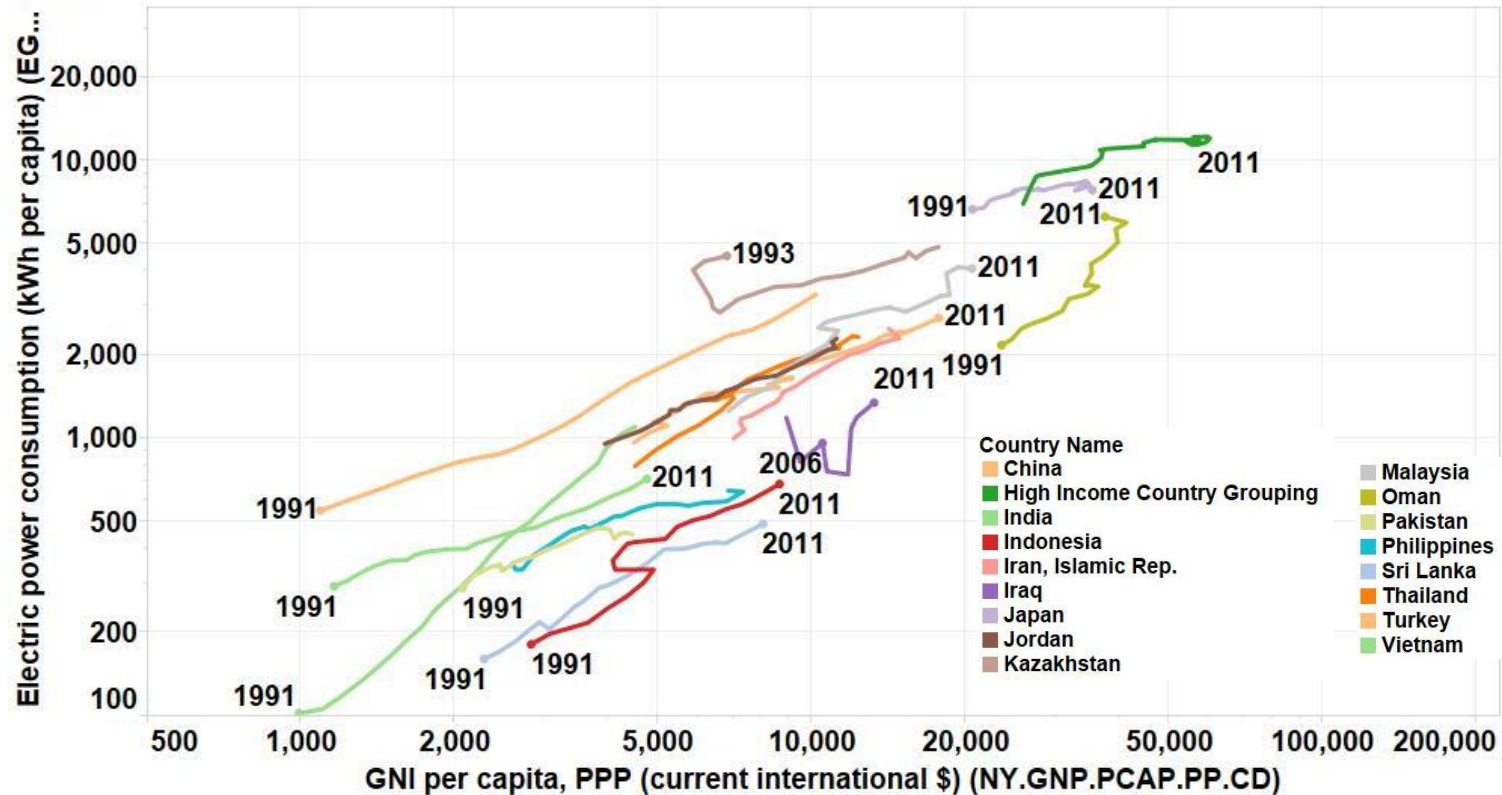
Progress in deployment of clean energy

Use of policy levers to support clean energy deployment

Questions and discussion

# Historically, rising per capita incomes have been strongly related to growth in power consumption

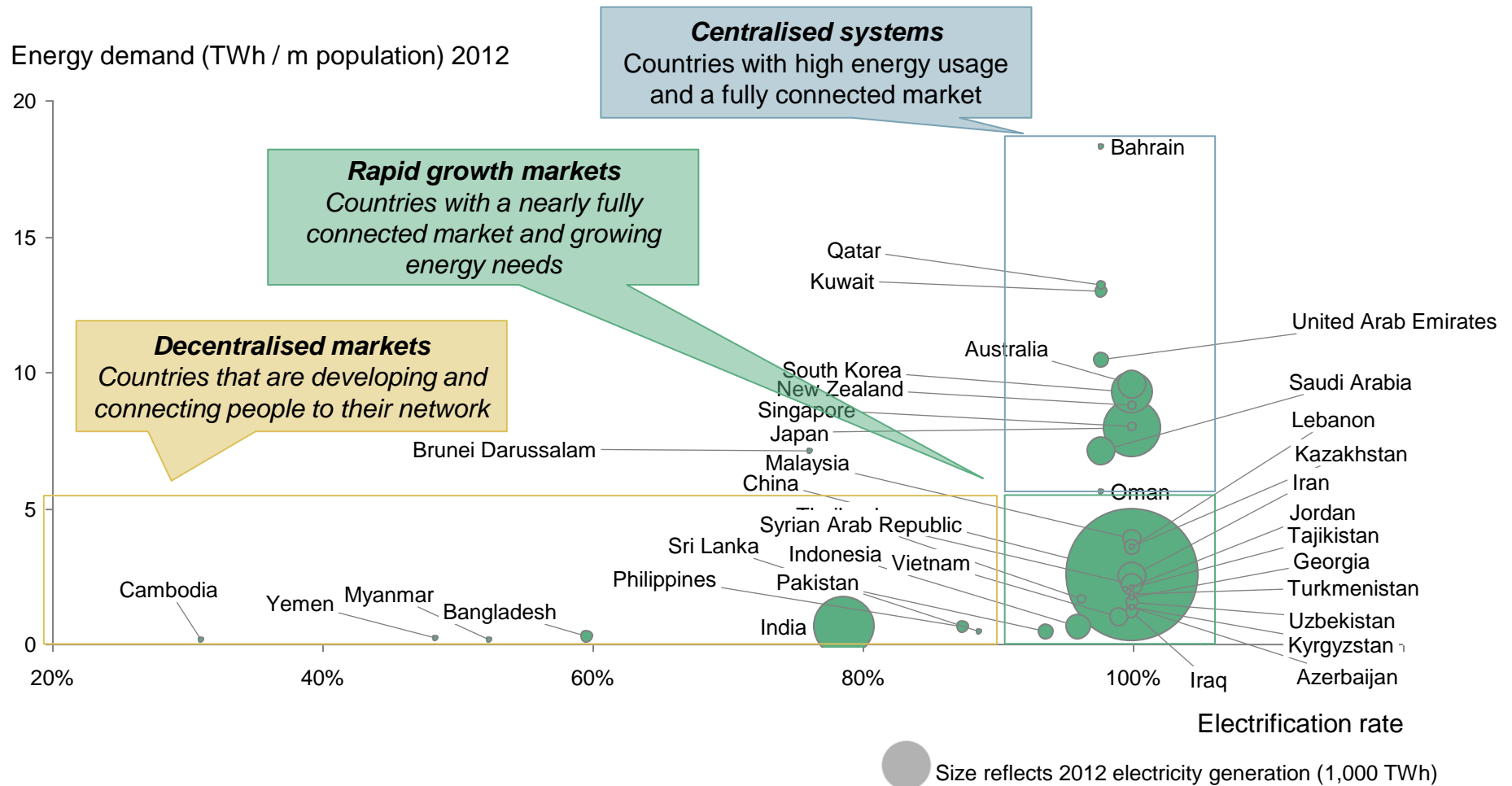
Country comparisons electric power consumption to per capita income



