

## Preamble

Office of the Energy Regulatory Commission or OERC organized the seminar “Annual Year Forum 2011: Regulation and Energy Sustainability” with intended to provide a platform for exchange of views, ideas and experience between experts, researchers, academics from various corporate sectors in the international level. Enhance the information that is useful to keep pace with changes in energy and environment during the fusion of the world by energy experts and relevant speakers to educate. To express the importance of energy sustainability that will be built in Power Industry. To facilitate useful and responsive to national development and economic, environment, social learning, which will take the countries and the people in every nation to progress steadily and sustainable.

The seminar consists of four sessions, the first session on **“Energy Security: Capital Planning and Expansion”** by a discussion on two main strategies exist for facilitating power supply; wholesale power trading and planned power procurement. Power markets promote efficient wholesale production while planned power procurement allows targets to be set to promote fuel diversity and renewable energy. The second session is **“Regional Views on Energy Sustainability Issues including Renewable Energy”**. The focus of this session is on Feed in tariffs are used to promote the use of renewable energy by providing additional revenue with case studies of renewable energy.

A discussion forum on topics such third session on **“Energy Security: Managing Demand through Efficiencies”**. Efficient and reliable system operations are influenced by the system of governance for the Codes that are used to manage access and operations. Smart Grid and Smart Meters are communications tools that can facilitate efficient and reliable system operations including DR programs. EMA Singapore and KOREC Korea will talk about their pilot projects in Smart Grid. Negawatts or energy savings can contribute to the maintenance of system reliability as well as provide economic savings. Demand Response programs are used in emergency system management, managing system efficiencies and for economic reasons. OPUC will provide a case study of experience with DR in Oregon. The last session is on **“WEC Developing Performance Indicators”**, A model of energy sustainability was developed by the World Energy Council. Thailand’s representative on the WEC task force that undertook the 2010 assessment of global energy sustainability will discuss the issue of performance indicators used to derive the assessment.



## Energy Regulatory Commission of Thailand

Energy Regulatory Commission of Thailand consists of seven members selected from the person recognized and respected with knowledge, experiences and expertise in Power Industry, Economics, Laws, and Environment.

### Prof. Emeritus Dr. Direk Lavansiri (ERC Chairman)



Ph.D (Civil Eng) Oregon State University, Oregon, USA

M.S.C.E University of Washington, Washington, USA

Bachelor of Engineering, Chulalongkorn University, Bangkok, Thailand

Past Experiences:

- Professor and Dean in faculty of engineering, Chulalongkorn University
- Board Member of many State Enterprises such as Metropolitan Waterworks Authority and Provincial Waterworks Authority
- Mass Rapid Transportation Authority, Committee and Specialist of Engineering Association of Thailand
- Professor at AIT, Thailand and Innsbruck University, Australia and etc.

### Nopadon Mantajit (Commissioner)



M.Sc. University of Manchester, UK

Bachelor of Science, Chulalongkorn University, Bangkok, Thailand

Past Experiences:

- Director-General, Department of Mineral Resources, Ministry of Industry
- Deputy Permanent Secretary, Ministry of Industry
- Director-General, Department of Mineral Fuels, Ministry of Energy
- Member of Board of Director of Petroleum Authority of Thailand, PTT Pls., PTT Exploration and Production Plc., and Malaysia-Thailand Joint Authority and etc.

**Chalit Ruengvisesh (Commissoner)**



Bachelor of Engineering, Second Honor, Chulalongkorn University, Bangkok, Thailand

Past Experience:

- Governor at the Metropolitan Electricity Authority (MEA)
- Committee at Distribution Combine Heat and Power (DCAP) at Suwannabhumi Airport

**Pallapa Ruangrong, Ph.D. (Commissioner)**



Doctor of Philosophy (Energy management& Policy), University of Pennsylvania, USA

Master of Science (Energy management& Policy), University of Pennsylvania, USA

Master of Science (Economic Development), NIDA, Thailand

Bachelor of Arts (Economics), Chiangmai University, Thailand

Past Experiences:

- Director of State Enterprise Department
- State Enterprise Policy Office(economic regulation of utilities and transportation sector)
- Member of Privatization Committee for the Initial Public Offering of Airports of Thailand
- Board Member of State Railway of Thailand, Director, Power Division of National Energy Policy Office, Office of the Prime Minister
- Policy and Planning Analyst, Energy Project Sector, National Economic and Social Development Board, Office of the Prime Minister
- Board member of District Cooling and Power (DCAP) and etc.

**Lieutenant Thaksin Limsuvan (Commissioner)**



Bachelor of Law, Second Honor, Chulalongkorn University, Thailand

Barrister of Law, Bangkok, Thailand

Past Experience:

- Deputy Governor at Electricity Generating Authority of Thailand (EGAT)
- Legal consultant of EGAT
- Legal Professor and etc.

**Chongchet Boonkerd (Commissioner)**



Master Degree in Public and Private Management, NIDA, Thailand

Bachelor of Economic, Kasetsart University, Thailand

Experience in economic, financial in both Public and Private Sector;

- Assistant of the Commission of State Enterprise Privatization, House of Senate
- Senior Economist responsible for Management at Minister of Finance
- Chief Finance Officer at SME Bank and etc.

**Supichai Tangjaitrong, Ph.D. (Commissioner)**



Ph.D. in Geographical Science, Australian National University, Australia

M.Eng.Sc. in System Engineering, James Cook University, Australia

M.Sc. in Physic, Chulalongkorn University, Thailand

B.Sc. in Physic, Chulalongkorn University, Thailand

Experiences in science, system engineering, natural resources and environmental management;

- Deputy Director of Environmental Research Institutes Chulalongkorn
- Deputy Director, Environmental Research Institute, Chulalongkorn University
- Advisor, Science and Technology Commission in the house of representative
- Member, Reviewing Board of IEA in Petroleum exploration and production
- Commissioner of Science and Technology
- Specialist Commissioner of Environmental Effect Research Analysis and etc.

## **Main responsibilities of ERC**

### **Services**

**Price regulation:** ERC regulates the rates of Energy Adjustment Charge (FT) power fee and pipeline distribution fee that are realistically respondent to the economy, investment costs and expenses on technology. It also oversees price calculation methods that are transparent and open to inspection to ensure good and fair rates to consumers.

**Assurance of sufficient supply of energy:**ERC keeps power supply sufficient to domestic consumption and distributes power to consumers in rural areas.

**Quality control:** ERC provides the energy service which is of high quality at maximum efficiency

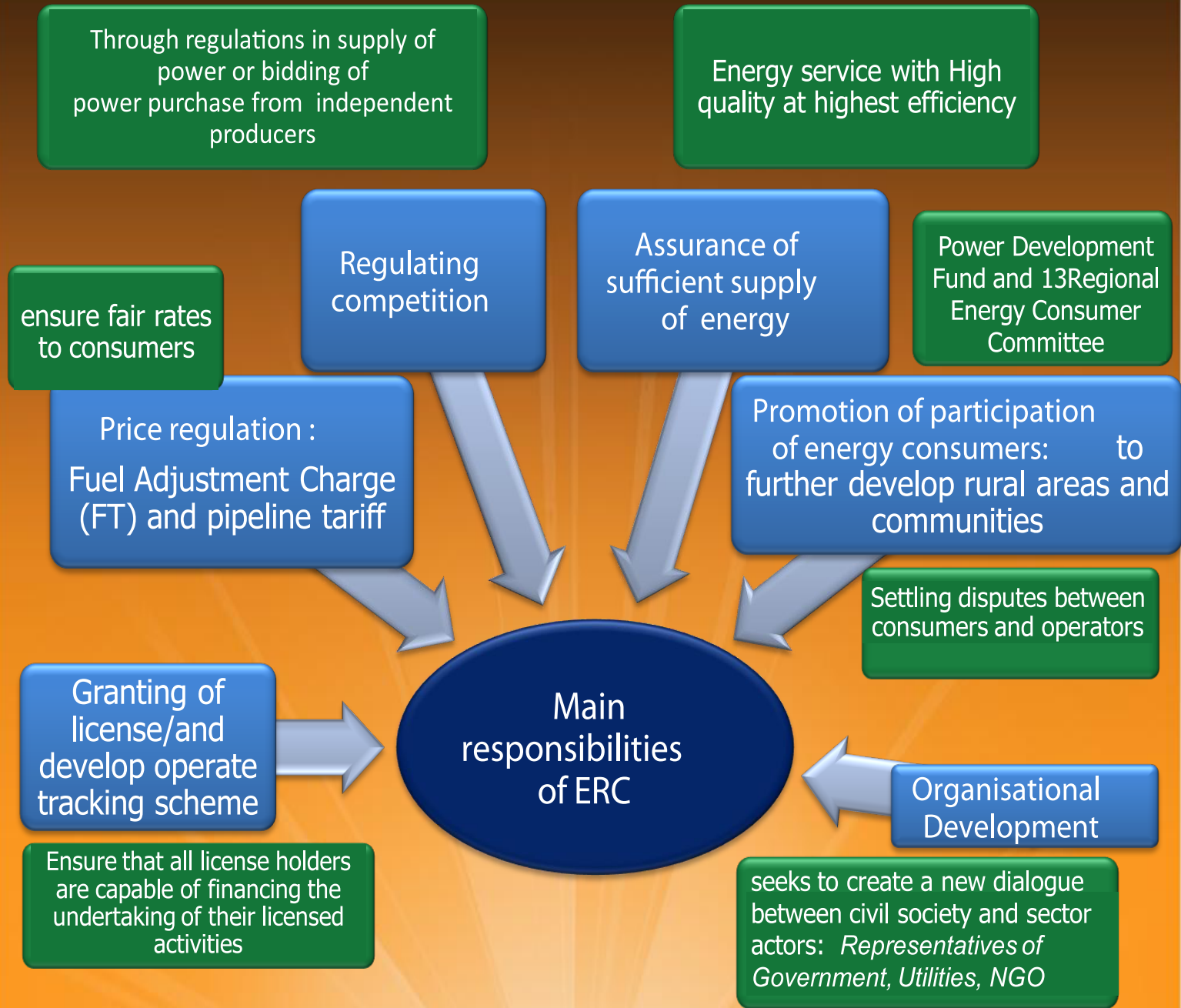
### **Promotion of participation of energy consumers**

