



# Energy Efficiency Business in APEC



**Asia-Pacific Economic Cooperation Workshop  
on Environmental Services  
Hanoi, Vietnam**

**Mahesh Patankar, PhD**  
**([mahesh@mpensystems.com](mailto:mahesh@mpensystems.com))**  
**11 May, 2017**

# + Outline

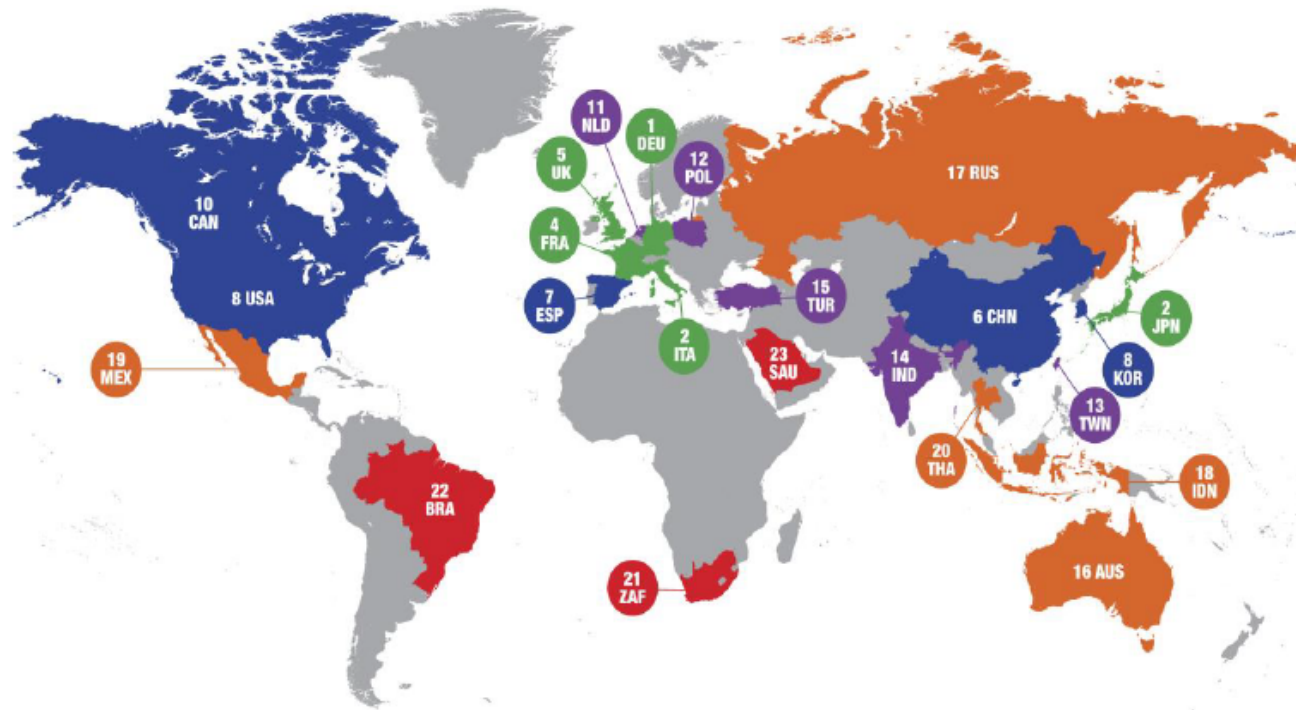
- I. Energy Efficiency in APEC Economies
- II. Types of Energy Efficiency Businesses
- III. Trends in EE technologies
- IV. Challenges and Opportunities



# Energy Efficiency in APEC Economies

# + EE in APEC Economies

Energy efficiency is the concept of providing more desired services per unit of energy consumed



