

Power system integration: Perspective from Clean Energy Ministerial

Rui LUO, Deputy Head of the CEM Secretariat

20 June 2018

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The changing world of power systems

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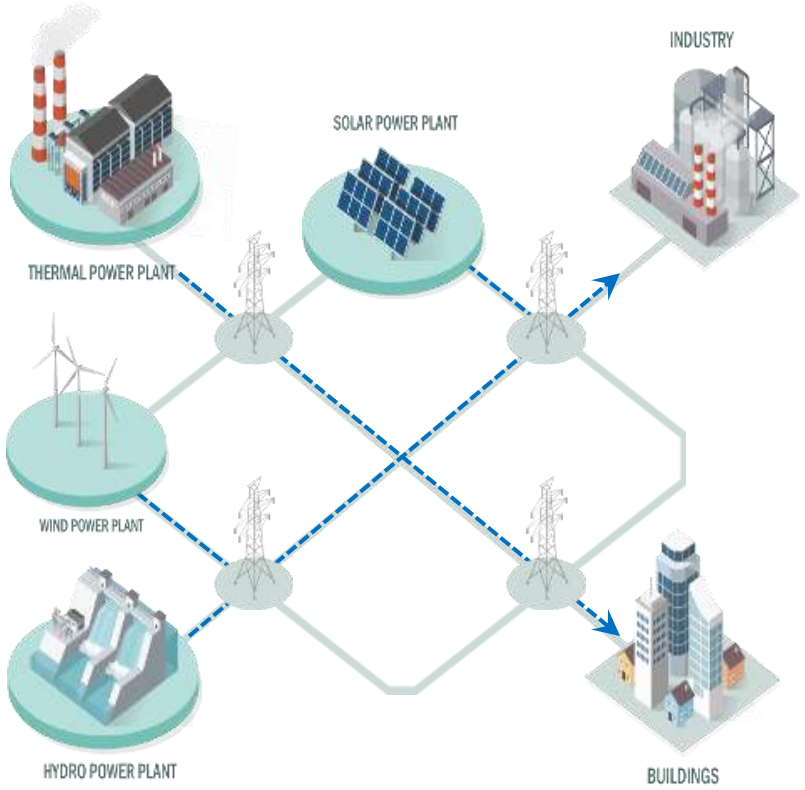
We are becoming more integrated, from unidirectional flows and distinct roles …



Source: Digitalization and Energy, IEA (2017)

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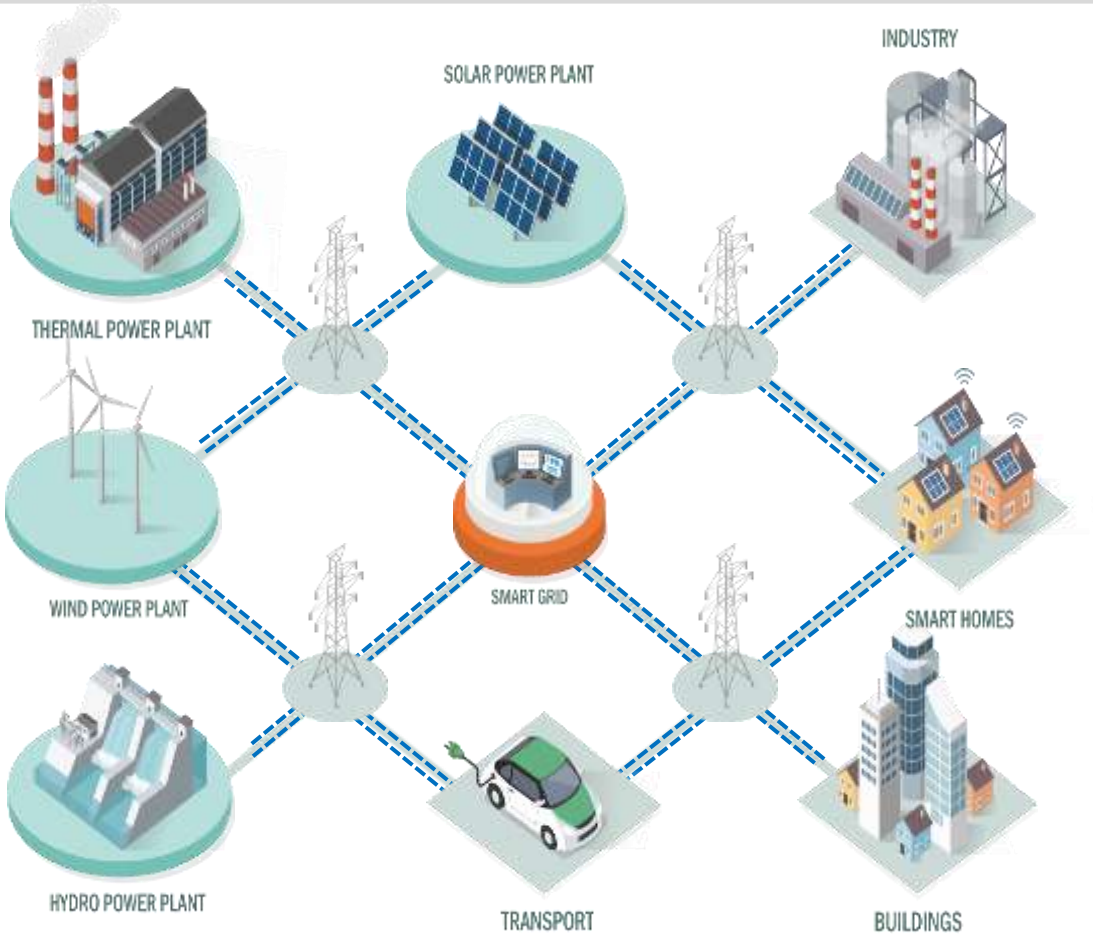
To more multidirectional flows and mixed roles