Note: High Income country grouping comprises: Australia, Bahrain, Brunei, Saudi Arabia, The Republic of Korea, UAE, Qatar, and Japan.  
Source: EIA Annual Energy Outlook 2015



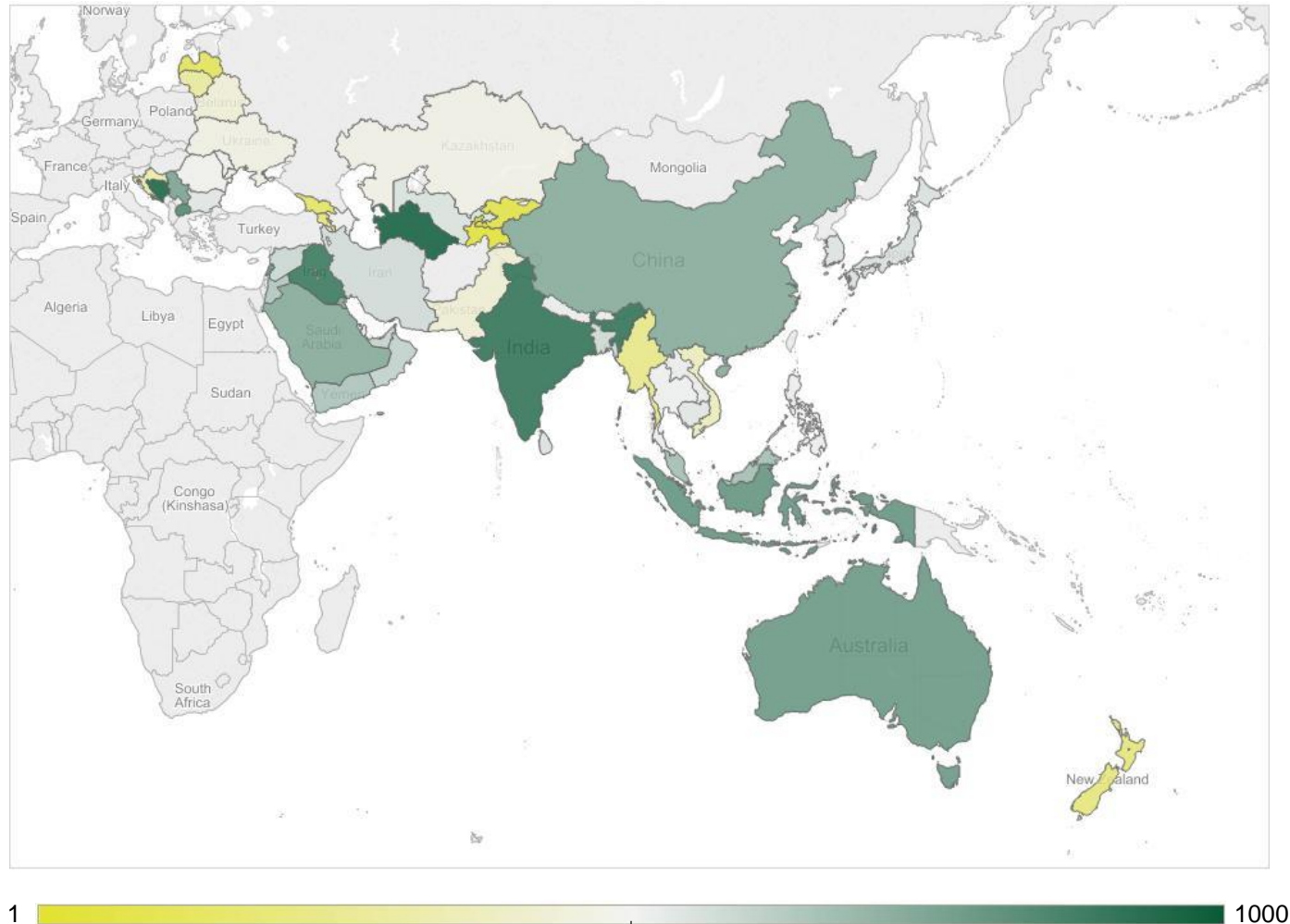
# Asian countries have a range of priorities in terms of electric sector development...