Five APEC economies rank amongst the world's top ten energy efficient economies

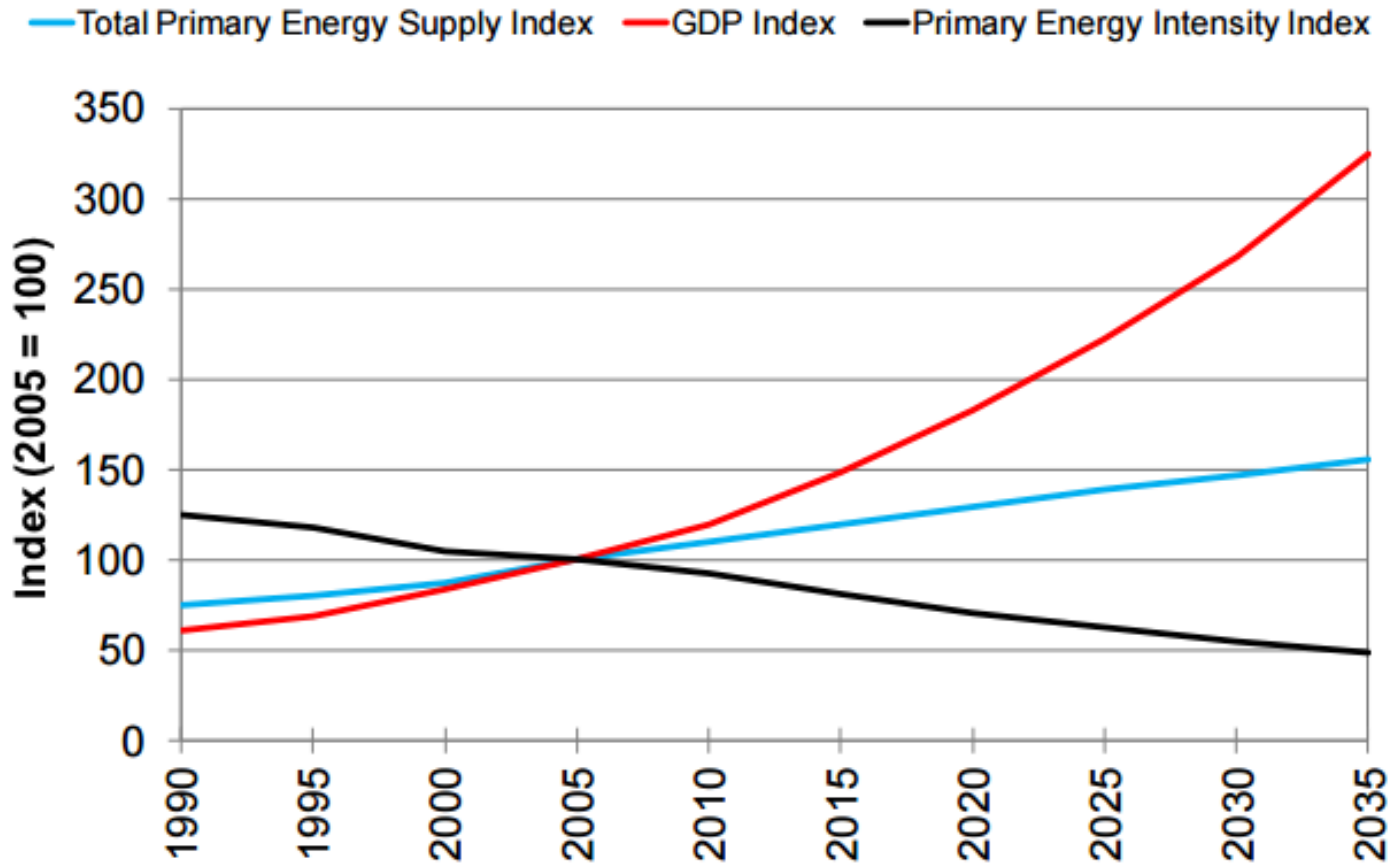
ACEEE, 2016

Energy Efficiency Businesses in APEC, May 2017



# APEC: Energy Efficiency and Rising Productivity

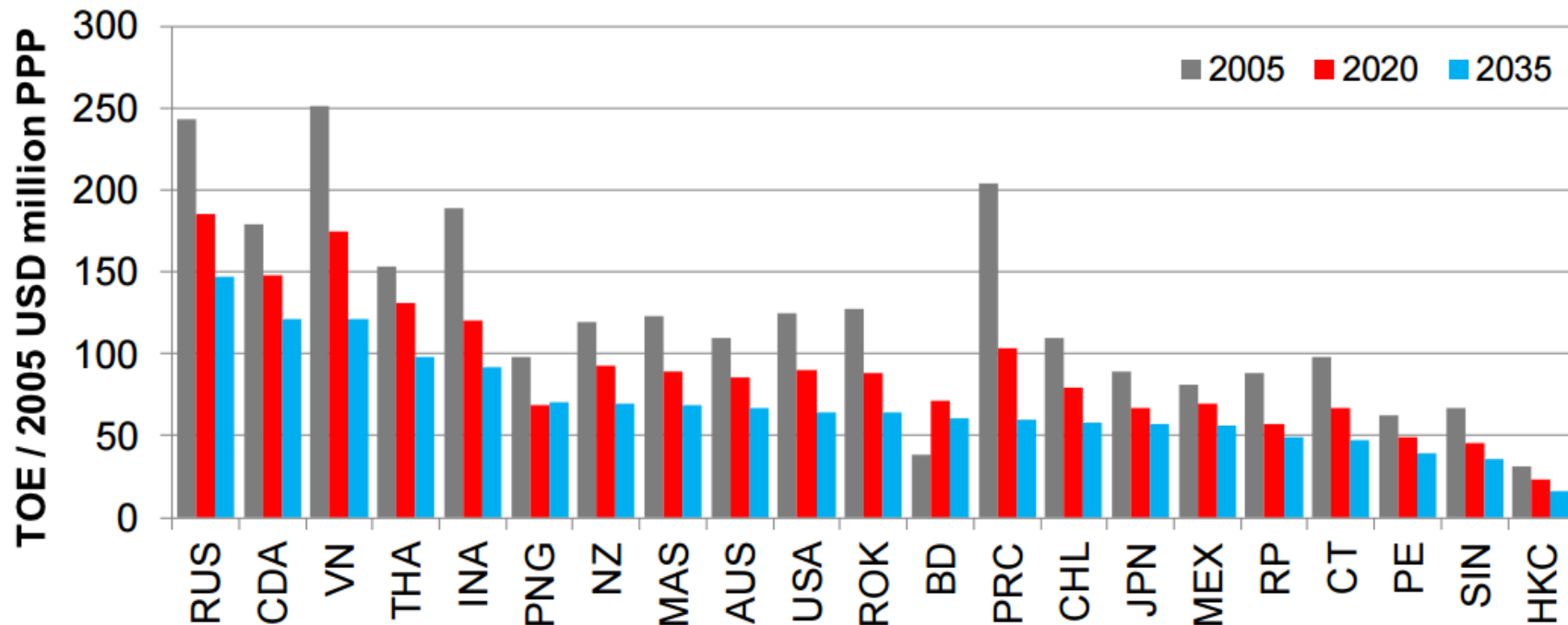
## Change in APEC Primary Energy, GDP, and Energy Intensity