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Source: Digitalization and Energy, IEA (2017)

With implications for business pioneers in energy markets, appearing in many places

Pioneers from several quarters

Envision Plans to Launch Global Digital Hub in Singapore

by Envision

SINGAPORE IOct
technology and e
plan to establish a

The Global Digital
Internet of Things
global footprint of
Valley, Denmark,

As a strategic inve
Singapore's Smart

Mexico's Energy Auction
Lowest Solar Power Price

Preliminary results
power also hit a re

JASON DEIGN | NOVEMBE

How has EESL transformed
the energy efficiency market in Ind

The **EESL's Unnat Jyoti by Affordable LEDs for All** (UJALA, meaning Light in Hindi), is the world's largest lighting replacement programme. By 2019, **UJALA aims to replace 770 million old wasteful lamps** with modern, efficient and longer lasting LED lamps, without the need for any government subsidies.

To date more than **100 million LED bulbs** have been delivered across the country, completely transforming the way people look at LED bulbs and energy efficiency.

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HOME COMMUNITY JOBS FUNDING NEWS FOR RECRUITERS FOR EXECUTIVES

Trending COP23 DFID leadership Global Fund Sexual harassment in aid

INSIDE DEVELOPMENT » THE RISE OF CHINESE AID

Through China, a green financing leader emerges

By Fatima Arkin | @FatimaAR | 31 August 2017

A view of the city of Hangzhou, site of 2016 G20 Summit in China. Photo by: Andrey Samaonov / CC BY-NC-ND

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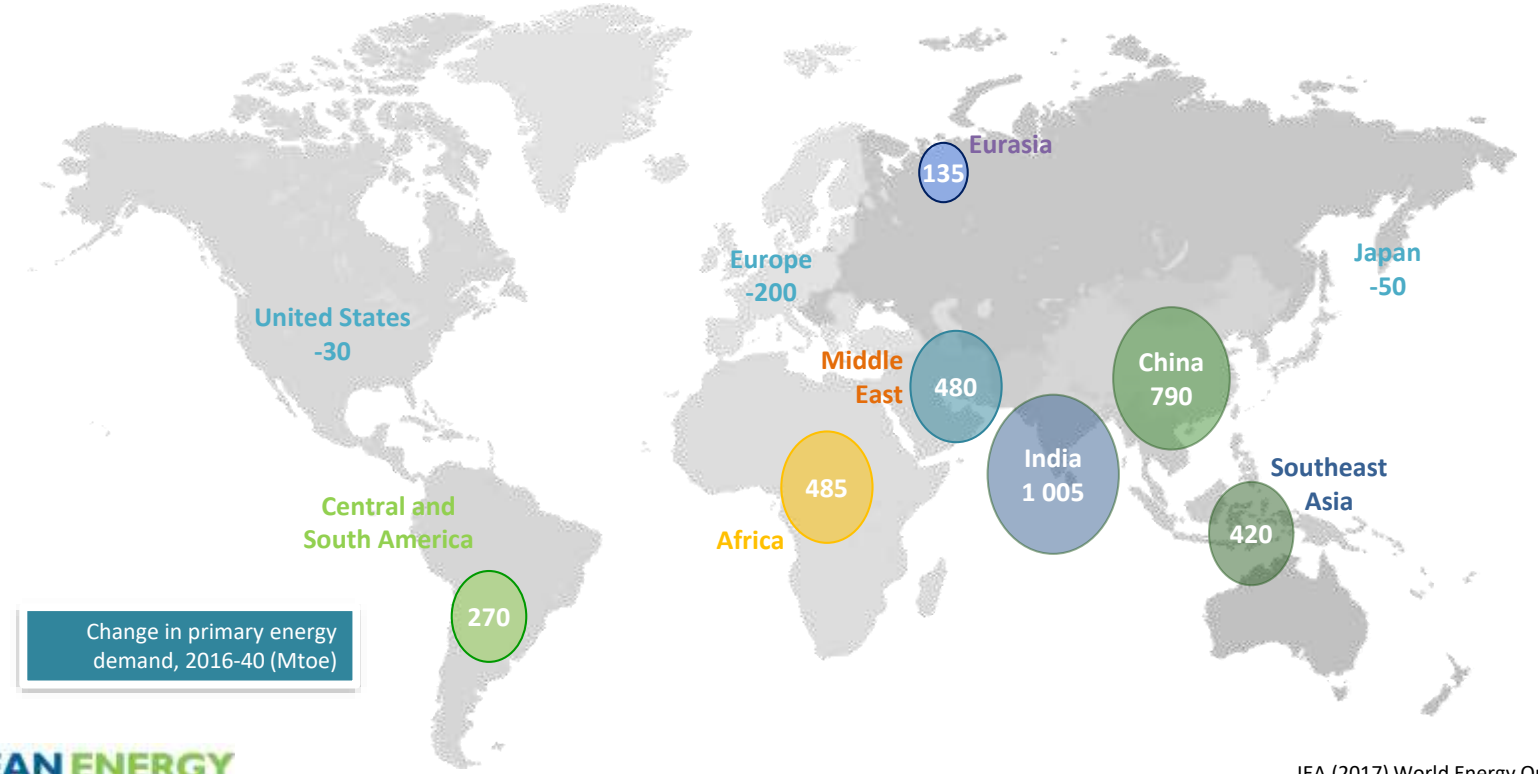
The relative weight of countries is shifting too, and rapidly.