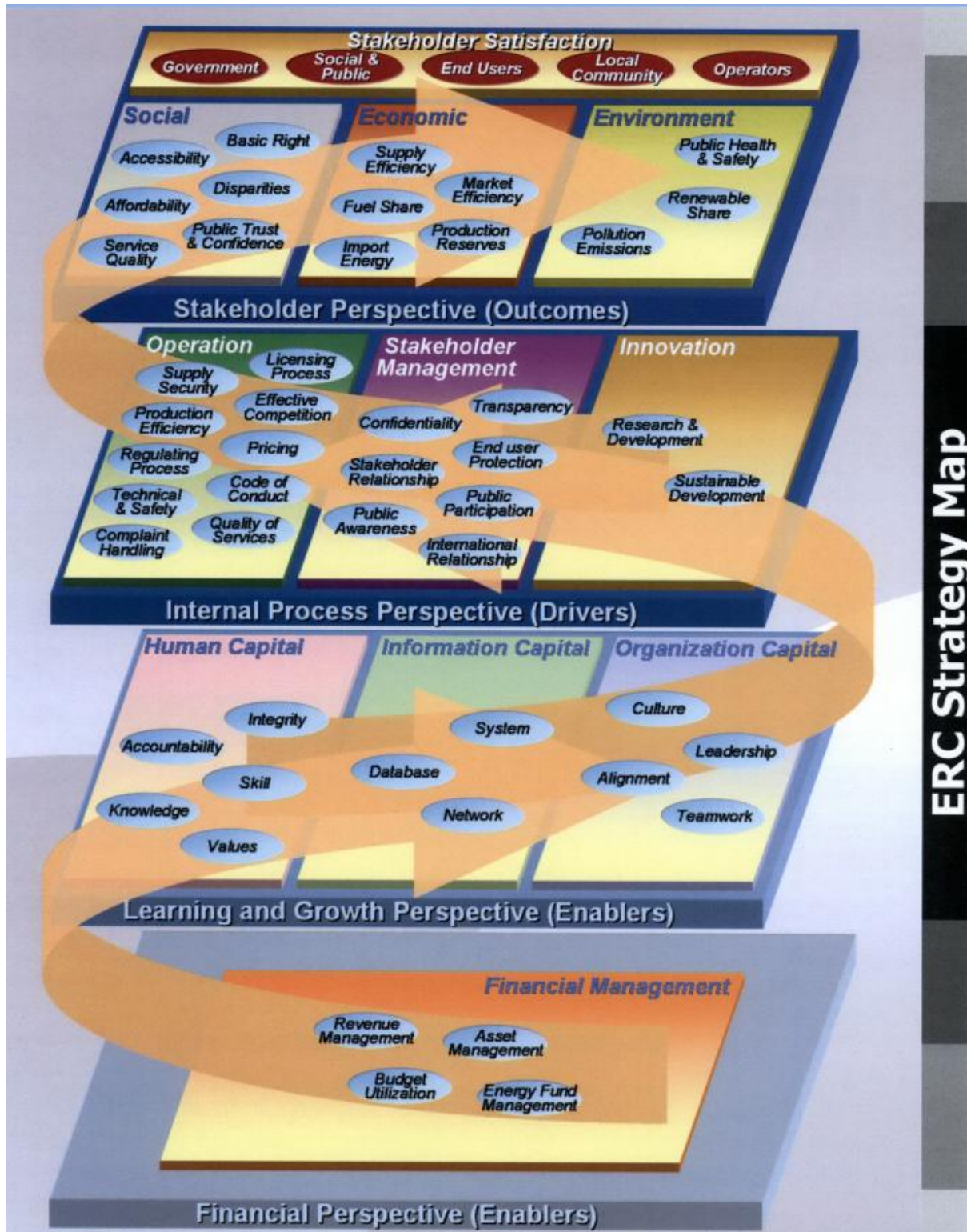
**Establishment of "Electricity Development Fund"** to raise financial support to thoroughly distribute power service to further develop rural areas and communities possibly affected by power-generating operations.

**Establishment of "Area Committees of Energy Consumers"** from representatives of the general public to help regulate local power consumption, and to receive complaints from them, or from business owners, and to respond to feedback from energy consumers in general. ERC now has 13 regional offices operating across the country.

**Regulations of real-estate properties** that will be used to build power or gas distribution and sale systems that will minimally affect communities

**Settling disputes between consumers and operators or their appeals**





ERC Strategy Map





Regulatory and the Energy Sustainability Forum

23<sup>rd</sup> March 2011- Bangkok, Thailand

- 
- 08.30 – 09.00 Registration
- 09.00 – 09.10 Welcome Speech  
**By Prof. Emeritus Dr. Direk Lavansiri (Chairman, ERC)**
- 09.10 – 10.00 Opening Ceremony  
& Keynote Address: Energy Sustainability  
**By H.E. Mr. Wannarat Channukul, Ministry of Energy**
- 10.00 – 10.30 Break
- 10.30 – 11.05 Plenary Session on “Energy Security: Capital Planning and Expansion”  
**By Dr. Dinh The Phuc**  
(Deputy Director General of Electricity Regulatory Authority of Vietnam)  
**Dr. Daovong Phonekeo**  
(Deputy Director General, Department of Electricity, Ministry of Energy and Mines, Laos)  
**Mr. Badri Prasad Rekhani**  
(Advisor of Electricity Authority of Cambodia)  
**Mr. Maury Galbraith,**  
(Oregon Public Utilities Commission: OPUC, The United States of America)
- 11.05 – 11.20 Questions & Answers
- 11.20 – 12.30 Plenary Session on “Regional Views on Energy Sustainability Issues including Renewable Energy”  
**By Mr. Max Dupuy**  
(Regional Coordinator, Regulatory Assistance Project)  
**Mr. Francis Xavier Jacob**  
(Energy Management and Industry Development, Energy Commission, Malaysia)  
**Mr. Syun Hidai**  
(Policy Planning Division, Agency for Natural Resources and Energy, METI, Japan)

12.30 □ 13.30

Lunch

**Place: Colonnade, Sukhothai Hotel**

13.30 □ 14.15

Plenary Session on “Regional Views on Energy Sustainability Issues including Renewable Energy” (Cont.)

**By Mr. Musa Metail**

(Deputy Director of Department of Electrical Services, Brunei)

**Mr. Nuzahar Hasril**

(Deputy Director of Electricity Business Regulation, Directorate General of Electricity and Energy Utilization, Indonesia)

14.15 □ 14.30

Questions & Answers

14.30 □ 15.00

Plenary Session on “Energy Security: Managing Demand through Efficiencies”

**By Ms. Susan Ackerman**

(Commissioner of Oregon Public Utilities Commission: OPUC,  
The United States of America)

**Patrick J. Oshie**

(Commissioner Washington Utilities & Transportation Commission,  
The United States of America)

15.00 □ 15.30

Break

15.30 □ 16.30

Plenary Session on “Energy Security: Managing Demand through Efficiencies”  
(Cont.)

**By Ms. Hui Chen Sharon Tan**

(Deputy Director of External Relations: Energy Market Authority of  
Singapore)

**Mr. Lee Okheon**

(Director of Smart Grid Team, Korea Electricity Regulatory Commission)

16.30 □ 17.00

Plenary Session on “WEC Sustainability Assessment”

**By Dr. Bundit Fungtammasan**

(World Energy Council Assistance Team)



**Plenary Session on**

**“Energy Security: Capital Planning and Expansion”**



# REGULATING DISTRIBUTED GENERATION IN CAMBODIA

BADRI PRASAD REKHANI  
Consultant to  
ELECTRICITY AUTHORITY OF CAMBODIA



## The Supply System in Cambodia

1. Large number (180 in 2009, 160 in 2010) of small isolated system having its own generation and distribution System supplying a small area (in most cases for part of the day)
  - ☐ Consolidated license consisting of generation and distribution license
  - ☐ high cost of supply resulting in high tariff
  - ☐ managed by entrepreneurs having limited technical and managerial capacities

## **Regulatory Aims of EAC**



- 1. Safe and Quality supply**
- 2. Fix standards of operating norms**
- 3. Lower cost of supply and tariff**
- 4. Gradually improve to 24 hours supply**
- 5. Make situation conducive to development of Grid System**

## **Regulatory Actions of EAC**



### **1. Issue of Regulations and Procedures**

- Procedure for issuing, revising, suspending, revoking or denying licenses
- Regulation on general conditions of supply
- Regulation on overall performance standards for suppliers
- Procedure for filing complaints to EAC and their resolution
- Regulation on general principles for regulating electricity supply
- Procedure for data monitoring, application, review and determination of tariff