Source: APERC Analysis (2012)

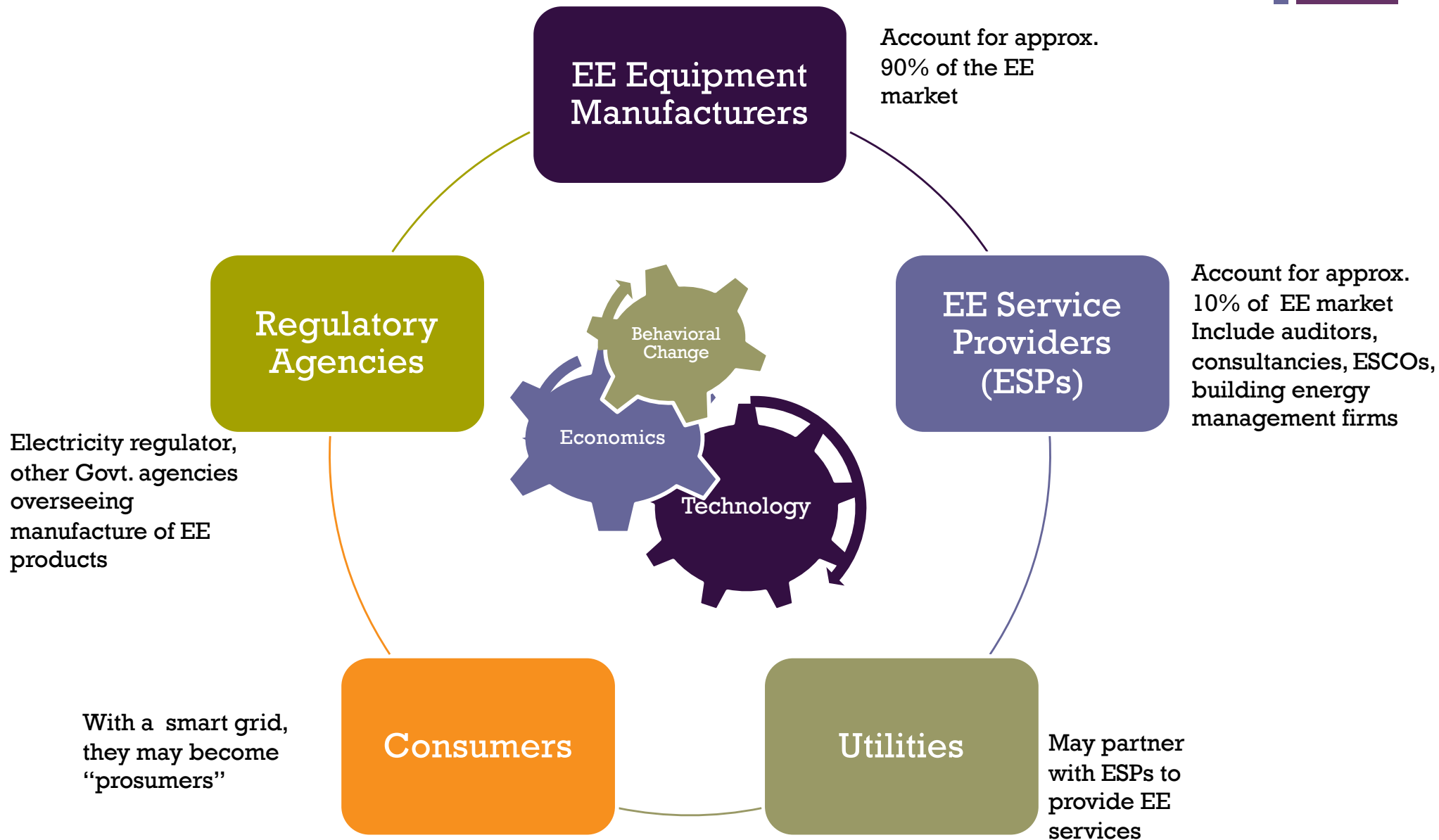
# + APEC Energy Intensity- Present and Forecast