Fundamental changes underway, impacting both demand and supply.



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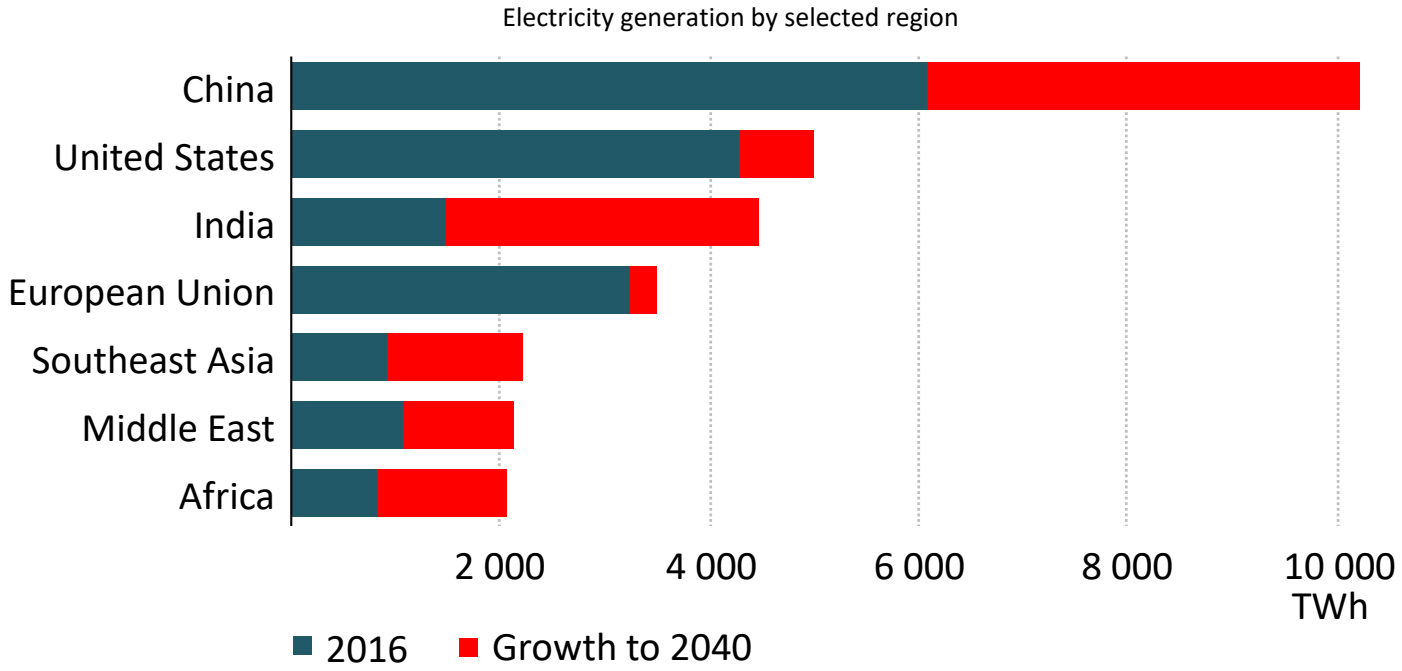
IEA (2017) World Energy Outlook

Similar story for power systems more broadly …



India adds the equivalent of today's European Union to its electricity generation by 2040, while China adds the equivalent of today's United States

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IEA (2017) World Energy Outlook

How are clean energy technologies progressing now?

In power sector, demand side and system integration

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Of 38 clean-energy technologies 4 are on track, 23 need improvement & 11 are off track, to meet long-term climate, energy access and air pollution goals

Power

- Renewable power
- Solar PV
- Onshore wind
- Offshore wind
- Hydropower
- Bioenergy
- Geothermal
- Concentrating solar power
- Ocean
- Nuclear power
- Natural gas-fired power
- Coal-fired power
- CCS in power

Industry

- Cement
- Chemicals
- Steel
- Aluminum
- Pulp and paper
- CCS in industry

Transport

- Electric vehicles
- International shipping
- Fuel economy
- Trucks
- Transport biofuels
- Aviation
- Rail

Buildings

- Building codes
- Heating
- Cooling
- Lighting
- Appliances & equipment
- Data centres and networks

Energy Integration

- Energy storage
- Smart grids
- Demand response
- Digitalization
- Hydrogen
- Renewable heat