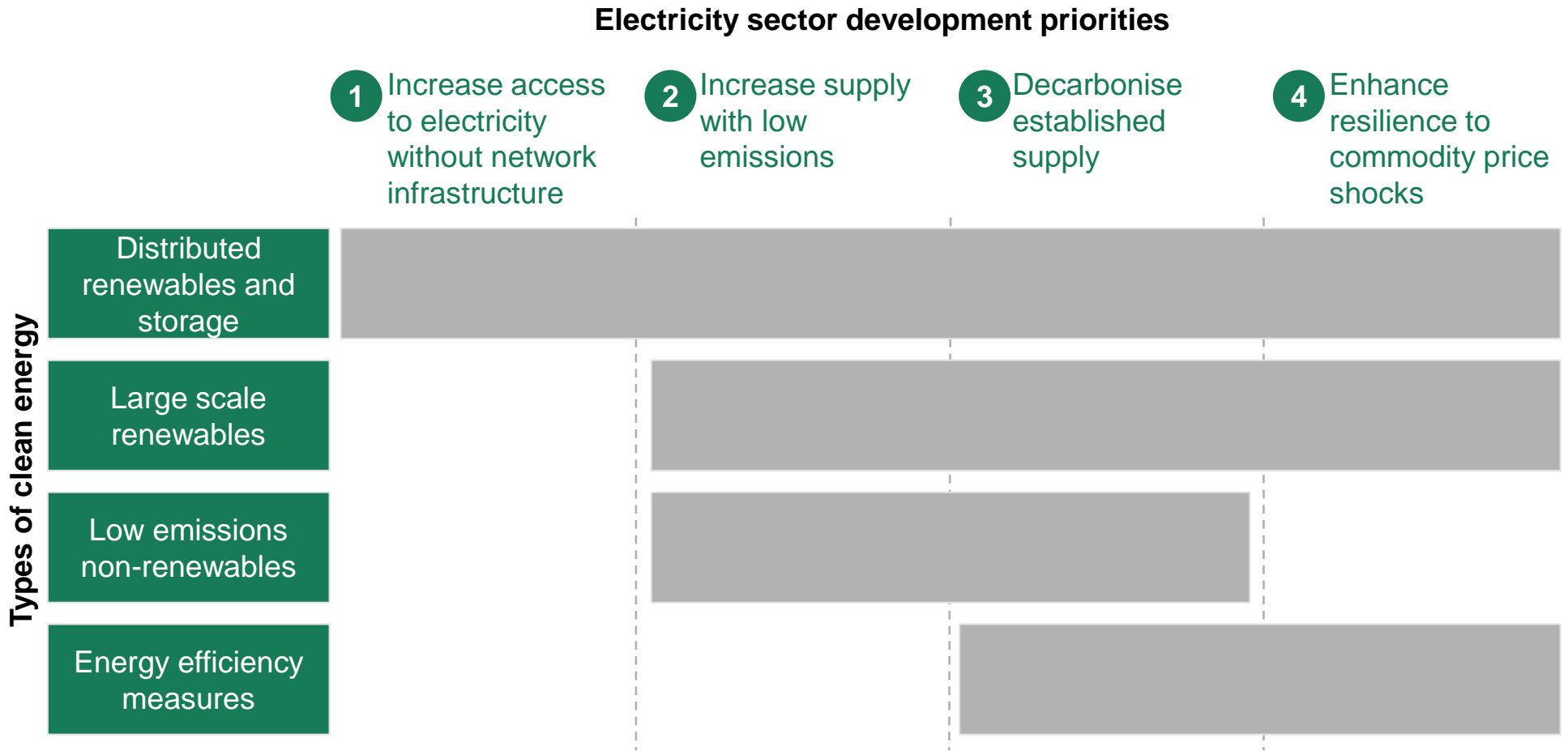
1. % of the population with access to electricity  
 Note: countries selected based on countries represented at recent IEF Asian Ministerial Roundtable events  
 Source: Euromonitor, Worldbank, IEA, EIU, BCG analysis

# ... and in terms of emissions intensity

Carbon dioxide equivalent of energy generation (kg CO<sub>2</sub>e/kwh)



# Different forms of clean energy can help address the range of electric sector development priorities



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Key observations
















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# Many Asian countries have set clean energy targets for renewables

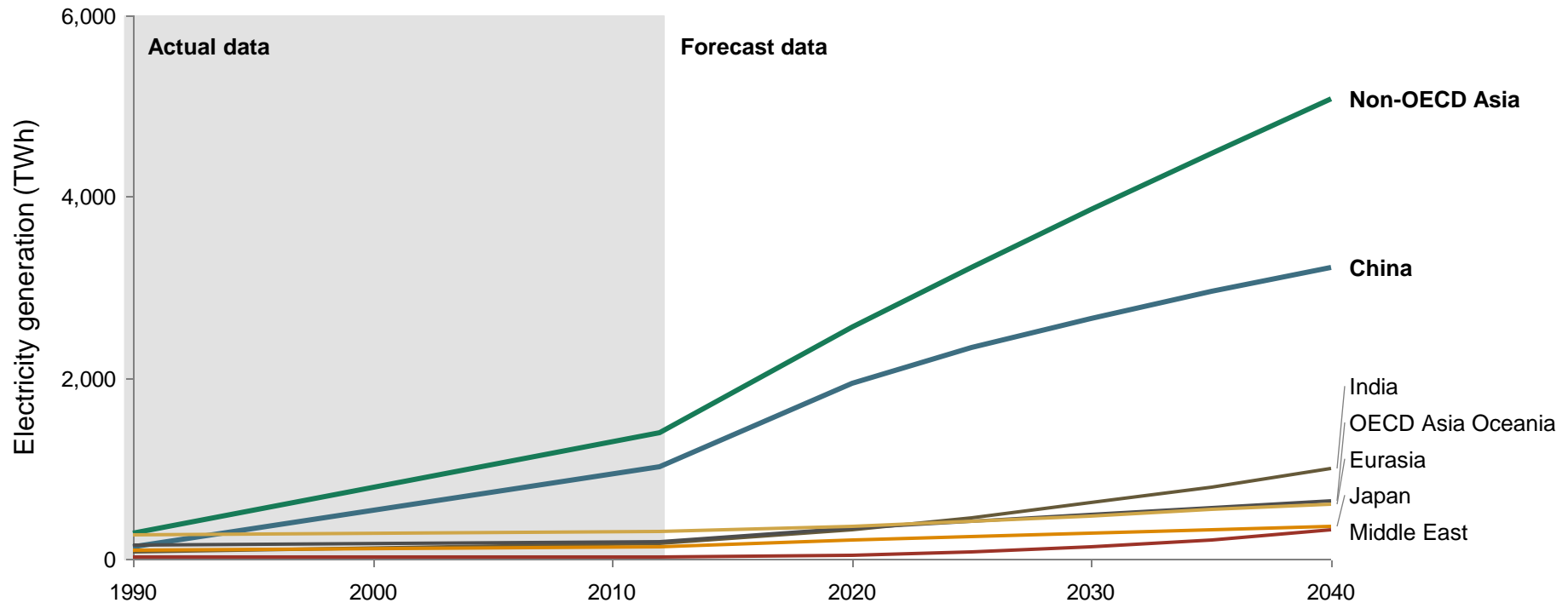
Country	Renewable energy target	Target year	Established
 <b>New Zealand</b>	<b>90%</b> Electricity generated from RES	<b>2025</b>	2011
 <b>Kazakhstan</b>	<b>50%</b> Power generation from RES	<b>2050</b>	2013
 <b>Malaysia</b>	<b>24%</b> Electricity generated from RES	<b>2050</b>	2010
 <b>Australia</b>	<b>20%</b> Electricity supply generated from renewables	<b>2020</b>	2010
 <b>Thailand</b>	<b>20%</b> Total energy consumption from renewables	<b>2036</b>	2015
 <b>Indonesia</b>	<b>15%</b> Electricity demand met by RES	<b>2025</b>	2005
 <b>China</b>	<b>11%</b> Total primary energy consumption from RES	<b>2015</b>	2012
 <b>South Korea</b>	<b>11%</b> Gross final energy consumption from RES	<b>2035</b>	2014
 <b>Japan</b>	<b>10%</b> Energy supply met by RES	<b>2020</b>	2010
 <b>Bangladesh</b>	<b>10%</b> Power demand met by RES	<b>2020</b>	2008
 <b>India</b>	<b>9%</b> Generation capacity from renewables (excl. hydro)	<b>2018</b>	2012
 <b>Abu Dhabi</b>	<b>7%</b> Energy generation capacity from renewables	<b>2020</b>	2011
 <b>Dubai</b>	<b>5%</b> Energy consumption form solar	<b>2030</b>	2011
 <b>Russia</b>	<b>5%</b> Electricity generated from RES	<b>2020</b>	2009
 <b>Singapore</b>	- No recorded target	-	-