### APEC Energy Intensity by Economy



Source: APERC Analysis (2012)

# + Energy Efficiency Stakeholders





# Energy Efficiency Businesses

Energy Efficiency Manufacturing

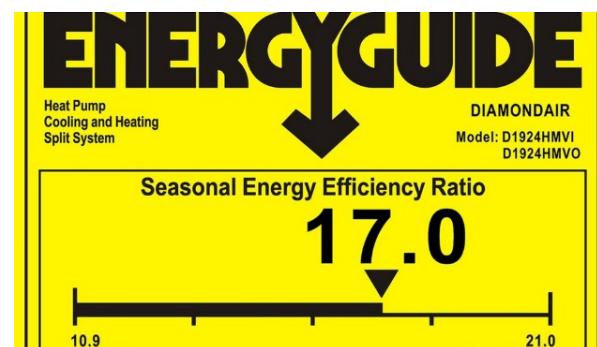
Energy Efficiency Services



# + EE Manufacturing

- Manufacturing of the following energy efficient equipment:
  - Lighting, HVAC, Pumping, Compressed Air, Motors and Variable Speed Drives
  - Building materials- cement, glass, insulation material, steel, roofing etc.
  - Combined Heat and Power (CHP)
  - Building Energy Management Systems
- APEC economies – particularly in SE Asia, are a manufacturing hub for the world's EE equipment including LEDs, Air Conditioners, Hybrid Electric Vehicles (HEVs)

## Energy Efficiency Appliance Labels- USA, Vietnam





# Energy Efficiency Services (ESP) Business Models

Full-service, high risk

## Full Service ESCO

- Designs, finances, implements the project, verifies energy savings
- Shares agreed percent of actual energy savings over fixed period

Shared savings model

## End-use Outsourcing

- Takes over operations and maintenance, supplying output (steam, heat, cooling, lighting)
- Costs borne by ESCO, ownership remains with customer

Chauffage or Energy Supply

## ESCO with third-party financing

- Designs and implements project but does not finance it
- Guarantees that energy savings will cover cost of project

Guaranteed savings model

## ESCO with variable term contract

- Similar to Full Service ESCO, but contract term can vary to ensure ESCO recovers agreed amount

## Equipment Supplier Credit

- Equipment supplier designs and commissions project
- Customer pays lumpsum or over-time, based on expected energy savings

## Equipment Leasing

- Similar to equipment supplier credit, but ownership of equipment remains with supplier till all payments are made

## Technical Consultant (with performance-based payments)

- Conducts energy audit, project implementation
- Performance-based fee

Low-service, low risk

## Technical Consultant (with fixed payment)

- Conducts energy audit, designs project
- Fixed fee

# + Demand for EE Businesses Driven by National Priorities

Country	Energy Efficiency Targets, 2020	Required Investment, USD million
<b>Brunei Darussalam</b>	Attain 25% reduction of energy intensity from 2005 level by 2030	48
<b>Cambodia</b>	Reduce final energy consumption by 10% in all sectors	126
<b>Indonesia</b>	Decrease energy intensity by 1% annually and decrease energy-GDP elasticity to below 1% by 2025	6
<b>Malaysia</b>	Reduce final energy consumption in the industry, commercial and residential sectors by 10% from 2011 to 2030, and reduce final energy consumption of the transport sector by 1.4 ktoe by 2030	901
<b>Philippines</b>	Reduce final energy consumption by 10% in all sectors from 2007 to 2014	601
<b>Singapore</b>	Reduce energy intensity by 20% by 2020 and by 35% by 2030 from 2005 level: cap CO <sub>2</sub> emissions from fuel combustion at 63 Mt-CO <sub>2</sub> by 2020	97
<b>Thailand</b>	Reduce the energy intensity of GDP by 25% by 2030 relative to BAU	2,006
<b>Vietnam</b>	Reduce energy consumption by 3%-5% by 2010 and by 5%-8% by 2010-2015	649
<b>China</b>	Reduce CO <sub>2</sub> emissions per unit of GDP by 40%-45% from 2005 level by 2020	865,260