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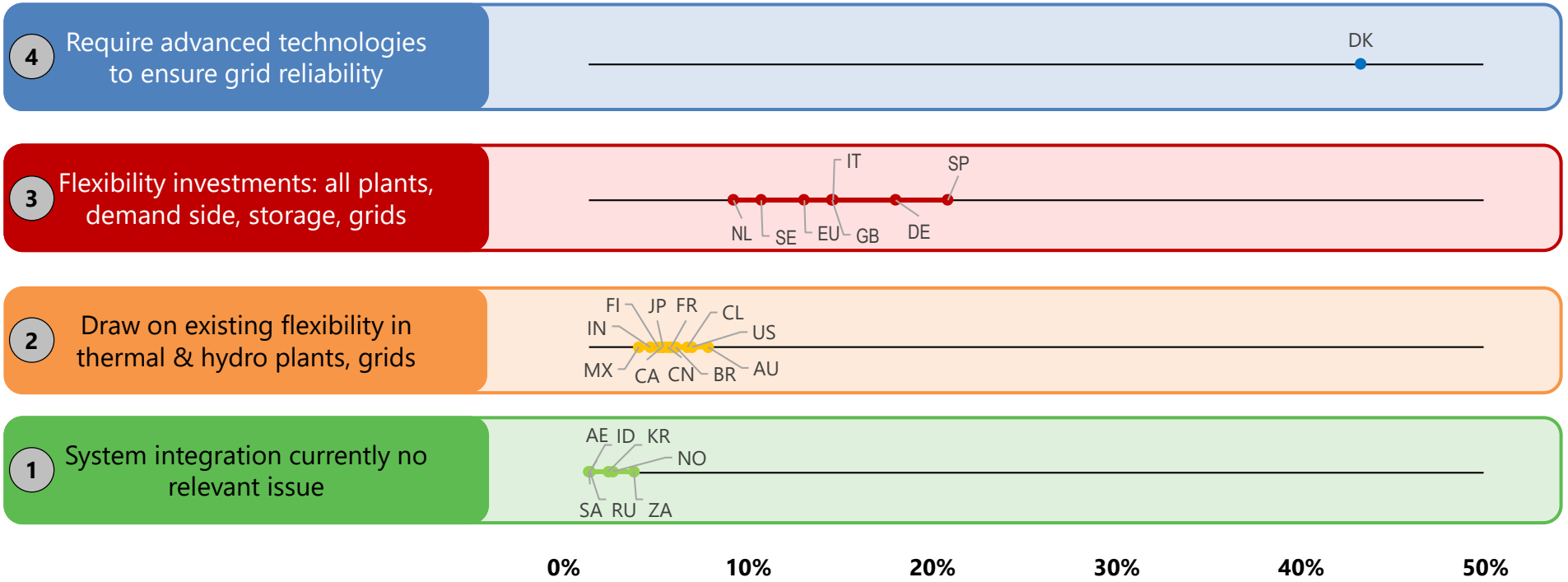
IEA (2018) tracking clean energy progress
http://www.iea.org/tcep/

Wind & solar making strong inroads, needs emerged for system flexibility

Four phases of wind and solar integration



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IEA (2018) tracking clean energy progress http://www.iea.org/tcep/

This integration of power systems will accelerate.