Source: IEA Global Renewable Energy, IEA/IRENA Joint Policies and Measures Database

# Some progress in deploying renewable generation

IEA expecting new policies to accelerate uptake

## Historical and forecast renewable electricity generation



**Renewable electricity generation driven by non-OECD Asia and China**

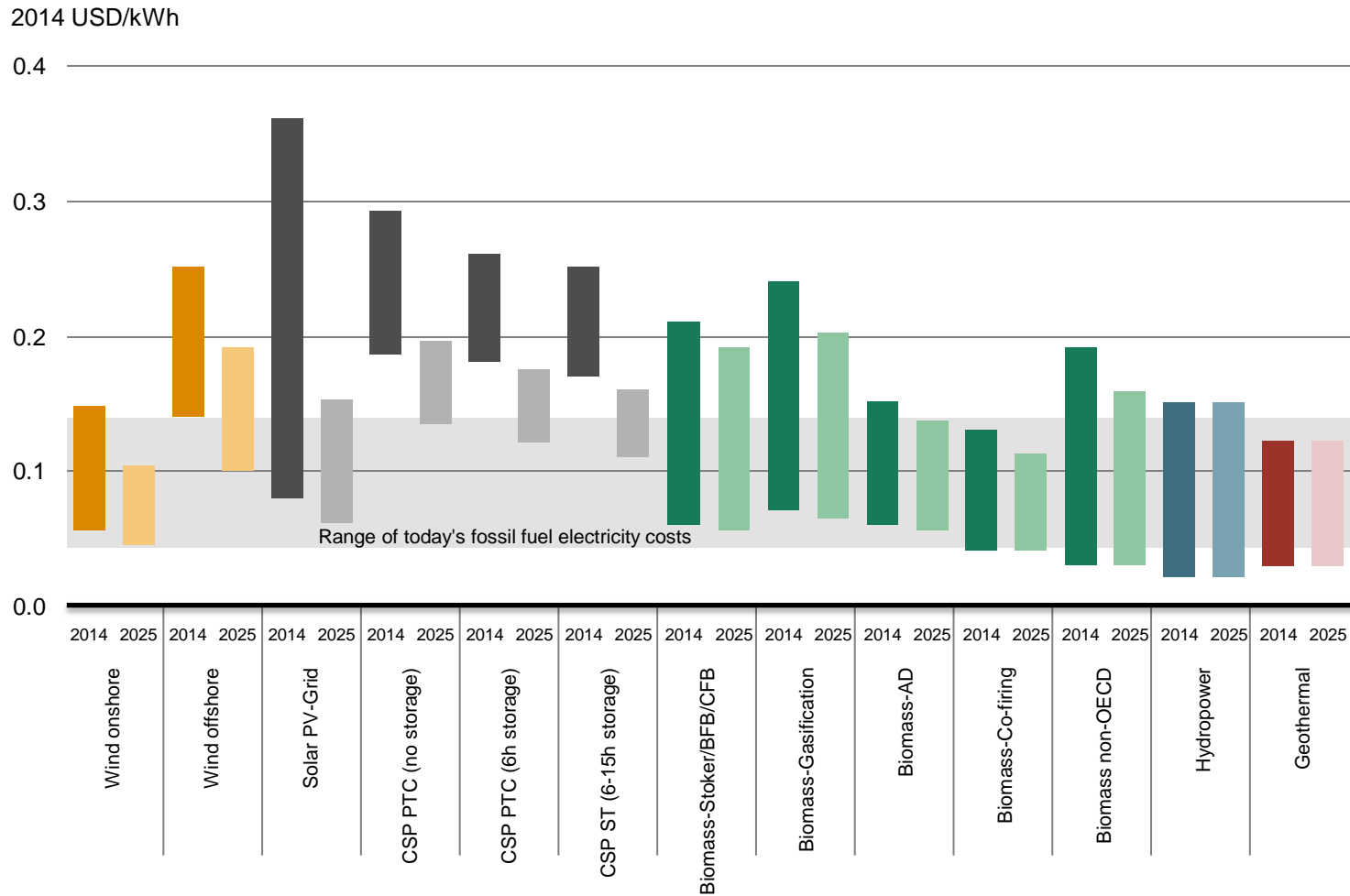
Note: Renewable energy includes hydro, bioenergy, wind, geothermal, solar PV, CSP and marine; Forecasts based on IEA new policies scenarios

Source: IEA 2014 World Energy Outlook

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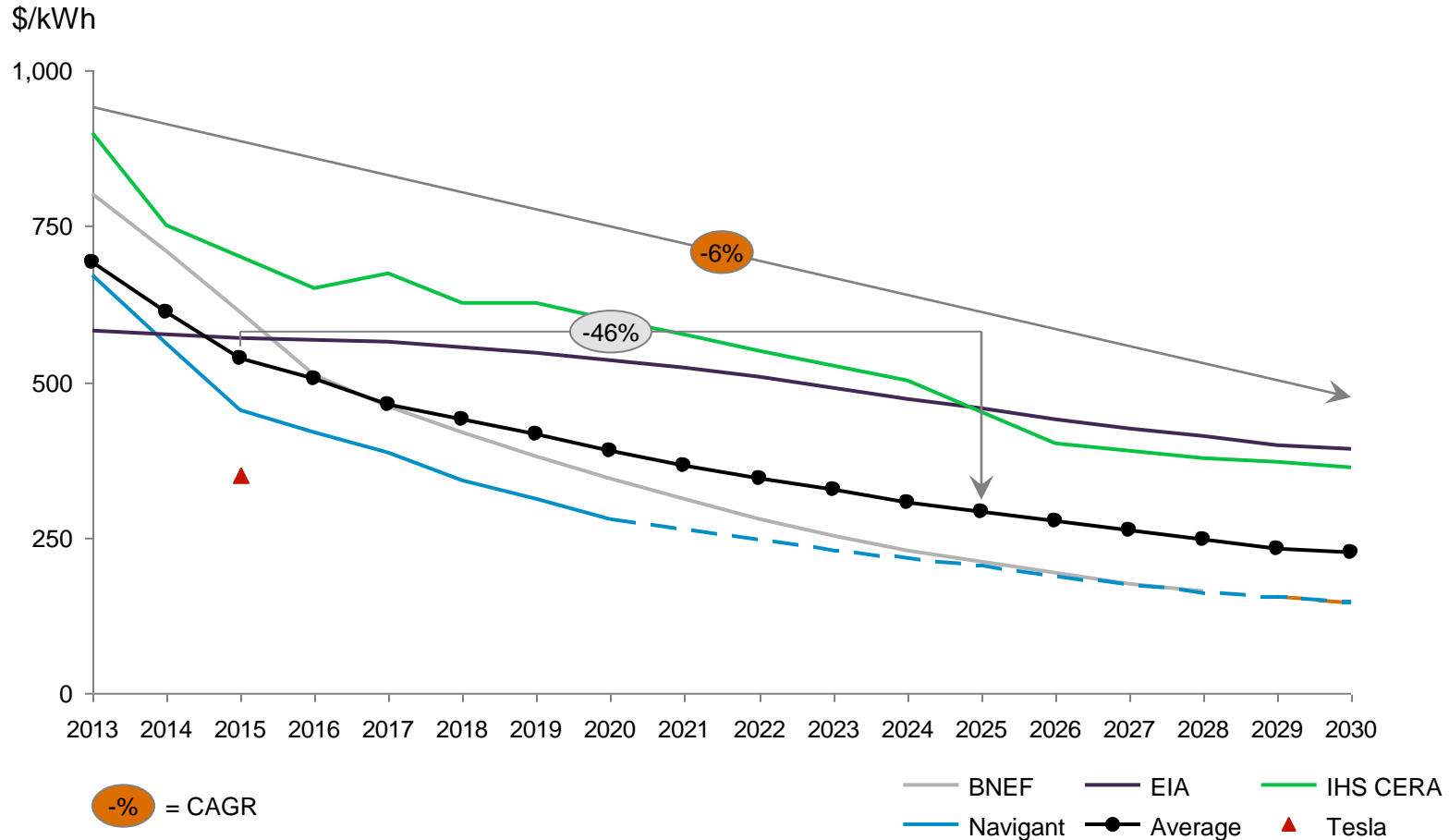
# Decreases in clean energy costs will make it a more affordable approach (I)