ADB, 2013



# Trends in Energy Efficiency Technologies

# + Trends in Technologies: Sectors and EE Measures

Sector	Energy Efficiency Measures
Residential and Commercial Buildings	<ul style="list-style-type: none"> <li>• Efficient equipment for heating and cooling</li> <li>• Adjustments in use patterns</li> <li>• Using appropriate construction materials for new and retrofitted buildings</li> <li>• Maintenance and monitoring</li> </ul>
Industry	<ul style="list-style-type: none"> <li>• Data collection, regular analysis of energy performance</li> <li>• Combustion control and instrumentation of boilers and furnaces</li> <li>• Minimize heat loss in industrial processes</li> <li>• Waste heat recovery</li> <li>• Installing efficient motors, boilers, pumps, fans</li> </ul>
Transport	<ul style="list-style-type: none"> <li>• Modal shift</li> <li>• Fleet replacement with efficient vehicles</li> </ul>
Power Generation, Transmission, Distribution	<ul style="list-style-type: none"> <li>• Clean coal technologies</li> <li>• Fuel switching</li> <li>• Cogeneration</li> <li>• Transmission and Distribution line upgradation</li> <li>• Improved control and operations, power factor improvement, voltage regulation</li> </ul>

UNIDO, 2010

Energy Efficiency Businesses in APEC, May 2017

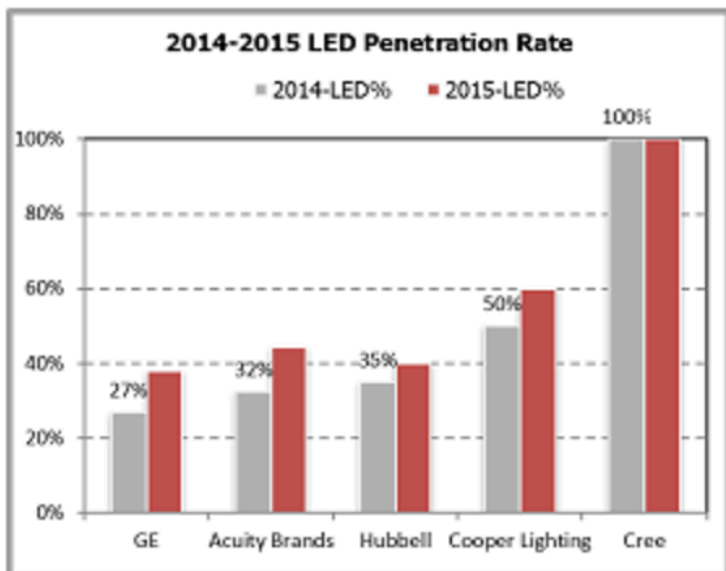
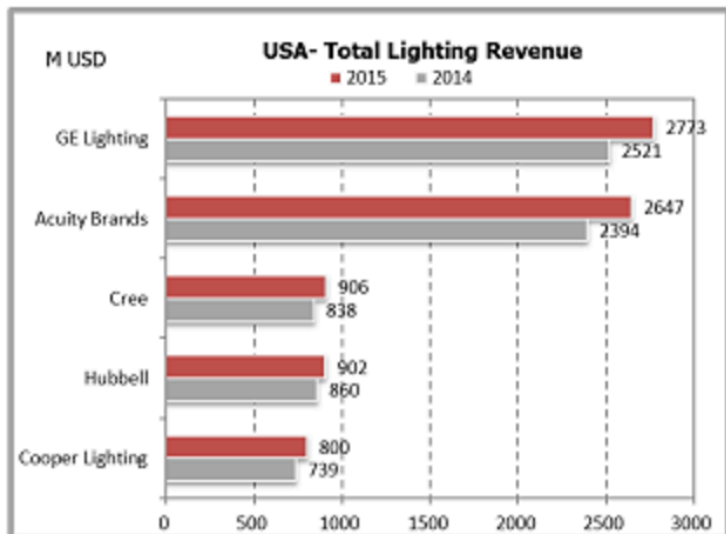
# + Trends in Technologies: Sectors and EE Measures

EE Technology	Technology Description	Market
Energy Storage	Energy storage for the power grid to increase penetration of renewable energy Residential, commercial or industrial behind-the-meter energy storage	<ul style="list-style-type: none"> <li>Grid energy storage is likely to play a prominent role in APEC countries that are moving towards higher penetration of renewable energy, smarter grids, and flexible grids</li> <li>Behind-the-meter grid storage grew at 125% in 2016 in the US residential market</li> </ul>
District Cooling	A cooling network distributing chilled water to a number of buildings	<ul style="list-style-type: none"> <li>North America, Middle East, Europe, and Japan account for over 80% of the global district cooling market</li> <li>China has the potential to level with North America in 5 years</li> </ul>
Smart Buildings	Using information and communication technologies to integrate building systems and to automate operations and control	<ul style="list-style-type: none"> <li>China has over 2,500 green building projects, Singapore aims to have 80 per cent of its buildings certified green. Other Asian countries are building technical expertise</li> </ul>