Hence, policy approaches will need to be integrative, too

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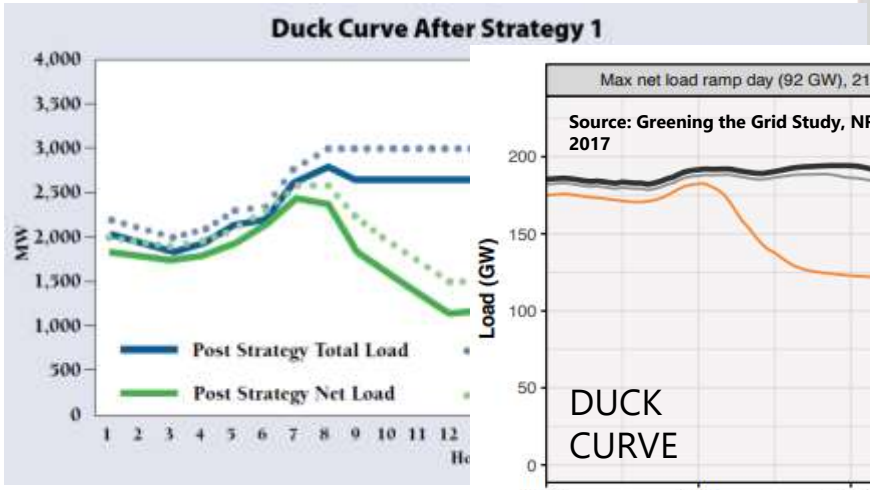
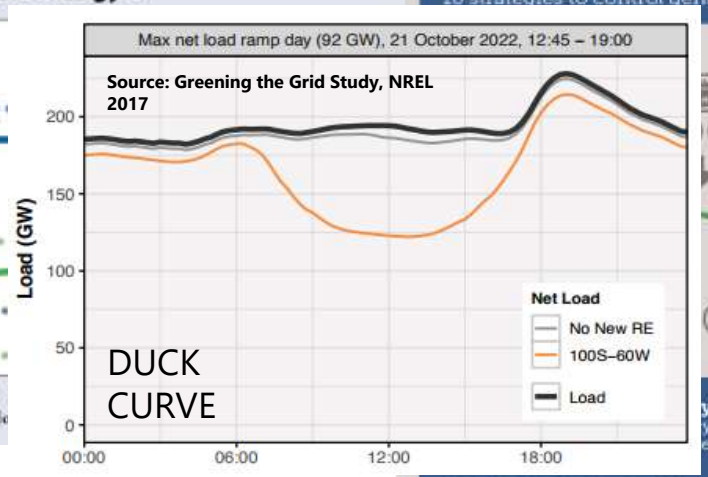
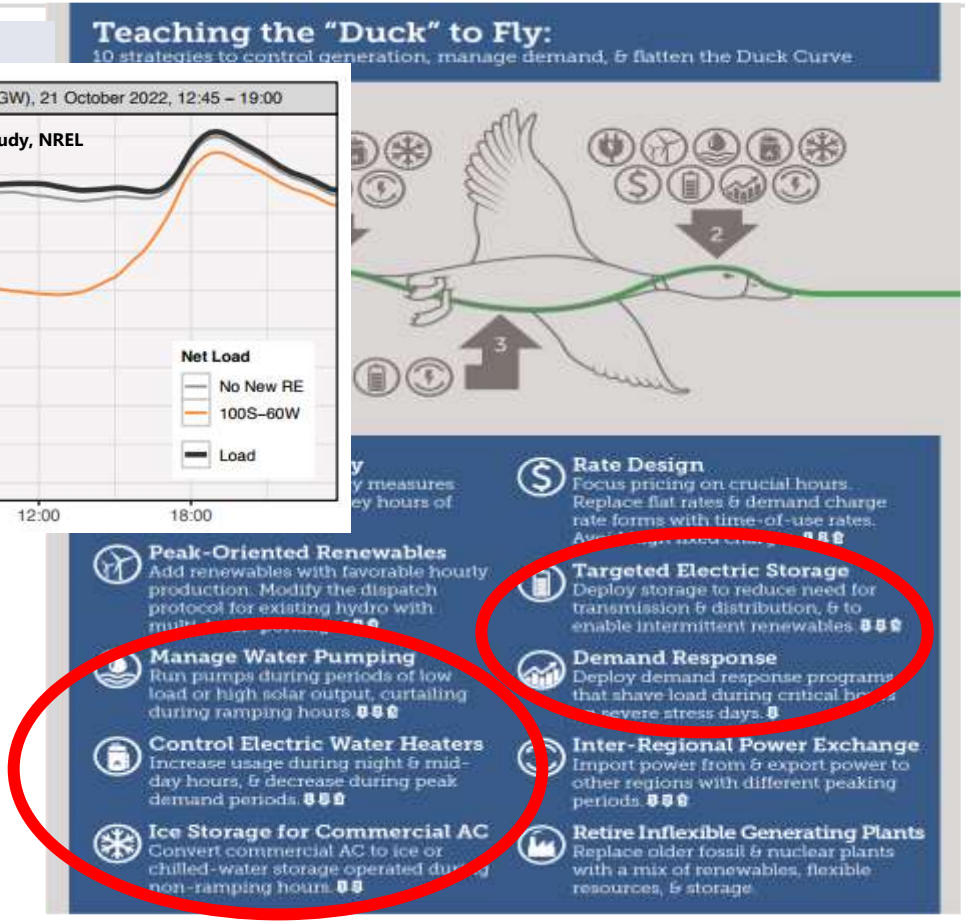
One example: power system policy is about more than supply





Strategy 1: Acquire energy efficiency measures with a focus on measures that provide savings in key hours of system stress.



Source: *Teaching the "duck" to fly*, RAP 2016

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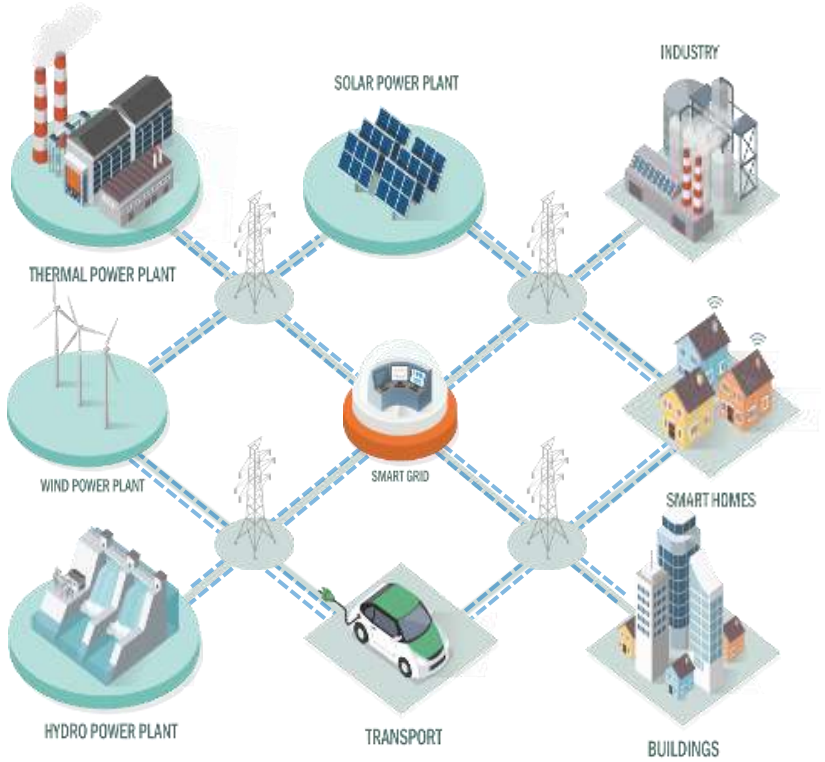
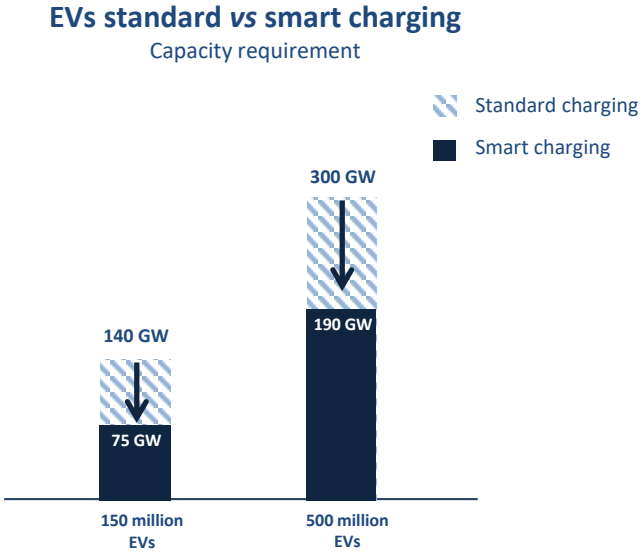
Another example: electric vehicles being an asset for the power system (or a challenge)