## Regulatory Actions of EAC



**2. Issue Licenses** - for generation, distribution, transmission  
(individual and in combination)

**3. Detail monitoring of**

- Performance  $\square$  metering, loss, fuel consumption, load
- Cost of supply
- Design of distribution system
- Safety

**4. Provided advice on**

- Improvement of infrastructure
- Improvement of performance
- Safe and efficient operation
- Lowering of Cost of supply

## Regulatory Actions of EAC



**5. Determination of Tariff**

- Calculated on the basis of standard norms considering the size and operating conditions of the licensee
- Decided tariffs for different ranges of fuel cost so that the change in fuel cost can be reflected in tariff without going through the consultative process each time

**6. Incentivize improvement of supply system**

- Longer term of license - Supply Licenses with term of 5 years or more - by end of 2004 = 23%, By end of 2010 = 91%

**7. Encouraged mergers and extension of supply area**

- 9 licensees merged with their neighboring licensee
- Licensed area extended by 140 licensees

## Development of Grid Supply



### 1. High Voltage Lines

- 230 kV line from Vietnam to Phnom Penh with substations at Takeo and Phnom Penh (2009)
- 115 kV line from Thailand to Siem Reap with substation at Banteay Meanchey, Battambang and Siem Reap (2007)
- 115 kV lines around Phnom Penh with 3 substations

### 2. Medium Voltage Lines

- 22kV lines from Vietnam (11 locations), from Thailand (8 locations) and from Laos (1 location) to areas near the border
- 22 kV lines from substations or generating stations as part of the sub-transmission system
- 22 kV lines as part of the distribution system

## Development of Grid Supply

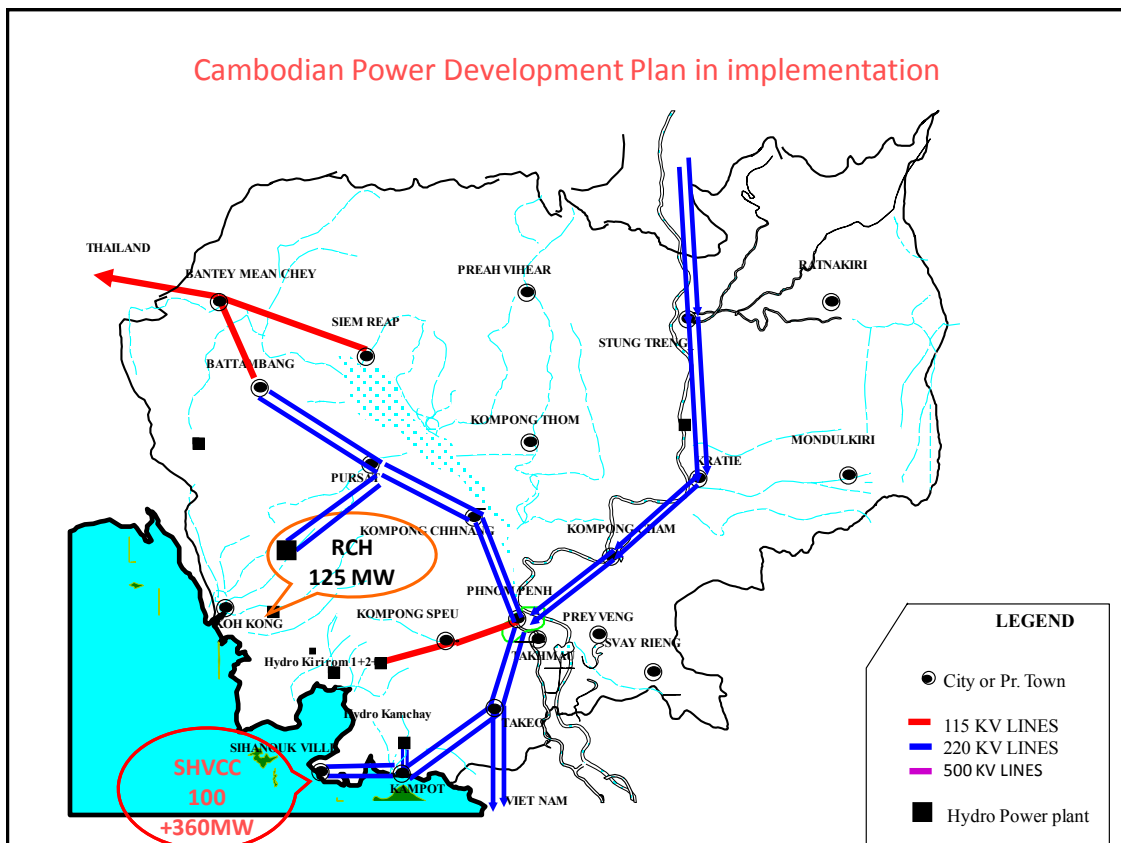
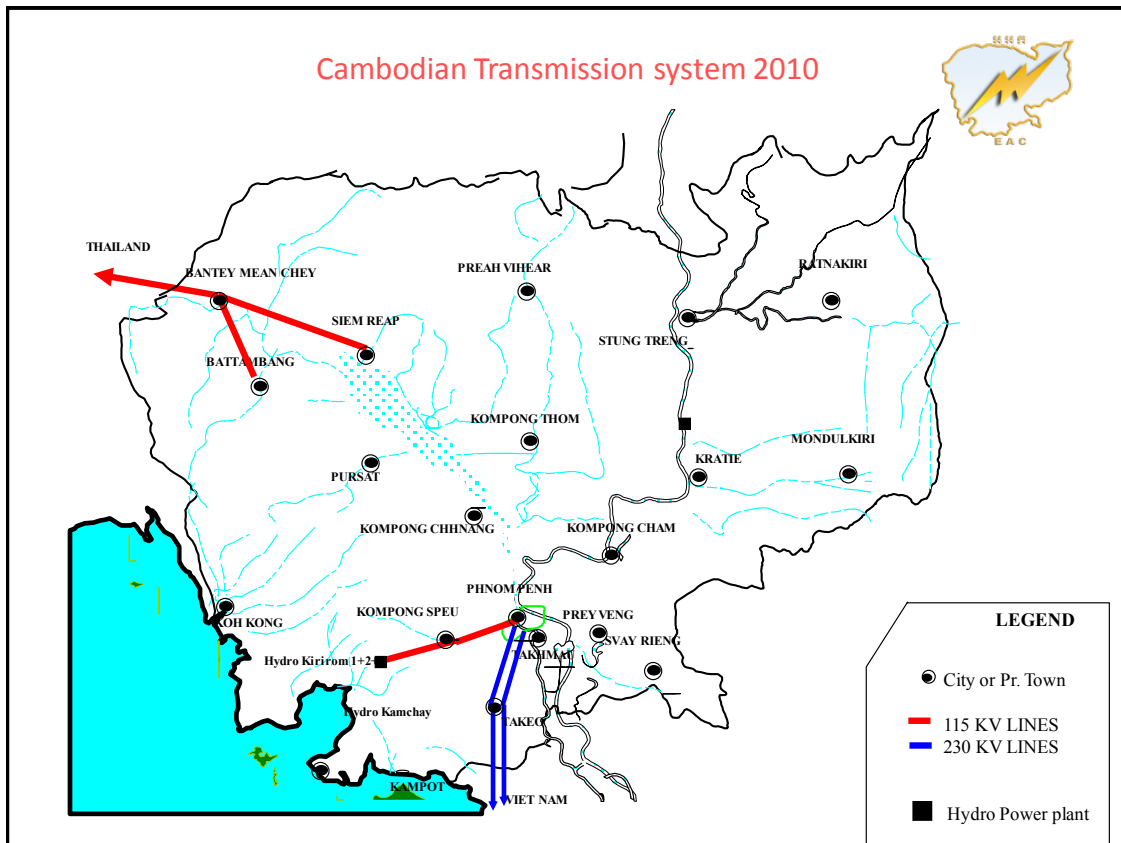


### 3. Licensees connected to grid supply

2008 ☐ 26, 2009 ☐ 47, 2010 ☐ 97

### 4. Improvements due to Grid Supply

- Substantial reduction in cost of supply resulting in lower tariff
- Supply extended to more areas
- more consumers can afford electricity supply
- Supply for 24 hours





THANK YOU

Energy Regulators Forum  
Regulation and Energy Sustainability  
Joint Session with Thai Agencies

# Integrated Resource Planning: Fundamentals

Maury Galbraith  
Manager, Electric Rates and Planning  
Oregon Public Utility Commission



March 23, 2011  
Bangkok, Thailand

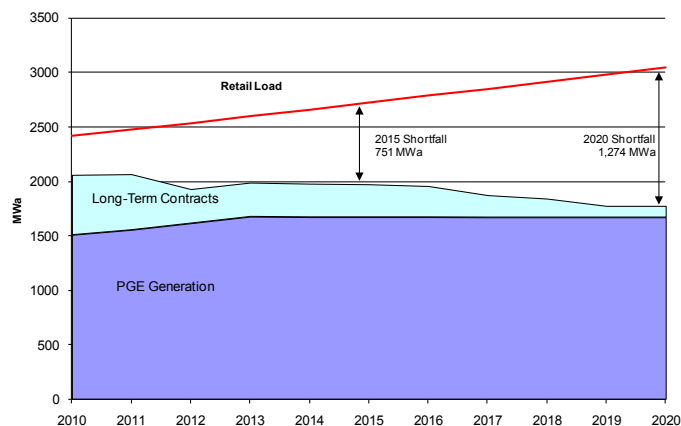


## Outline

- **Fundamentals of IRP:**
  - **Determine Resource Needs**
  - **Develop Multiple Resource Portfolios**
  - **Develop Multiple Future Scenarios**
  - **Select Portfolio with Best Combination of Cost and Risk for Customers**