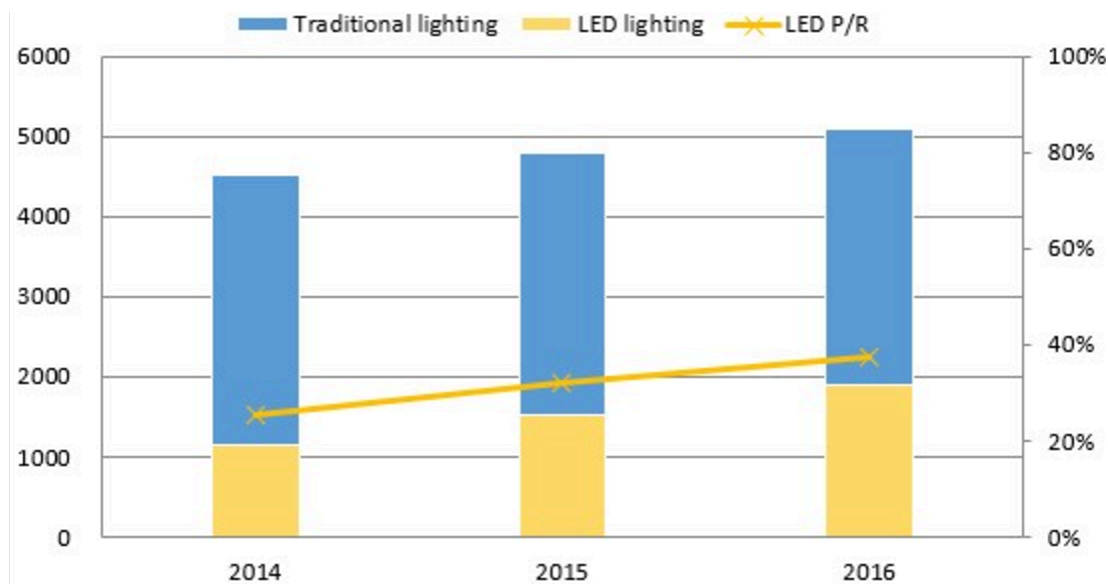


# EE Lighting in APEC

## LED Market Trend in USA, 2014-15



## Lighting Market Scale and Trend in ASEAN-APEC Economies, 2014-16



TrendForce Data



# Average Annual Efficiency Improvements

Product	Refrigerator	AC-Unitary	AC-Split
	(Normalised kWh/Litre) <sup>1</sup>	EER	EER
Australia	-3.6 %	3.1 %	5.3 %
Canada	-2.3 %	0.2 %*	
Korea		0.5 %	1.5 %
USA	-11.9 %		

IEA-4E, IEA 4E Benchmarking Document

*Note 1: the underlying units for the first three products are 'energy intensity', so a negative figure implies an increase in energy efficiency. Korea data based on just 3 years of data, whilst reference [1] reports a 14% decrease in energy intensity from 2006 to 2010, equivalent to a decrease of -2.1% per annum.*

*\*' indicates where the values are model-weighted, rather than sales-weighted.*



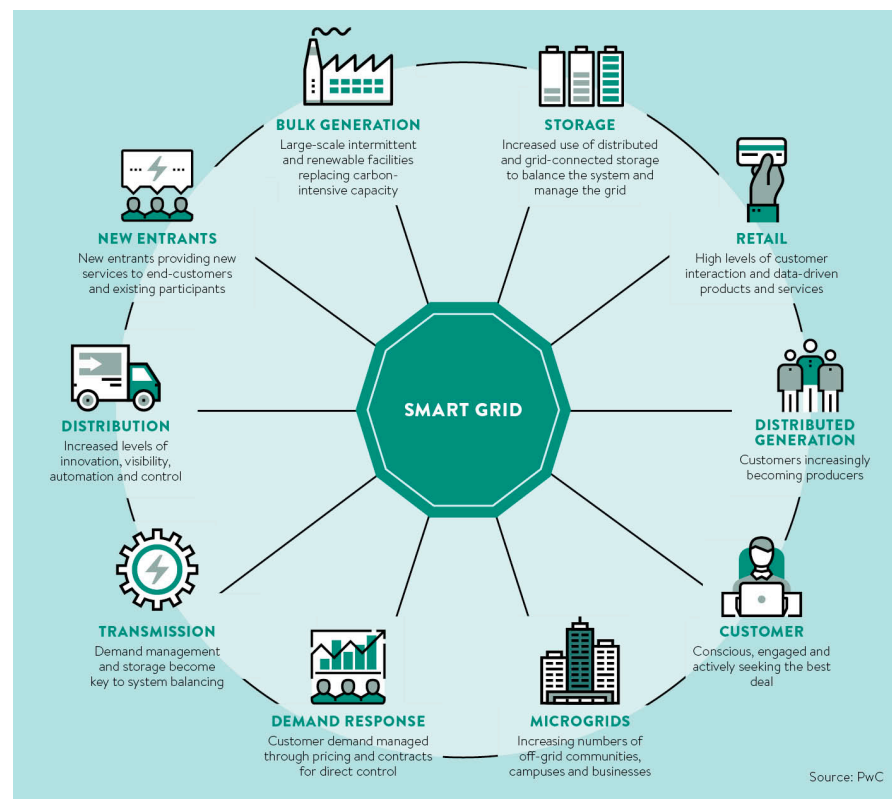


# EE Highlights: Smart Grid

The smart grid is an electricity supply network that uses digital communications technology to detect and react to local changes in usage.