- EVs smart charging would provide further flexibility to the grid
- Saving between USD 100-280 billion investment in new electricity infrastructure

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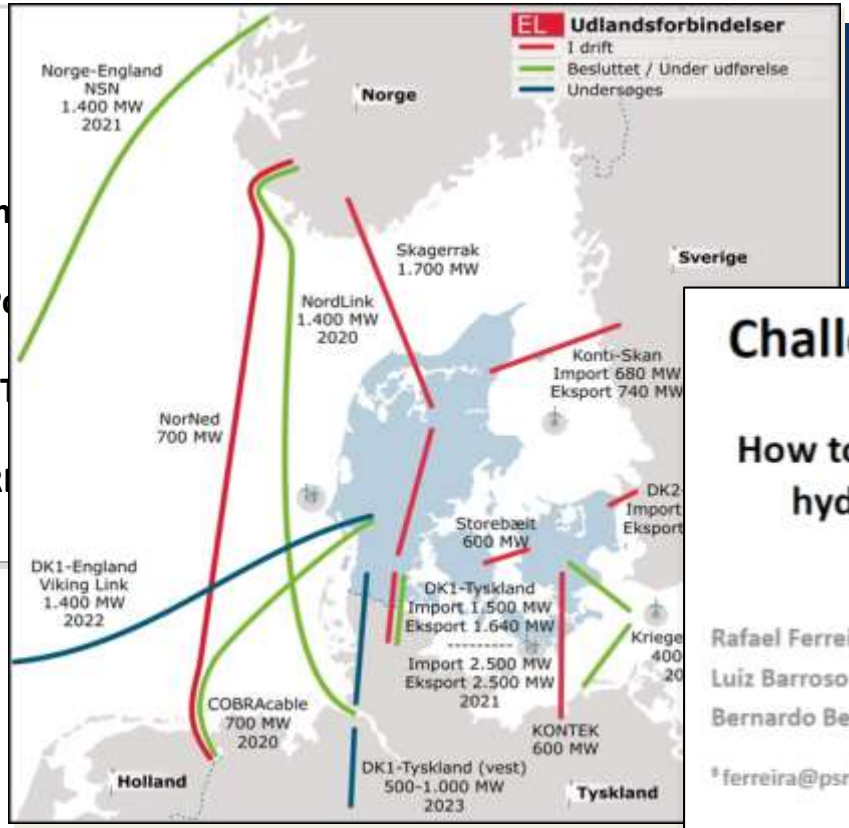
IEA (2017) Digitalization and Energy

Many countries are grappling with similar issues (power systems decarbonisation, flex and power systems regional interconnection, etc)



国家发展和改革委员会 能源研究所 Energy Reform Institute NDRC.PRC

CNREC 国家可再生能源中心 CHINA NATIONAL RENEWABLE ENERGY CENTRE

CIFF CHILDREN'S INVESTMENT FUND FOUNDATION

China Renewable Energy

Challenges for demand response in Brazil

or

How to change the mindset after decades of relying on hydro to provide all flexibility the system needs?

Rafael Ferreira‡

Luiz Barroso

Bernardo Bezerra

‡ferreira@psr-inc.com

PES GM 2015

Panel: Demand response in fast growing countries: Challenges and opportunities

July 28th 2015

IEEE PES

IEEE

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Hence, the need for policy making and regulatory institutions to stay “on the front foot”

(not always the easiest task for governments …)