## Substantive IRP Requirements

- 1. Primary Goal IRP: Plan to meet the utility's future electricity demands by selecting the portfolio of resources with the best combination of expected costs and associated risks and uncertainties for the utility and its customers.**



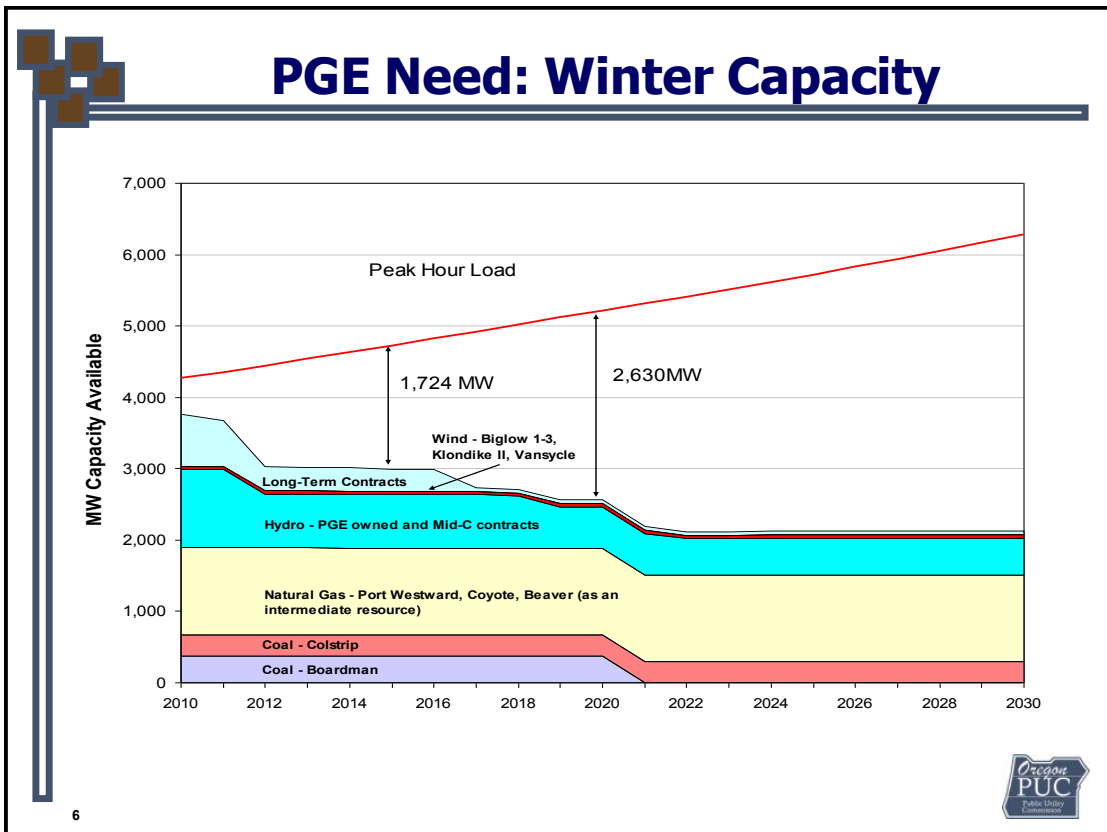
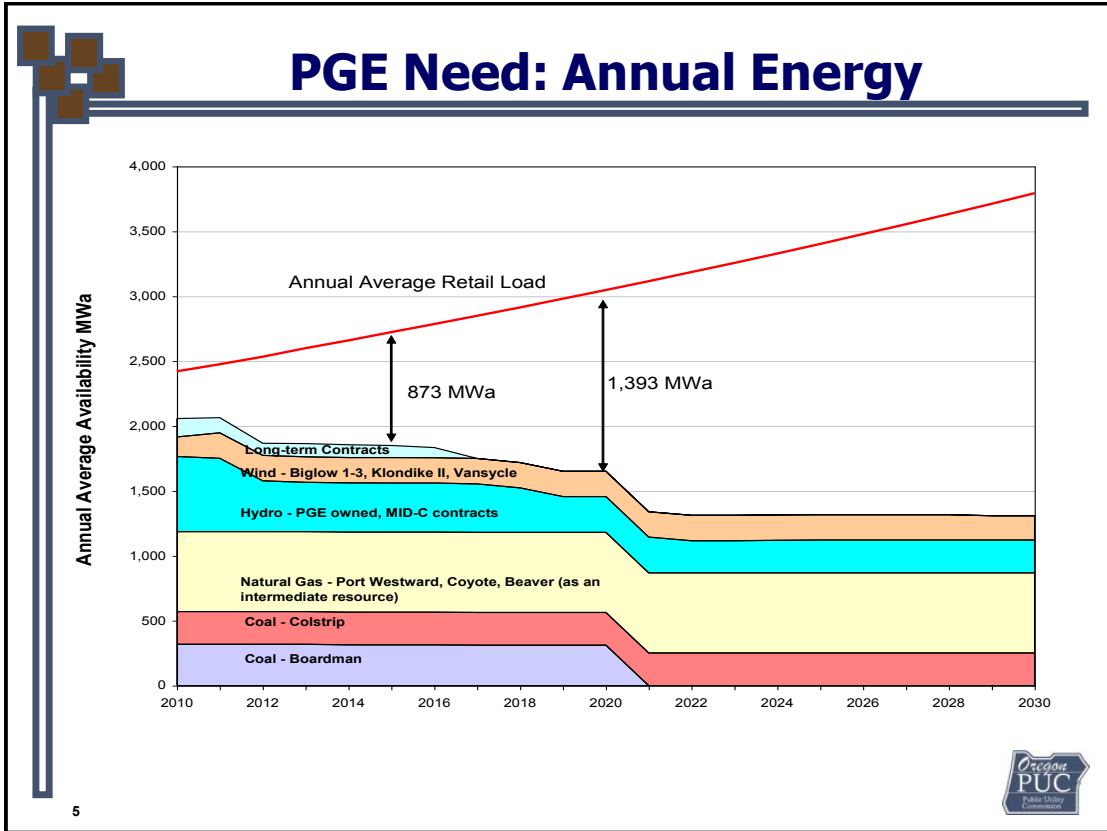
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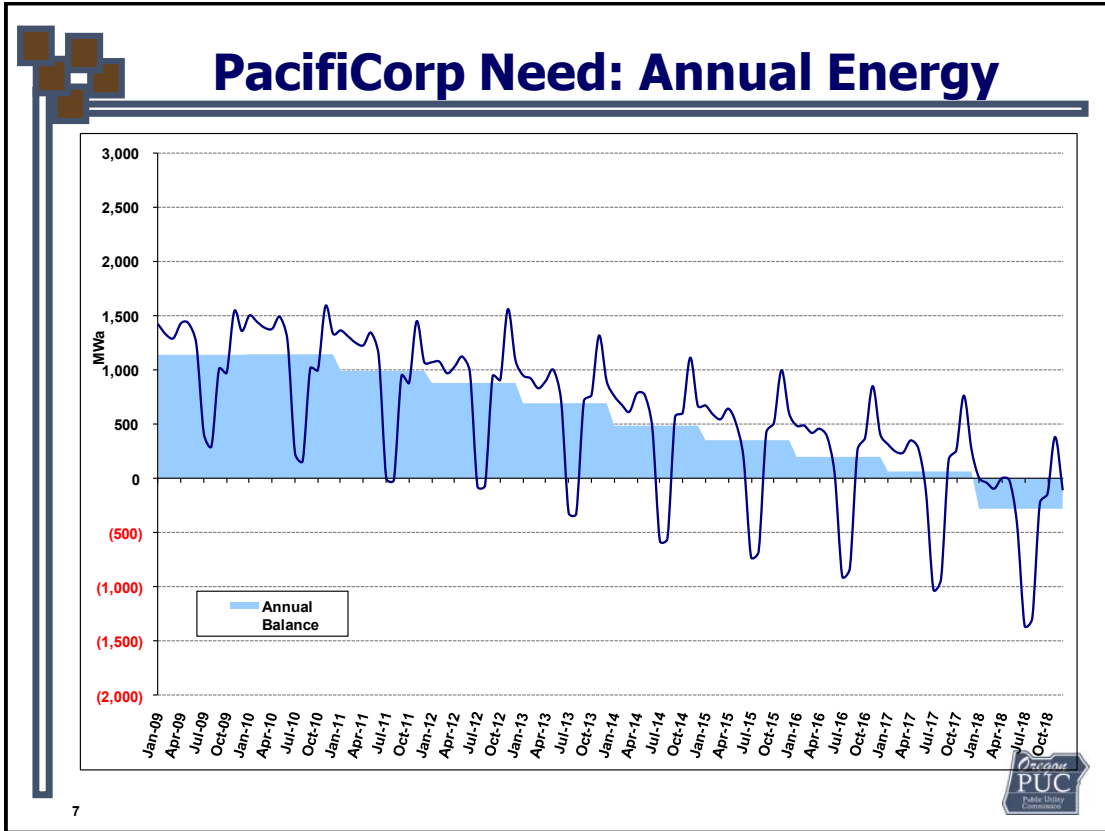
## More Substantive Requirements

- 2. All resources, including supply-side and demand-side options, must be evaluated on a consistent and comparable basis.**
- 3. Following sources of risk and uncertainty must be considered:**
  - Load forecasts
  - Wholesale electricity price forecasts
  - Natural gas price forecasts
  - Hydro generation conditions
  - Regulation of greenhouse gas emissions
- 4. Must be consistent with Oregon and U.S. energy policy.**