- Smart Grid in Jeju Islands, S. Korea
  - Smart transportation, smart place, smart renewable, smart power grid, and smart electricity market
  - One of the aims of the project was to improve energy efficiency by utilizing real-time information of supply and demand
  - Project outcome - advance metering infrastructure (AMI) reduced electricity consumption by 12%

ADB, 2016



PWC, 2016

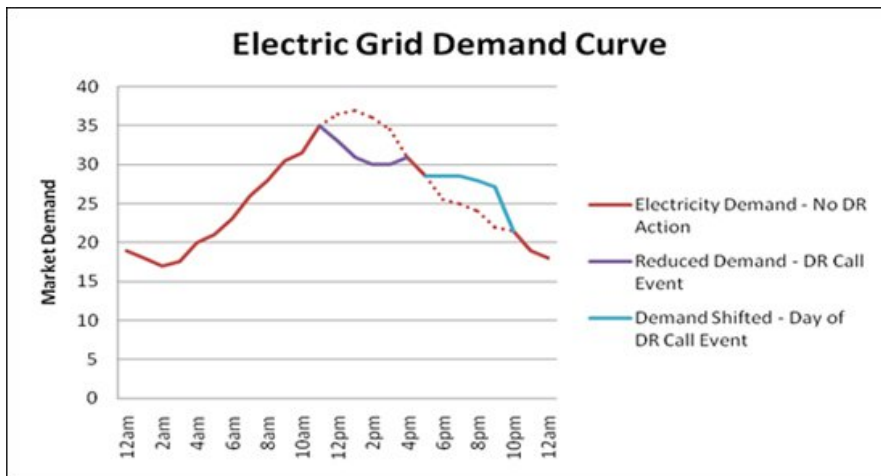


# EE Highlights: Demand Response



Demand response provides an opportunity for consumers to play a significant role in the operation of the electric grid by reducing or shifting their electricity usage during peak periods, in response to time-based rates or other forms of financial incentives.

## Demand Response in Glendale, California



City of Glendale, California

- Commercial or institutional customers can help maintain grid stability
- These measures are undertaken so as not to affect service levels
- Consumers earn by participating in DR
- In the US, DR participants include
  - Regional Transmission Organization- e.g. PJM
  - Utility- e.g. ConEdison
  - Equipment supplier- e.g. Schneider Electric



# Energy Efficiency Businesses: Challenges and Opportunities

# + Regulatory Challenges Facing EE Businesses

## EE Manufacturing Sector

- National EE standards, green building standards, EE appliance labelling programs are lacking in some countries and not mandatory in others
- Inadequate testing facilities for EE labelled products
- Lack of enforcement of EE labelling programs
- EE not included as a part of public procurement norms

## EE Services

- Lack of recognition and understanding of the ESCO industry
- Lack of legislation or regulation related to ESCOs
- Difficulty in introducing ESCO projects to government buildings
- Lack of government support to ESCO associations
- Lack of accreditation or certification in the ESCO industry in some economies
- Improvement is still needed in public procurement and financing of local government. Procurement of energy services should be included in EE legislation. EE should be stipulated as one of criteria for tendering

# + Financial Challenges

- In some APEC economies (e.g. Chinese Taipei, Indonesia, Malaysia, Vietnam) energy prices are heavily subsidized to stimulate economic growth, reducing the return on energy efficiency investments
- The perceived high risk of EE drives up implicit discount rates associated with EE projects
- High transaction costs in implementing EE projects
- Difficulties in structuring workable contracts for preparing, financing, and implementing energy efficiency investments
- Economic incentives or taxation systems favoring EE are not in place in many APEC economies
- The lack of understanding and involvement in the ESCO business by local banks and financial institutions in Asia