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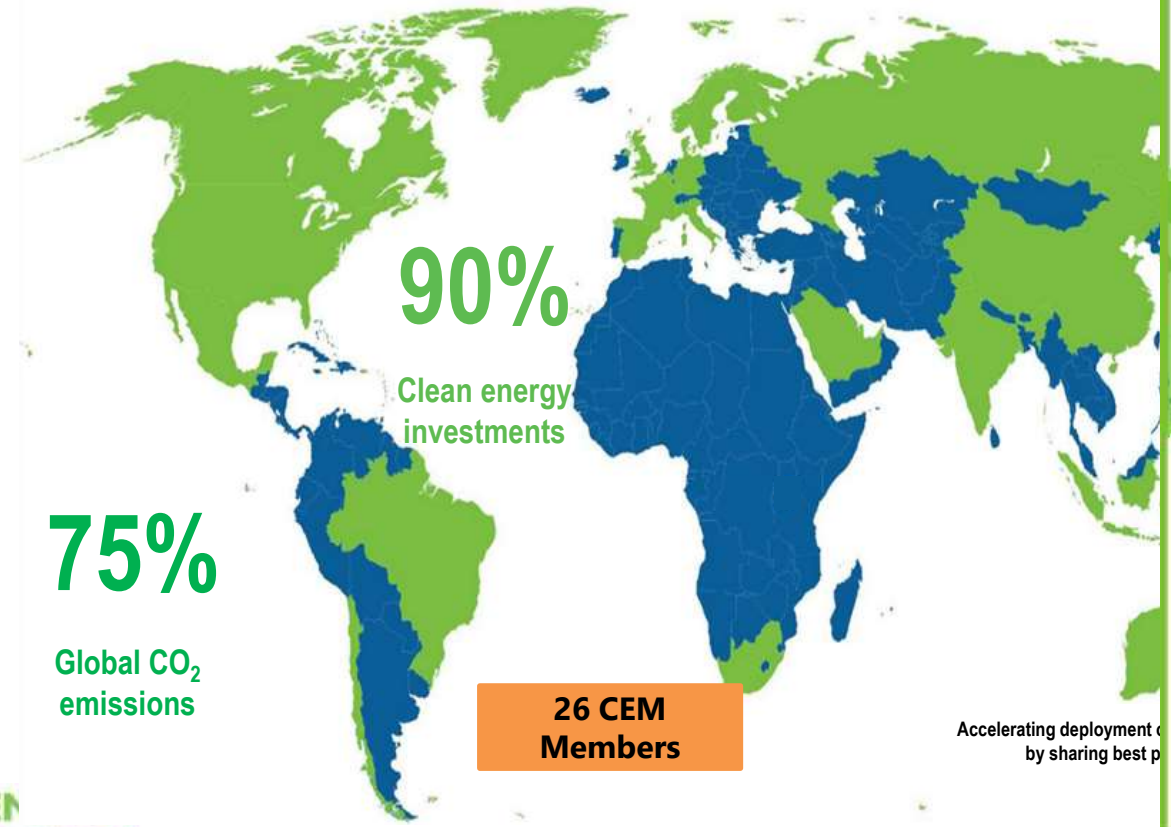
CEM Ministers constitute a special group with global market-shaping potential



Initiatives and campaigns have global market shaping potential

India: Deployment of 1 billion high-efficiency, high-quality, and affordable lighting products in a potential 10-35 billion USD ESCO Market

Accelerating deployment
by sharing best p

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Annual Ministerial Meeting: manageable size, dominated by a collegial, plus-sum way of collaboration

…combined with year round work streams focusing on policy and regulatory frameworks for clean energy uptake

Accelerating deployment of renewable energy and power system transformation

- *Supply and energy system integration*

decarbonisation of industry and other end-use sectors

- *Focusing on industry decarbonisation, several areas for deep decarbonisation*

Accelerating clean energy investments

- *New topic for the CEM; energy policy and regulation is key*

What CEM has been working on under these focus areas

21st Century POWER PARTNERSHIP – Accelerating the transformation of power systems

Multilateral Solar and Wind Working Group

ADVANCED POWER PLANT FLEXIBILITY

CORPORATE SOURCING OF RENEWABLES

ISGAN – INTERNATIONAL SMART GRID ACTION NETWORK

Global LEAP

SEAD

The Energy Management Working Group (EMWG)

AC – ADVANCED COOLING CHALLENGE

EV30@30

Electric Vehicles Initiative

Sustainable cities and eco-town Initiative

GLOBAL LIGHTING CHALLENGE

NEARLY ZERO ENERGY BUILDINGS

ENERGY MANAGEMENT CAMPAIGN

CLEAN ENERGY SOLUTIONS CENTER – ASSISTING COUNTRIES WITH CLEAN ENERGY POLICY

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Direction of travel: Increasing focus on policy & regulation and country-specific work

Global analytics

Country overviews

Country specific policy and technical work

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21st century power partnership

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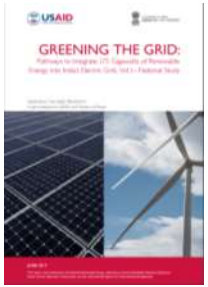
21st Century POWER PARTNERSHIP
Accelerating the transformation of power systems

enabled **Mexico's comprehensive electricity sector reform agenda**

built confidence and ambition in **India's 175 GW renewable energy target**



contributed to the planning and production of the **China Renewable Energy Outlook** in 2016 and 2017

Lead CEM member(s)

India, Mexico, United States*

CEM Member participants

Brazil, China, Denmark, Finland, South Africa, Spain

*U.S. leadership is under review.

Energy supply and systems integration

Deepen engagement with emerging economies; launching a new campaign on distributed generation, focusing on business model and regional experience sharing

International Smart Grid Action Network

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ISGAN
INTERNATIONAL SMART GRID ACTION NETWORK

- ***Knowledge Sharing*** to provide useful lessons learned and analysis in renewable energy deployment and power system integration and transformation.
- ***Technical Assistance*** to evaluate and improve smart grid technologies.
- ***Project Coordination*** to help policy makers orchestrate a sustainable transition to smart grids.
- ***ISGAN Award of Excellence*** recognize excellence in smart grid projects, policies and programs around the world

Energy supply and systems integration

Corporate Sourcing of Renewables Campaign under the solar and wind working group

CORPORATE SOURCING OF RENEWABLES

Multilateral Solar and Wind Working Group

Lead CEM Member(s)