Projected costs of generation from renewables



# Decreases in clean energy costs will make it a more affordable approach (II)

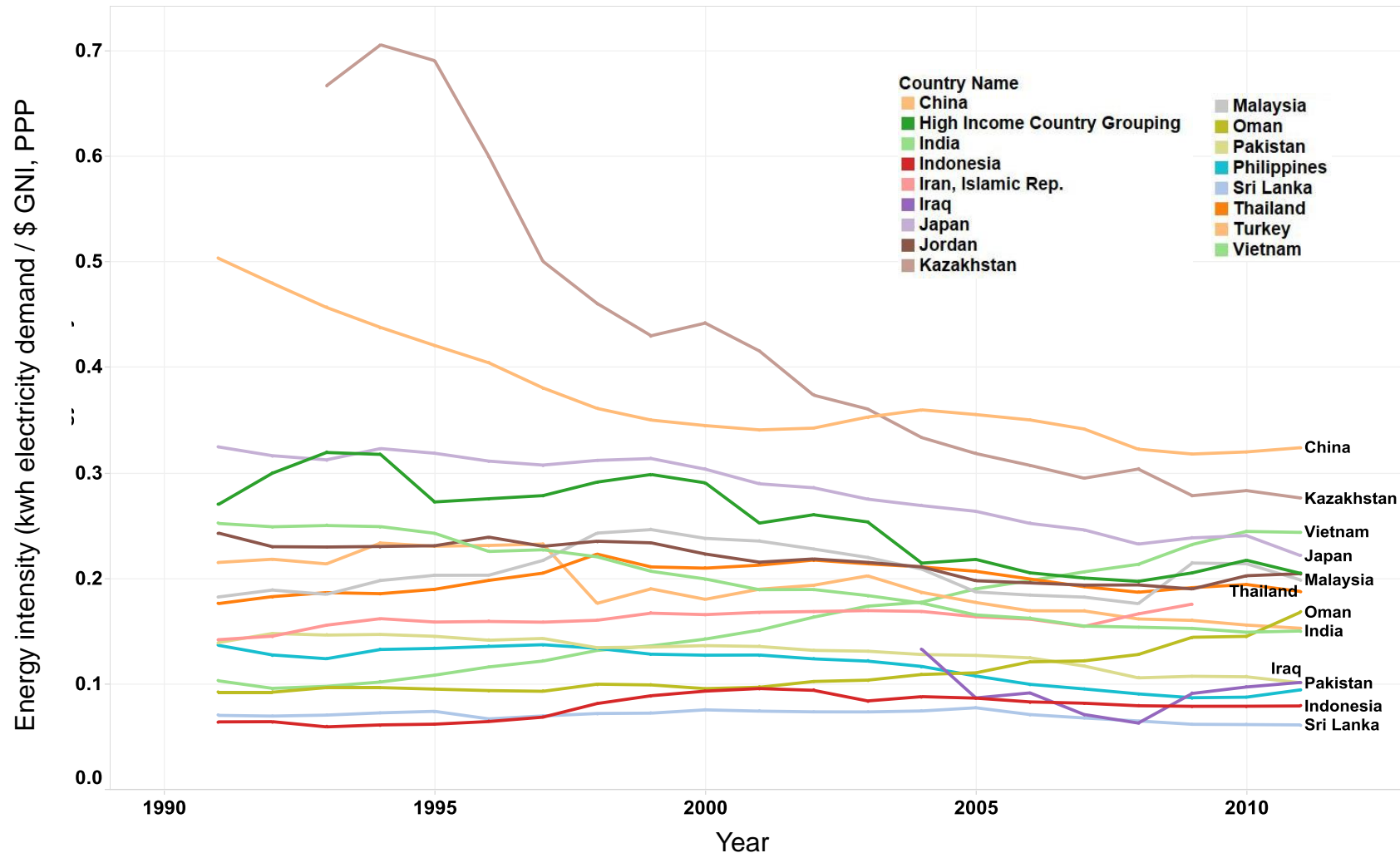
Projected costs of lithium ion battery storage



Note: Values presented in real 2012 dollars, Lithium ion battery costs  
 Source: Rocky Mountain Institute



# Some Asian countries managing to reduce the electricity intensity of their economies



Note: High Income country grouping comprises: Australia, Bahrain, Brunei, Saudi Arabia, The Republic of Korea, UAE, Qatar, and Japan.  
 Source: EIA Annual Energy Outlook 2015

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How clean energy can support electricity priorities of Asian countries