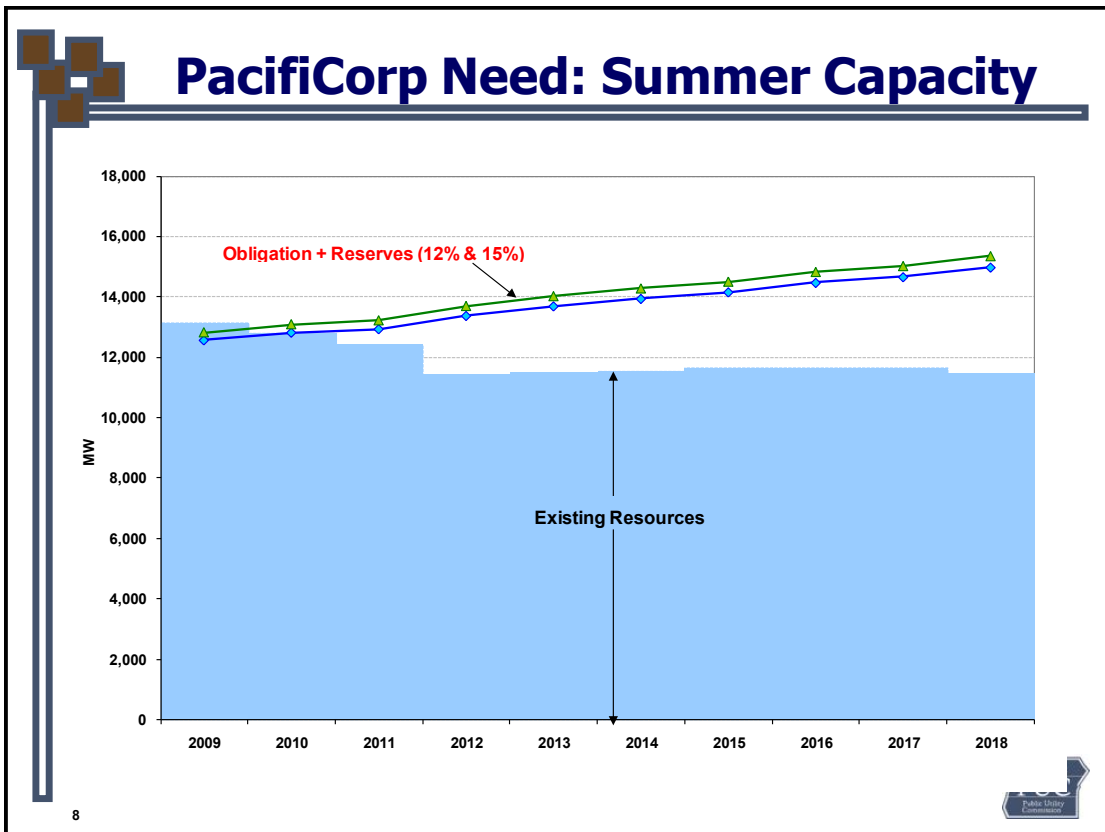


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## Develop Multiple Resource Portfolios

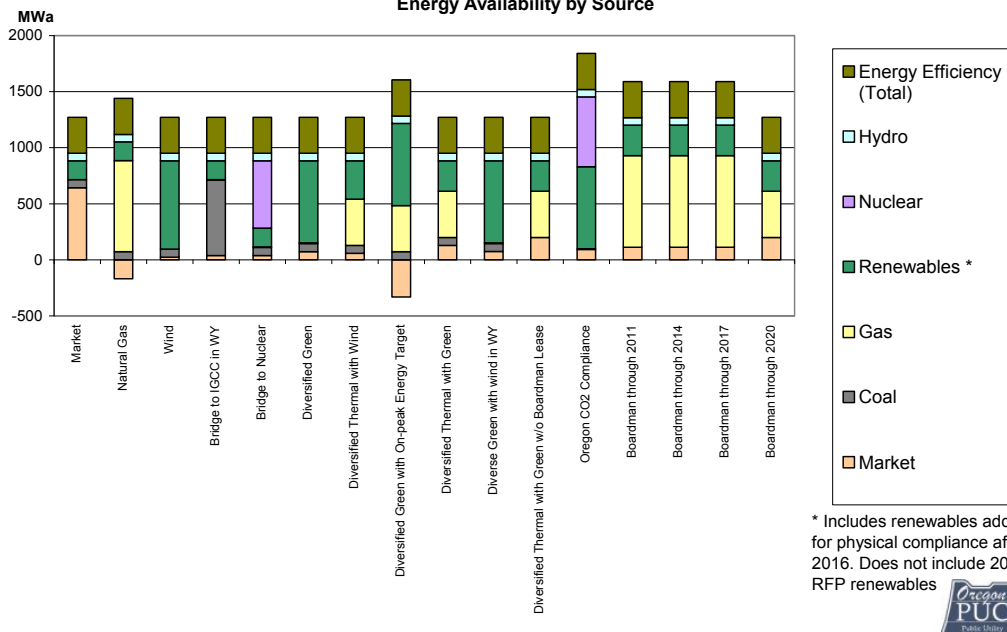
- Create and Evaluate Multiple Portfolios.
- Portfolios are Combinations of New and Existing Resources.
- Include both demand- and supply-side resources options.
- May include transmission expansion.
- Select the portfolio of resources with the best combination of cost and risk for the utility and its customers.



9

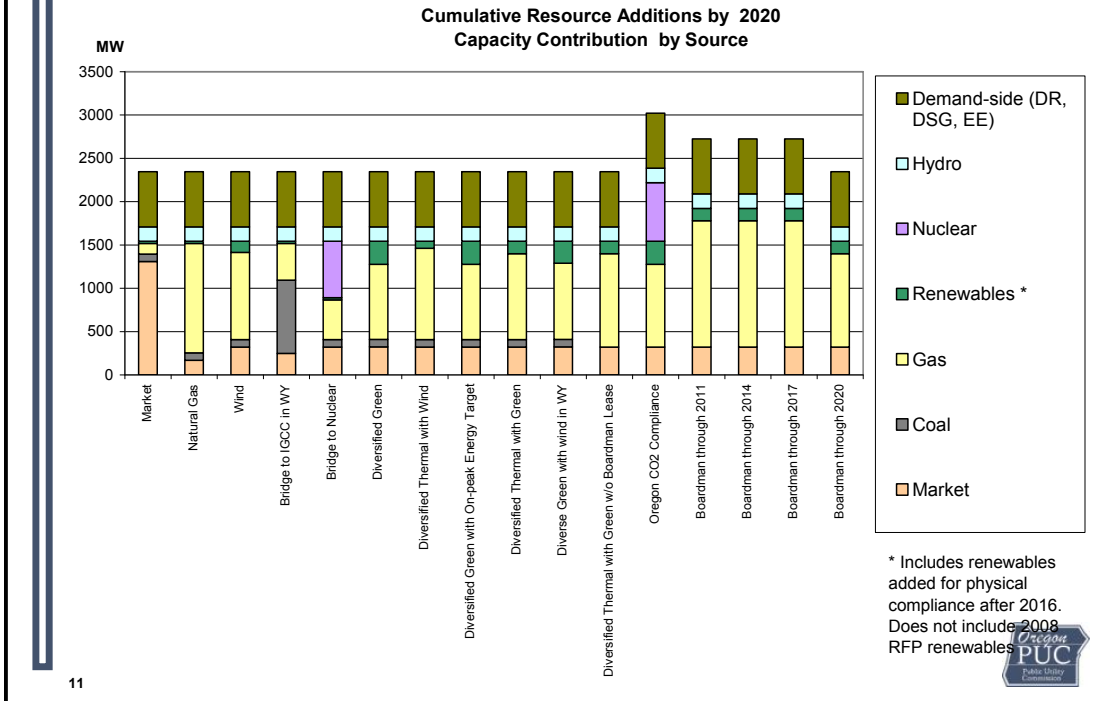
## PGE Portfolios: Energy

Cumulative Resource Additions by 2020  
Energy Availability by Source



10

## PGE Portfolios: Capacity

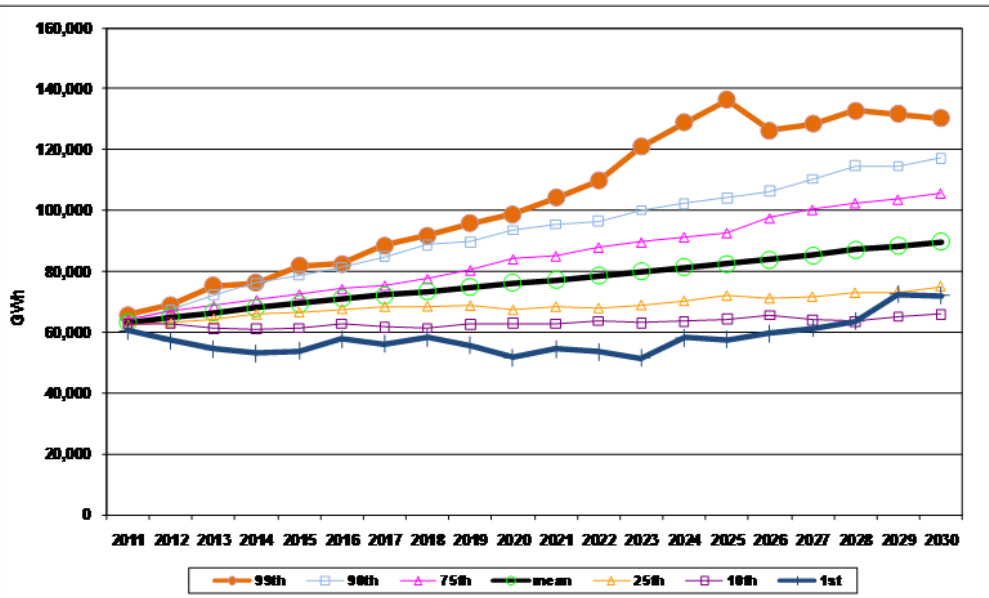


## Develop Multiple Future Scenarios

- Sources of future risk and uncertainty:
  - Load forecasts
  - Wholesale electricity price forecasts
  - Natural gas price forecasts
  - Hydro generation conditions
  - Regulation of greenhouse gas emissions
- Evaluate all resource portfolios on a consistent and comparable basis.
- Select the portfolio of resources with the best combination of cost and risk for the utility and its customers.