# + Opportunities for EE Manufacturers

## ■ Energy Efficient Buildings Market Potential

### **Vietnam**

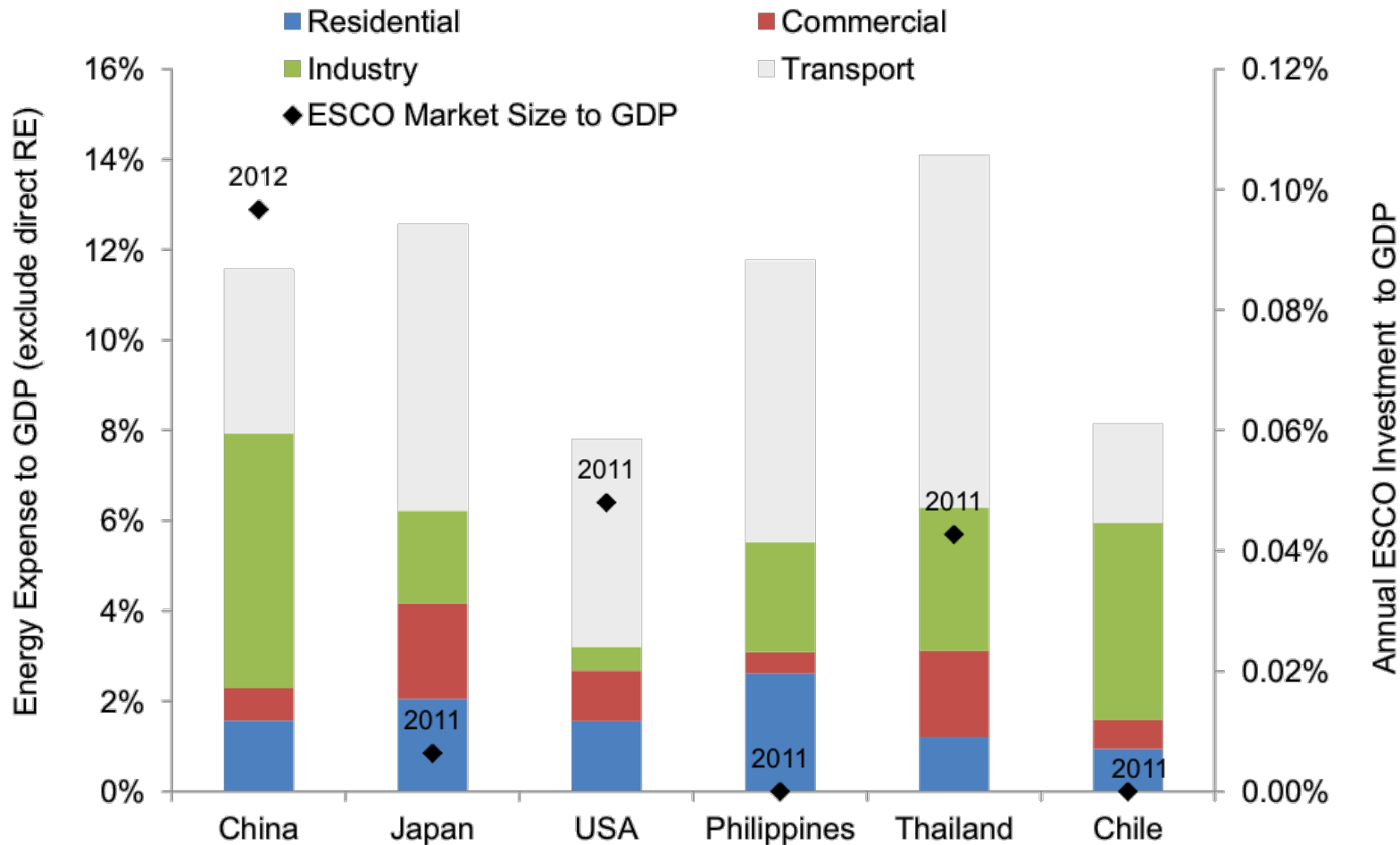
- LEED and LOTUS- two major green building certification programs
- Rising number of green buildings, with industrial and commercial facilities at the forefront
- From 2009 to 2014, the building products sector grew 17.6 percent
- Vietnam imported \$4.6 billion in HVACR, lighting, plumbing, wood products, insulation, windows and doors and glass from the world in 2014

## ■ Electric and Hybrid Vehicles Potential

- Tightening standards for fuel emissions across APEC economies
- Business opportunities in vehicle manufacture, charging infrastructure, and building linkages to smart grid
- Leading markets include USA, Japan, Korea, Singapore, New Zealand, Canada, China

# + Opportunities For EE Services

## Market potential of ESCOs





Thank you!





# Sources

- ADB (2013). Same Energy, More Power: Accelerating EE in Asia
- ADB (2017). District Cooling in the People's Republic of China: Status and Development Potential
- ADB (2017). Energy storage in grids with high penetration of variable generation
- AEEE (2016). The 2016 International Energy Efficiency Scorecard
- IEA (2016). Energy Efficiency Market Report 2016
- IFC (2013). Energy Service Companies (ESCOs) in China
- UNIDO (2010). Energy efficiency technologies and benefits
- UNIDO (2003). The Role of ESCOs and M&V in Promoting Energy Efficiency
- World Bank (2010). Public Procurement of Energy Efficiency Services Lessons from International Experience
- IEA-4E, IEA 4E Benchmarking Document
- IISD (2010). Energy Service Companies (ESCOs) in Developing Countries