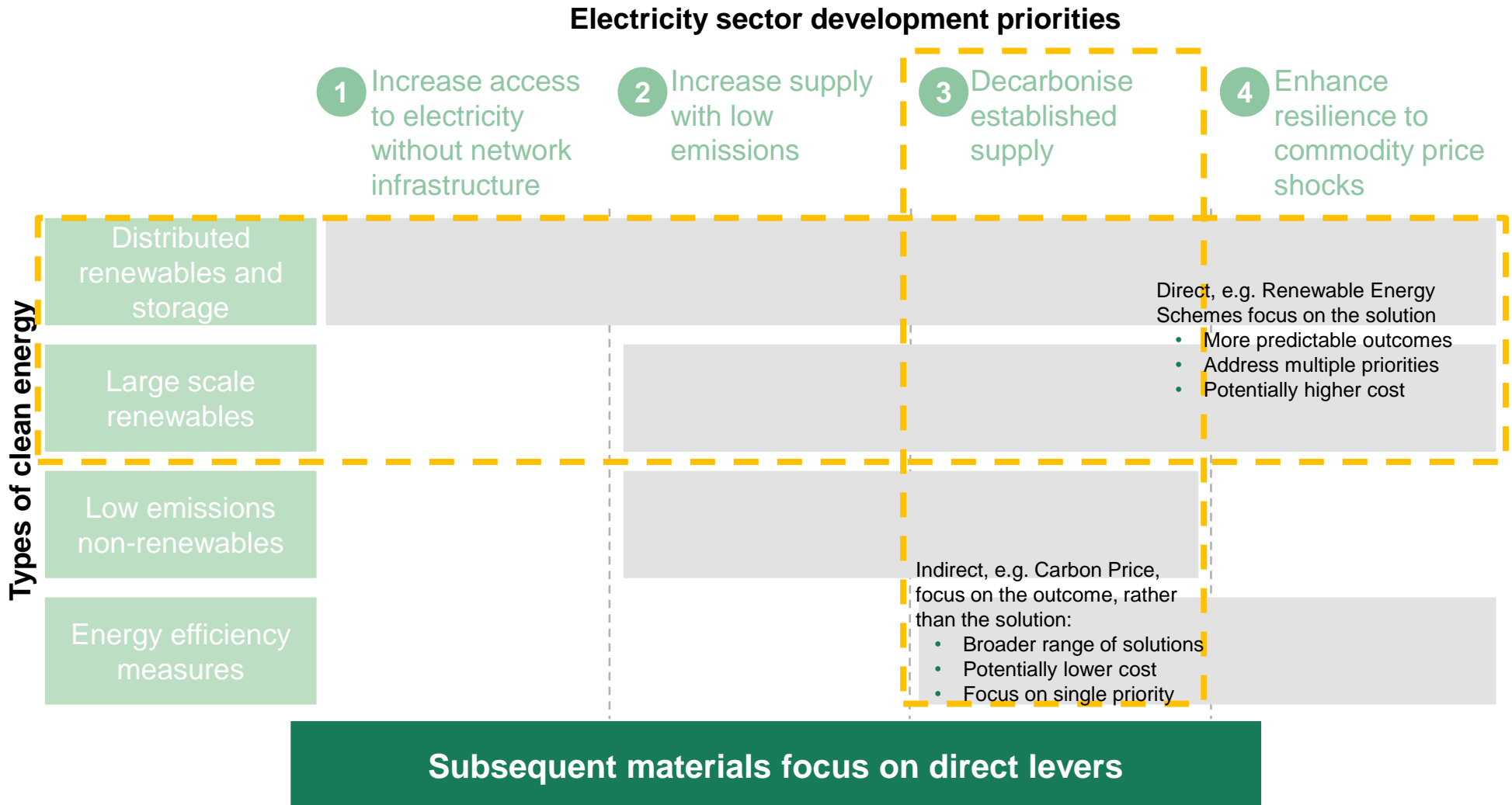
Progress in deployment of clean energy

**Use of policy levers to support clean energy deployment**

Questions and discussion

# Direct and indirect policy levers can support clean energy

Examples of direct and indirect levers (non-exhaustive)



# A range of direct policy levers can be used to support and promote deployment of clean energy (non-exhaustive)

	Mechanism	Rationale	Potential risks	Selected examples
Direct support	<ul style="list-style-type: none"> <li>Grants programs</li> </ul>	<ul style="list-style-type: none"> <li>Encourage development of particular projects</li> </ul>	<ul style="list-style-type: none"> <li>Do not encourage efficiency</li> <li>Funds lost if programs do not deliver</li> </ul>	<ul style="list-style-type: none"> <li>Indonesia's Clean Technology Fund</li> <li>Australian Renewable Energy Agency, ARENA Solar Flagships Program</li> </ul>
	<ul style="list-style-type: none"> <li>Low cost financing</li> </ul>	<ul style="list-style-type: none"> <li>Encourage development of particular projects</li> </ul>	<ul style="list-style-type: none"> <li>Funds lost if projects do not deliver</li> </ul>	<ul style="list-style-type: none"> <li>Australia's Clean Energy Finance Corporation</li> </ul>
	<ul style="list-style-type: none"> <li>Feed-in tariffs</li> </ul>	<ul style="list-style-type: none"> <li>Encourage technology deployment but limit risk of projects not being delivered</li> </ul>	<ul style="list-style-type: none"> <li>Risk of schemes being over-subscribed if uncapped</li> </ul>	<ul style="list-style-type: none"> <li>India's Solar Mission</li> <li>China</li> <li>Japan</li> <li>Kazakhstan</li> </ul>
Price mechanisms	<ul style="list-style-type: none"> <li>Renewable portfolio standards</li> </ul>	<ul style="list-style-type: none"> <li>Encourage large-scale technology deployment without direct funding</li> </ul>	<ul style="list-style-type: none"> <li>Concentrates deployment on specific technologies</li> <li>Sensitive to policy changes</li> </ul>	<ul style="list-style-type: none"> <li>South Korea's RPS</li> </ul>
	<ul style="list-style-type: none"> <li>Tradable certificate schemes</li> </ul>	<ul style="list-style-type: none"> <li>Find lowest cost approach to deploying renewable projects</li> </ul>	<ul style="list-style-type: none"> <li>Difficulties obtaining political support</li> <li>Sensitive to policy changes</li> <li>Rely on robust tracking/data</li> </ul>	<ul style="list-style-type: none"> <li>Australia's Renewable Energy Target (RET) scheme</li> </ul>
Volume controls	<ul style="list-style-type: none"> <li>Efficiency regulation and standards</li> </ul>	<ul style="list-style-type: none"> <li>Enforce deployment of efficiency standards without direct funding</li> </ul>	<ul style="list-style-type: none"> <li>May have added costs to consumers</li> </ul>	<ul style="list-style-type: none"> <li>Singapore's Energy Conservation Act</li> <li>Minimum Efficiency Performance Standards (Australia and New Zealand)</li> </ul>

Source: IEA policy database, <http://www.iea.org/policiesandmeasures/>

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**The following slides provide a small selection of policy levers employed in Asia**

**They are intended to exemplify the types of policies that can be leveraged to support the deployment of clean energy**

**The set of examples is far from exhaustive:**

- Within each country there are typical many policy levers being employed in tandem
- Most other countries have clean energy policies, that are not documented