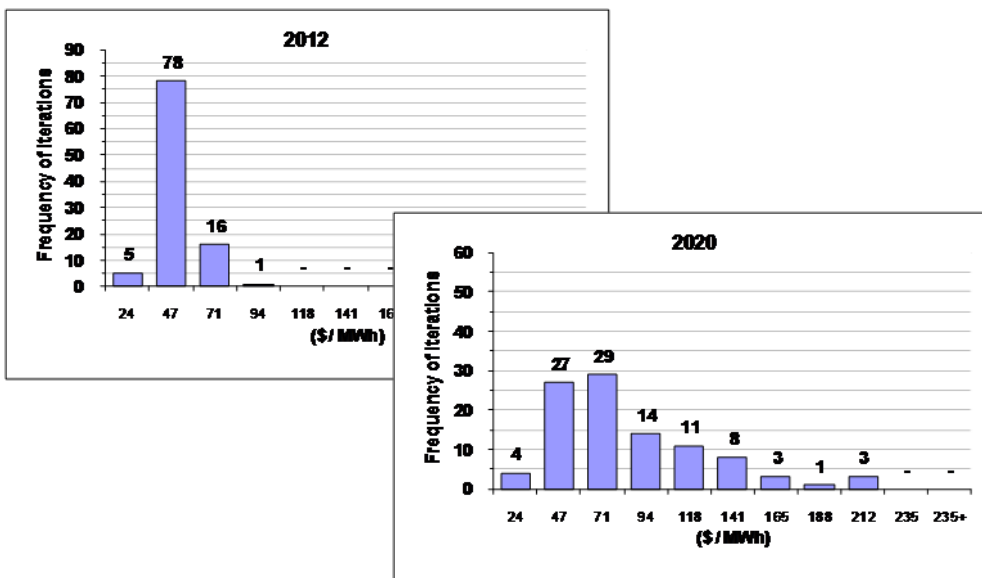
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## PacifiCorp Load Risk

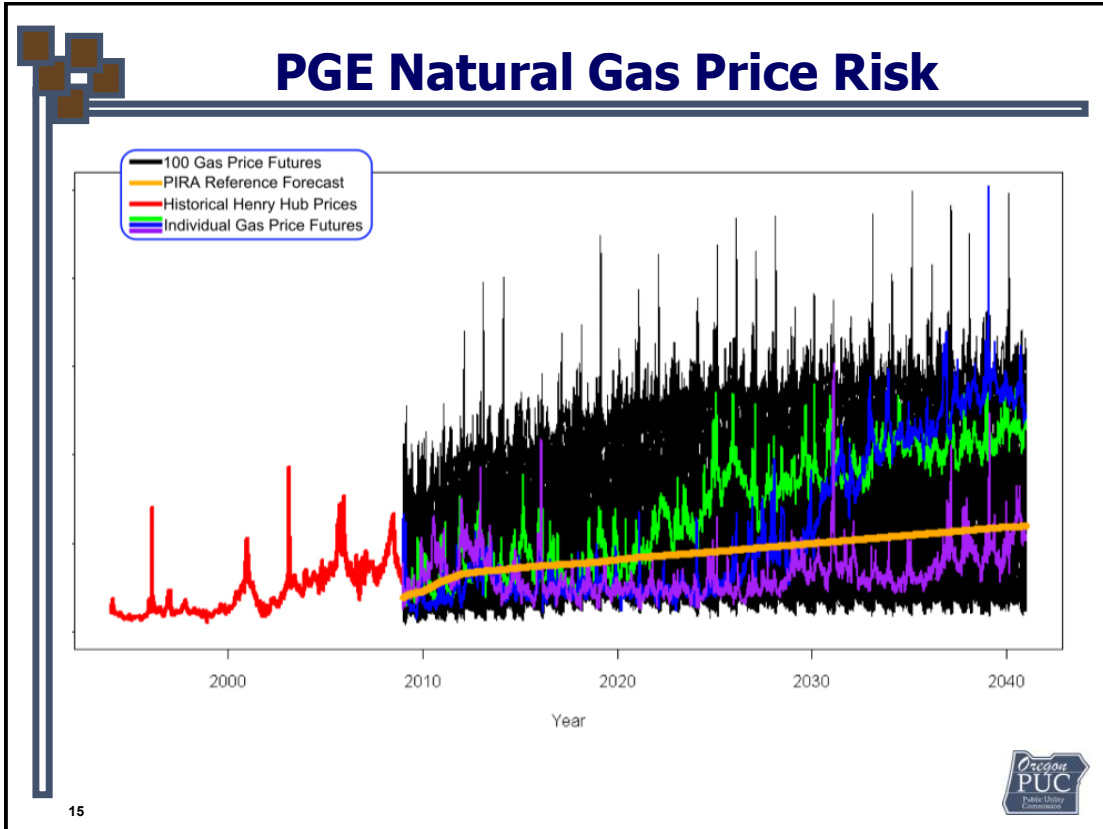


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## PacifiCorp Electricity Market Risk

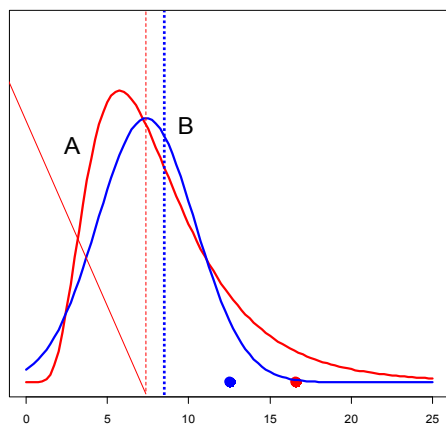


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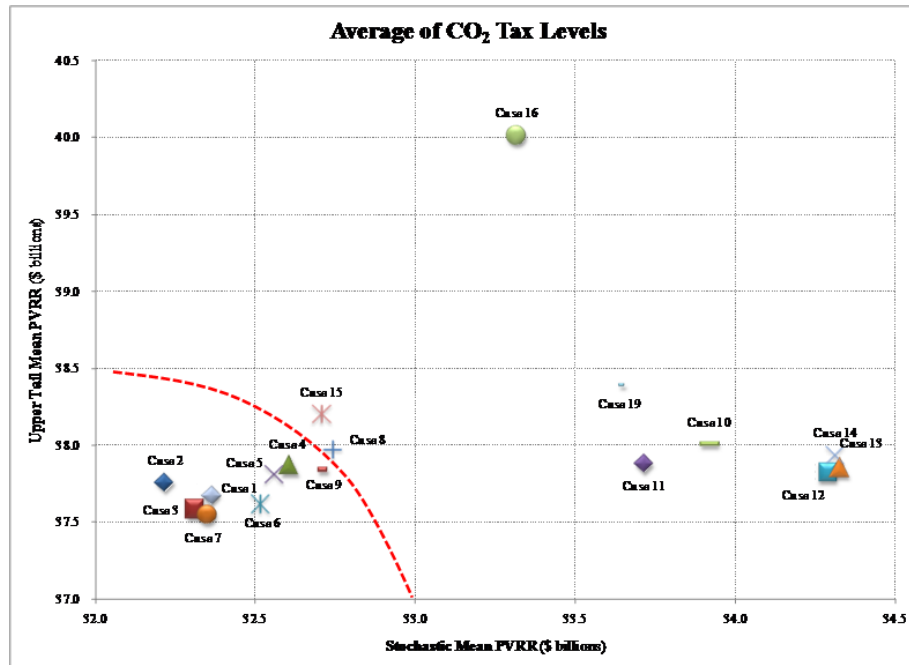
## Select Best Resource Portfolio

- **Cost Metric: Average Net Present Value Revenue Requirements (NPVRR).**
- **Risk Metric: Average of Worst 10 Percent Outcomes.**
- **Risk Metric is a Worst Case Cost Metric.**
- **Selection requires judgment.**