CEM Member Participant(s)

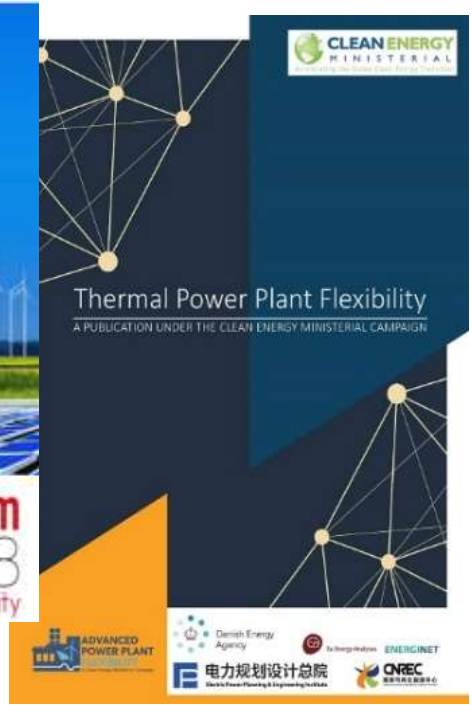
China, Denmark, Germany, Brazil, European Commission, Mexico, Sweden, United Kingdom, United States

Corporate sourcing of renewable energy now takes place in **75 countries**, including all CEM Member countries; over **900 corporate Power Purchase Agreement** (PPAs) have been signed for **about 20 GW**, and over **130 companies** have joined RE100 – a commitment to switch to 100% of renewable energy.

Energy supply and systems integration

Successfully concluded in May 2018; gained considerable large amount of business partners support

Advanced Power Plant Flexibility Campaign under the solar and wind working group



ADVANCED POWER PLANT FLEXIBILITY

Multilateral Solar and Wind Working Group

Lead CEM Member(s)

CEM Member Participant(s)

Germany, Denmark, China, Brazil, Canada, India, Indonesia, Italy, Japan, European Commission, Mexico, Saudi Arabia, South Africa, Spain, United Arab Emirates

Energy supply and systems integration

Expanding its scope to system flexibility, with emphasis on storage and demand side response

New areas of work – 5 out of 8 new work streams launched are power system related

4 new initiatives

4 new campaigns

Equal by 2030

A Campaign associated with the CEM initiative C3E.

Power System Flexibility Campaign

A Campaign associated with the Multilateral Solar and Wind Working Group (MSWWG) and 21st Century Power Partnership (21CPP)

Accelerating the Adoption of Distributed Generation in Strategic Regions

This campaign is launched by 21st Century Power Partnership (21CPP). It is also associated with International Smart Grid Action Network (ISGAN), Clean Energy Solutions Center (Solutions Center), Electric Vehicles Initiative (EVI)

Long-term energy scenarios for the clean energy transition

A Campaign associated with the Multilateral Solar and Wind Working Group (MSWWG)

5 new work streams on power systems

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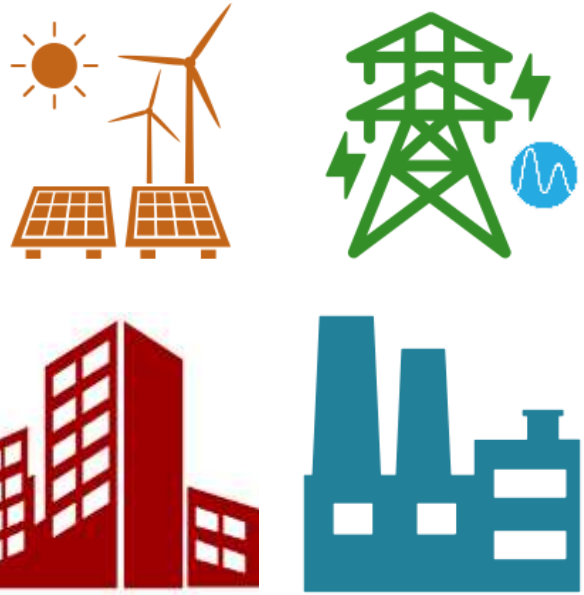
And…to address clean energy investment and finance

What issues might **CEM Energy Ministers** need to be aware of here?

Well, for starters …

- Energy policy and regulation influencing risk and investment attractiveness;
- Market frameworks incentivizing desired behavior;
- Encouraging - or stifling - business model innovation;
- Government kick-starting, then exiting … (*is exit happening*);
- Support for pipeline of investable projects.



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- **Initial thematic focus**

…… Therefore, more integrative work streams on power systems

Demand side work streams

Electric Vehicles Initiative

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ASSISTING COUNTRIES WITH CLEAN ENERGY POLICY

Clean energy investment and finance

Work streams will increase their synergies in the coming years – responding to more integrated power systems – blurring the boundary of supply and demand

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Way forward…… WHAT to FOCUS

- Increasing complexity for power system policy as ***energy systems*** become more ***integrated***
- looking at ***Regulatory structures and market designs*** which can ***unleash flexibility*** much more on thermal generation, grid, storage and demand side
- Power system ***regional interconnection*** focuses less on technical aspects and more on the relative stages of successive ***regulatory alignment***
- Government ***policy & market design*** will be instrumental in spurring deployment and private ***investment***
- the need for more ***integrated policy responses*** and so factoring ***EE policy*** *(EV, cooling etc.)* into power policy and the utility of ***longer-term planning***

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