**A comprehensive listing of policy levers being employed for clean energy can be found at the IEA or ARENA**

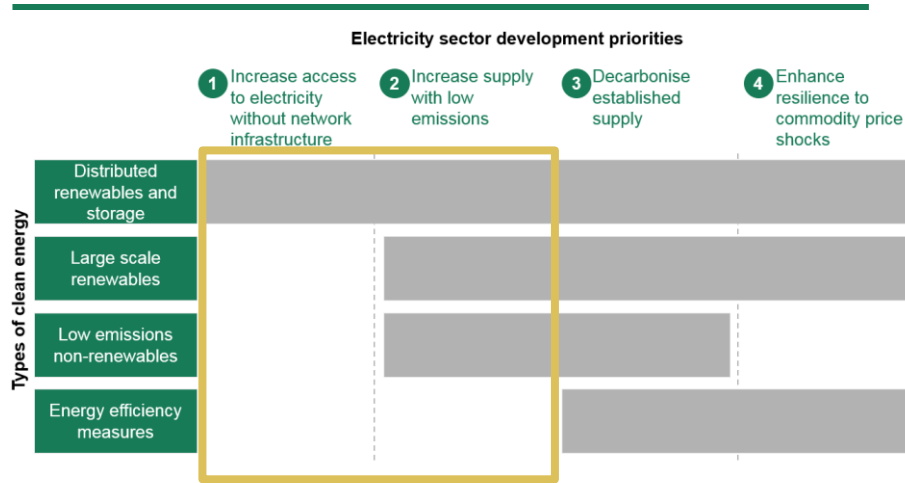
- Renewable energy policy levers: <http://www.iea.org/policiesandmeasures/renewableenergy/>
- Energy efficiency policy levers: <http://www.iea.org/policiesandmeasures/energyefficiency/>
- Emissions reductions policies: <http://www.iea.org/policiesandmeasures/climatechange/>

# Direct support: Grants programs

## Indonesia's Clean Technology Fund



### Objective



### Targets (in conjunction with other mechanisms)

- Increasing electricity access from 65% to 90% of population by 2020
- Reducing greenhouse gas emissions by 26% by 2020

### Mechanism

- \$400m clean technology fund
- Seeking to co-finance with up to \$2.7m from other sources
  - Expand large scale geothermal projects
  - Remove financing barriers to small/medium scale investments

### Outcomes to date

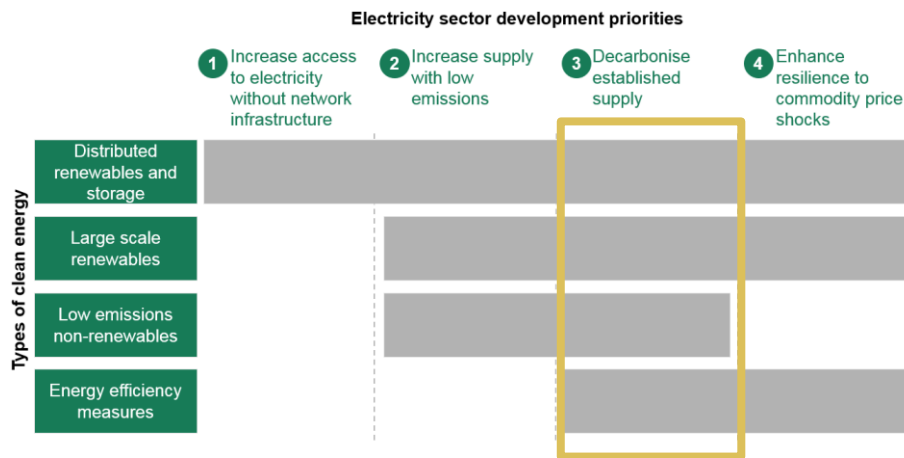
- First public-private partnership sponsored by Indonesia Ministry of Finance
- 1,900 MW new capacity geothermal



# Direct support: Low cost financing

Australia's Clean Energy Finance Corporation

## Objective



## Target

- AUD 10 billion for 5 years (beginning 2012) to invest in renewables, low emissions technologies, energy efficiency projects

## Mechanism

- Green investment bank
- Invests in renewable or energy efficiency projects
- Loans made available on commercial/concessional terms

## Outcomes to date

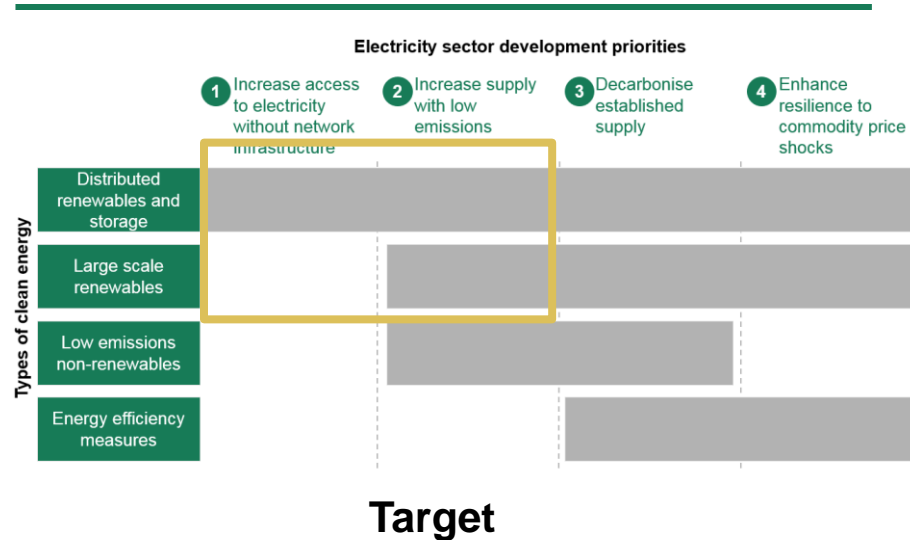
- By end of first fiscal year, contracted investments of \$900 million in projects over \$3 billion in total value
- To date, committed more than \$1.4 billion



# Direct support: Feed-in tariffs

## India's Solar Mission

### Objective



### Mechanism

- Feed-in-tariffs at differential rates for solar PV and solar thermal projects
- Supplemented by renewable energy portfolio obligations and
- Reduced import levies on solar equipment

### Outcomes to date

- Installed capacity
  - 2010-2013: Grid-connected PV (1.1GW), Off-grid solar lanterns (.2GW), Solar collectors (7 million m<sup>2</sup>)
  - 2013-2017: Grid-connected PV (4GW), Off-grid solar lanterns (1GW), Solar collectors (15 million m<sup>2</sup>)
  - 2017-2022: Grid-connected PV (20GW), Off-grid solar lanterns (2GW), Solar collectors (20 million m<sup>2</sup>)
- Installed solar capacity increased from ~18 MW (2010) to ~4.2 GW (2015)
- Tariffs decreased from ~\$0.25 per kWh in 2010 to ~\$ 0.10 per kWh in 2015