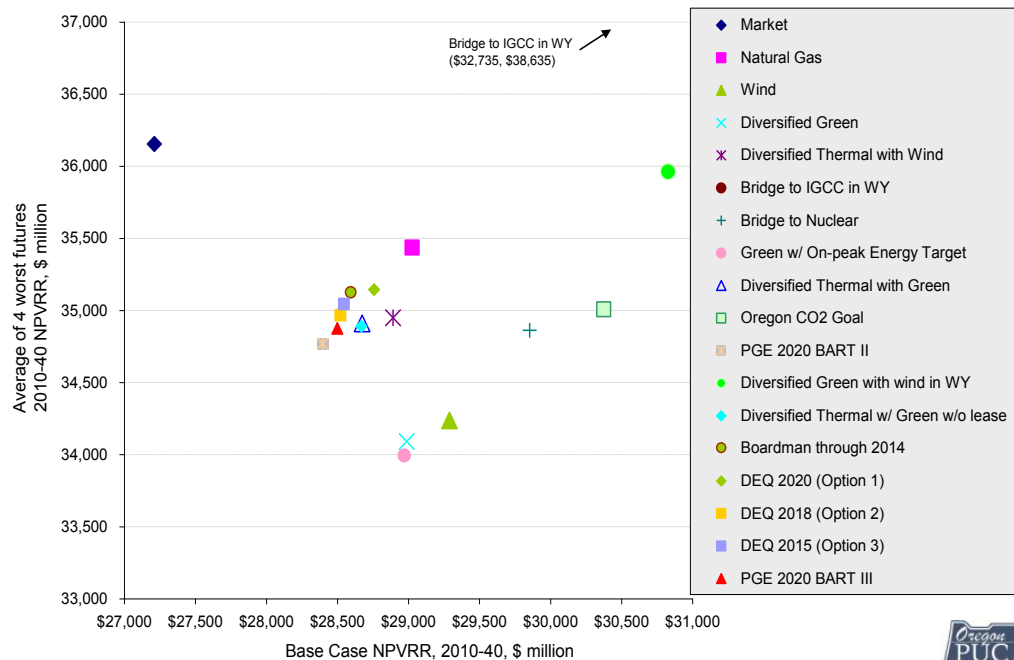
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## PacifiCorp Cost vs. Risk

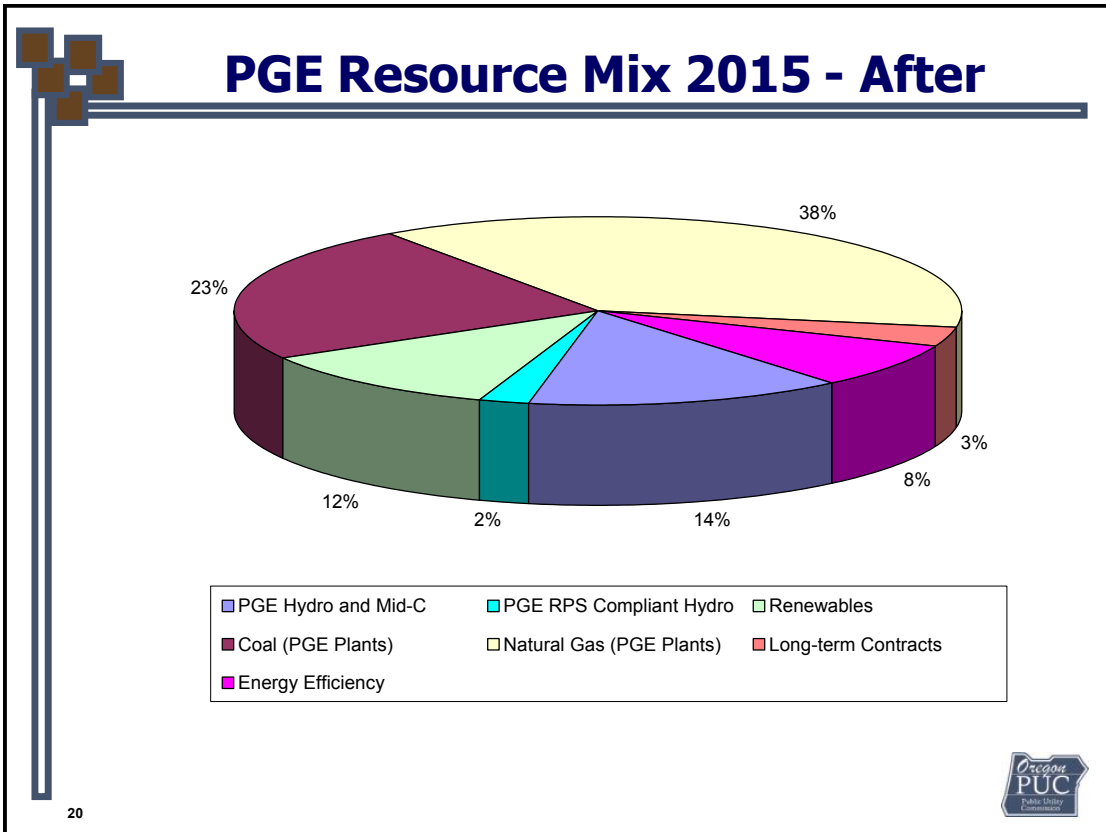
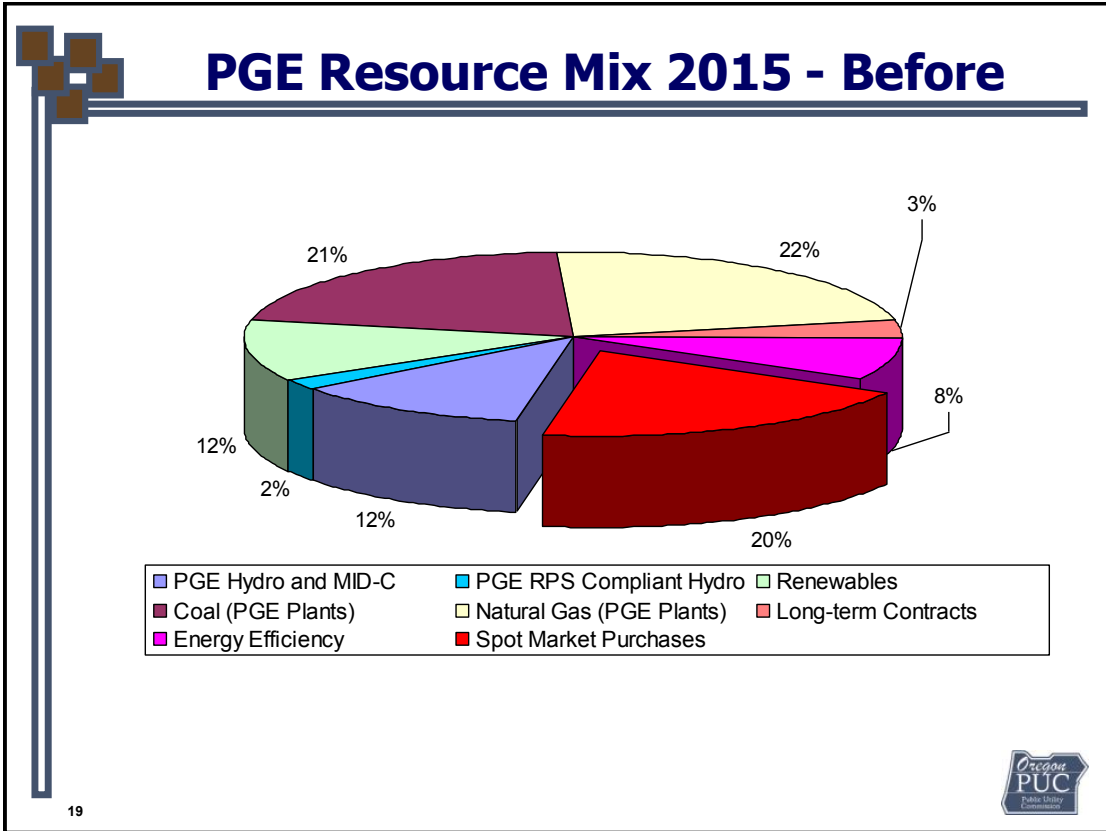


17

## PGE Portfolio Selection



18



## Summary

### Fundamentals of IRP:

- **Determine Resource Needs**
- **Develop Multiple Resource Portfolios**
- **Develop Multiple Future Scenarios**
- **Select the Portfolio with Best Combination of Cost and Risk for Customers**

21



## Conclusions

- **Public involvement in IRP is essential.**
- **Rigorous IRP is the best way for a utility to document prudent decision making and mitigate its cost recovery risk.**
- **Rigorous IRP allows the Commission to be proactive and forward-looking in its oversight of energy utilities.**
- **IRP is the best way to identify portfolios of resources that may provide the best combination of expected costs and associated risks for the utility and its customers.**

22



## Thank YOU

**Maury Galbraith**  
**Manager, Electric Rates & Planning**  
**Oregon Public Utility Commission**  
[maury.galbraith@state.or.us](mailto:maury.galbraith@state.or.us)

23



## Links to Utility IRPs

**Portland General Electric 2009 IRP:**

<http://www.portlandgenral.com/irp>

**PacifiCorp 2008 IRP:**

<http://www.pacificorp.com/es/irp.html>

**Idaho Power Company 2009 IRP:**

<http://www.idahopower.com/AboutUs/PlanningForFuture/irp/default.cfm>

**Puget Sound Energy 2009 IRP:**

<http://www.pse.com/energyEnvironment/energysupply/Pages/pseIRPcharts.aspx>

**Avista Utilities 2009 IRP:**

<http://www.avistautilities.com/inside/resources/irp/Pages/default.aspx>

24









**Plenary Session on  
“Regional Views on Energy Sustainability Issues  
including Renewable Energy”**

# Market-based mechanisms for GHG reduction – overview of some key lessons from international experience

March 2011

Max Dupuy

The Regulatory Assistance Project

China  
European Union  
United States

[www.raponline.org](http://www.raponline.org)

1

## Market-based mechanisms for emission reduction: examples

- EU Emissions Trading System
- US RGGI (Regional Greenhouse Gas Initiative)
- Australian White Certificate Schemes
- Italian White Certificate Scheme
- New Zealand ETS
- And more...