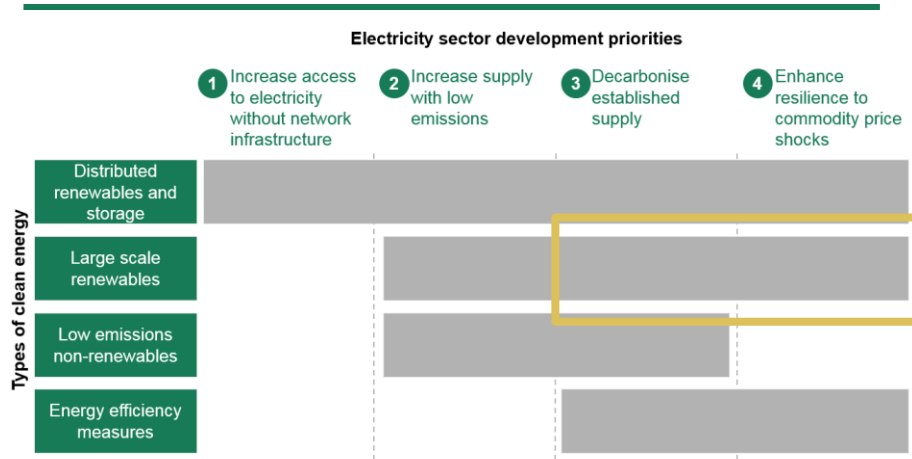




# Price mechanisms: Renewable portfolio standards

## Korea's renewable portfolio standards

### Objective



### Target

- Power producers to supply a certain amount of the total power generation by new and renewable energy, starting at 2% in 2012 and reaching 10% by 2024

### Mechanism

- Renewable portfolio standard requires 17 largest power companies (with installed power capacity larger than 500 MW) to comply
- Differential treatment of different types of clean energy based on technology and size of installation
- Also includes low emission fossil fuel technology: IGCC power stations

### Outcomes to date

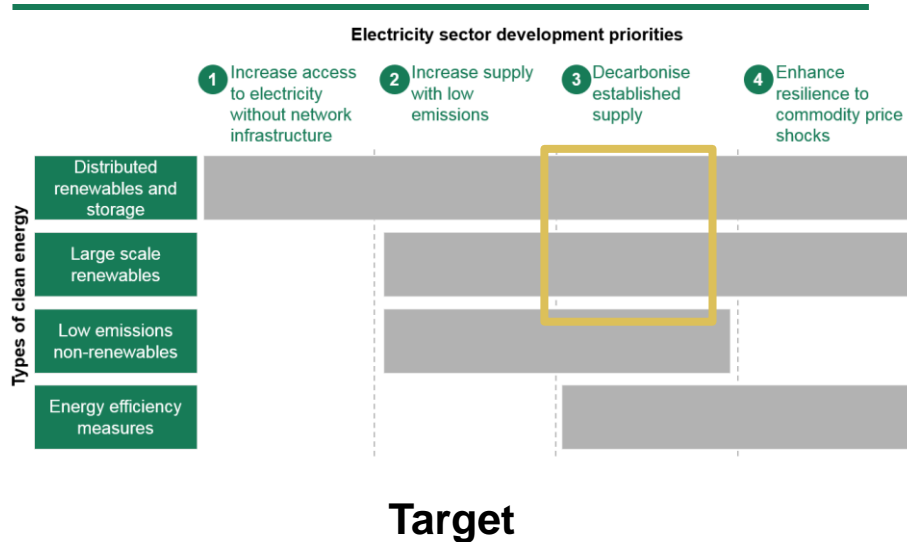
- Substantial increases in alternative electricity productions
- Focus on biomass co-firing and fuel cells

# Price mechanisms / Volume controls: Tradeable certificates



## Australia's Renewable Energy Target (RET) scheme

### Objective



- 33,000 GWh from large-scale renewable sources by 2020 (previously 41,000 GWh by 2020)

### Mechanism

- Separate tradeable certificate schemes for large-scale (LGCs) and small-scale (STCs) renewable certificates
- Wholesale electricity retailers required to surrender certificates LGCs and purchase STCs

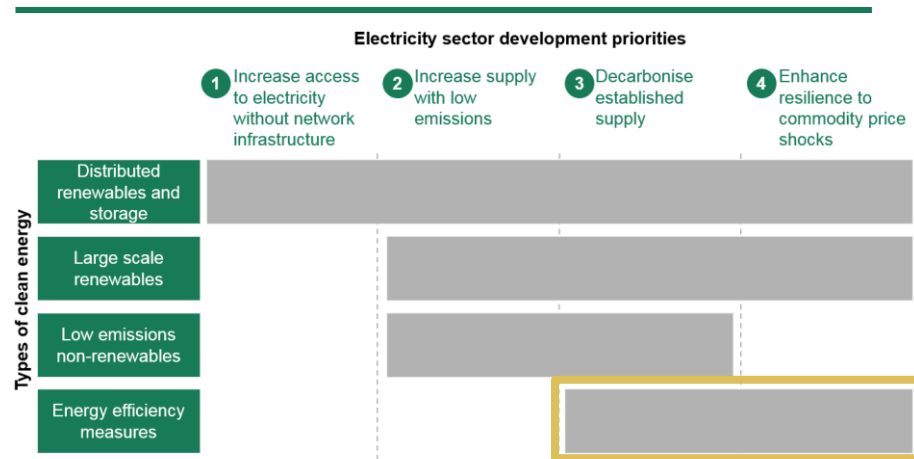
### Outcomes to date

- Large-scale development of wind-farms
  - 3.75 GW installed capacity
  - 12 GW announced
- Very high penetration of household solar
  - ~3.8 GW capacity
  - household penetration from 7-28% by state

# Volume controls: Efficiency regulation and standards

## Singapore's Energy Conservancy Act

### Objective



### Target

- Reduce energy intensity by 35% from 2005 levels by 2030

### Mechanisms

- Mandatory energy management practices for consumers using >15 GWh annually:
  - appoint energy manager
  - report usage
  - submit efficiency plan
- Efficiency regulation requiring minimum energy performance, labelling standards, and "Green Mark" scheme for buildings

### Outcomes to date

- Total primary energy supply per GDP PPP has fallen by over 20% (0.09 to 0.07 toe/ thousand 2005 USD) from 2005 to 2012
- Total final energy consumption has decreased by ~2% year-on-year from 2010 to 2013

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**Questions and discussion**

# Key questions

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- How can clean energy technologies be applied to help countries bypass substantial infrastructure development costs?
- Are there areas where regional, cross-border, or international co-operation could help to resolve challenges of deploying clean energy?
- What policy levers are best suited to the needs of each market?
- What is the 'right' mix of clean energy technologies based on local resource availability, existing regulatory structures and economic conditions?
- Do local regulations and industry structures encourage new methods, or enforce the status quo?
- If renewable energy providers were to enter the market, how difficult will it be for these players to gain access existing shared infrastructure?