## Market-based mechanisms (MBMs) for emission reduction: general points

- MBMs can be useful in reducing GHG emissions
- However, they are just tools
- An overall low-carbon plan requires many tools; MBMs can't do the whole job
- Around the world, some success with MBMs, but also lots of mistakes

## Two types of market-based mechanism

**1. Permit scheme:** eg, “cap and trade” scheme

**1. Energy efficiency certificate scheme:** eg, “white certificate” scheme

## 1. Permit schemes

- Obligated parties required to obtain a permit for each unit of emissions
- “Cap and trade” is the best-know variety of permit scheme
- Examples: the EU ETS, New Zealand ETS and RGGI in the US

## 2. Energy efficiency certificate schemes

- One or more entities (eg, large firms or grid companies) are obligated to stay within a target level of emissions
- They do this by:
  - reducing own emissions
  - or by buying certificates representing EE implemented by others
- Eg: Australian, Italian and French white certificate schemes.

## Key Lessons (1)

- Market-based mechanisms must be carefully **designed and managed** to achieve a desired result
- International experience shows most market-based schemes have had to be modified numerous times to address unanticipated problems
- If secondary market trading is adopted, an agency must be designated and authorized to watch its performance closely and manage it carefully

## Key Lessons (2)

- A **clearly defined target or cap** is critical
- Policymakers often end up adding features that undermine their own cap or simply set the cap too high.
- If a scheme includes secondary market trading, the level of the cap will be the most important factor determining the value of the tradable instrument and the incentive to engage in trading

## Key Lesson (3)

- **Linking** the scheme to **energy efficiency** is essential
  - US RGGI is a good example: auction permits and use revenue for EE
  - Relying on price signals alone to reduce energy use and deliver gains in energy efficiency is unrealistic because, to achieve results, these prices will have to be unacceptably high

## Key Lesson (4)

- **Limiting** the initial pilot programs **to the power sector** is a reasonable approach
- No government has yet been successful in designing a single comprehensive market-based mechanism that covers all sectors
- Many governments have initially limited the focus to the power sector (or just a few sectors)
- As policies are fine-tuned, coverage can be broadened

## Conclusion

- The most successful market-based mechanisms are combined with programs that invest directly in energy efficiency
- Permit schemes can "recycle" or reinvest, revenue from permit sales into cost-effective efficiency programs
- Energy efficiency certificate schemes achieve this same result more directly by requiring obligated parties to invest in energy efficiency or buy efficiency certificates

# TOWARDS A SUSTAINABLE ENERGY INDUSTRY IN MALAYSIA



ENERGY COMMISSION, MALAYSIA

# ELECTRICITY SUPPLY SYSTEM

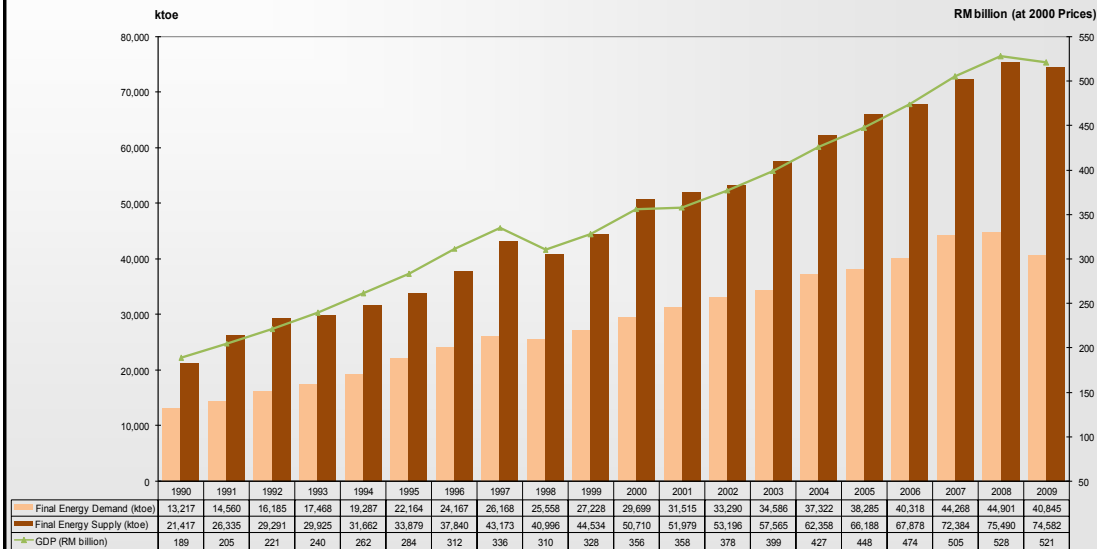


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2

## TREND IN GDP, PRIMARY ENERGY SUPPLY AND FINAL ENERGY DEMAND

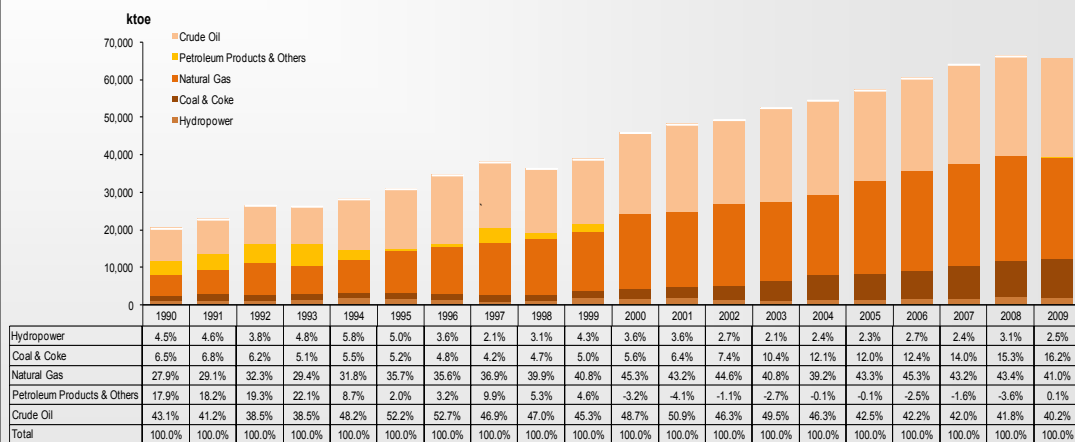


\* source: Preliminary Results - National Energy Balance 2009 Malaysia  
23 March 2011

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3

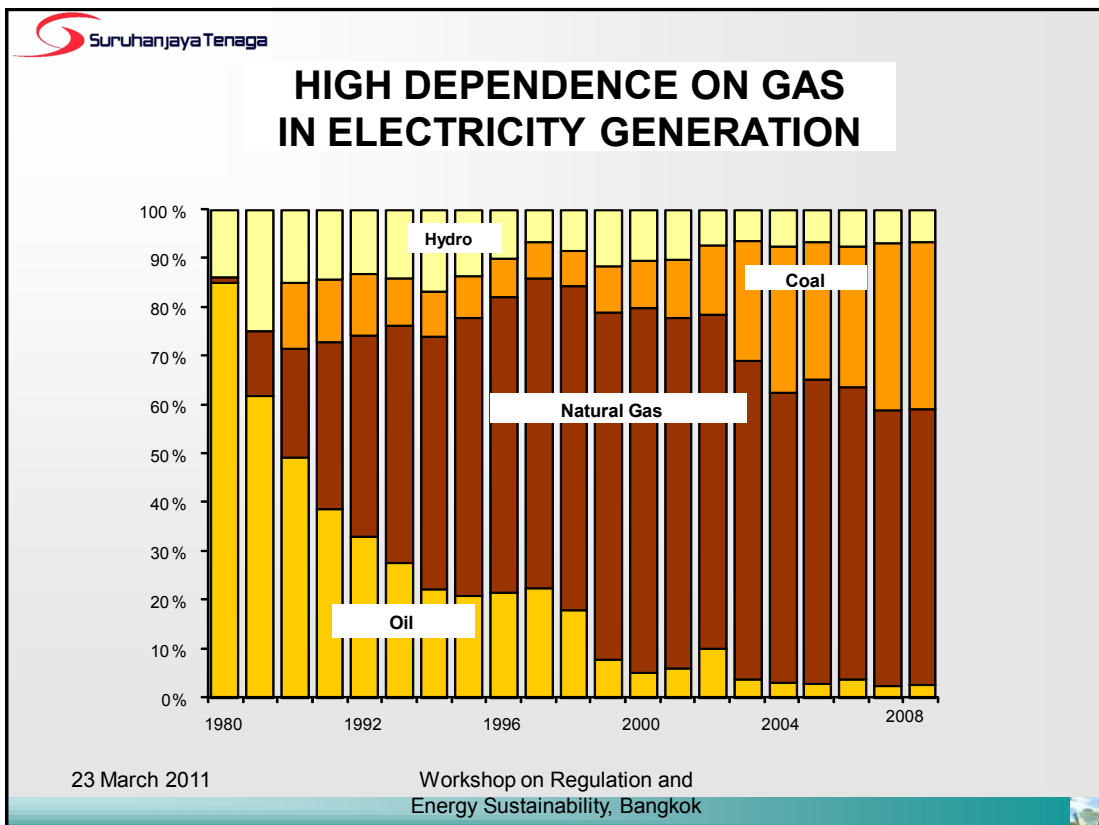
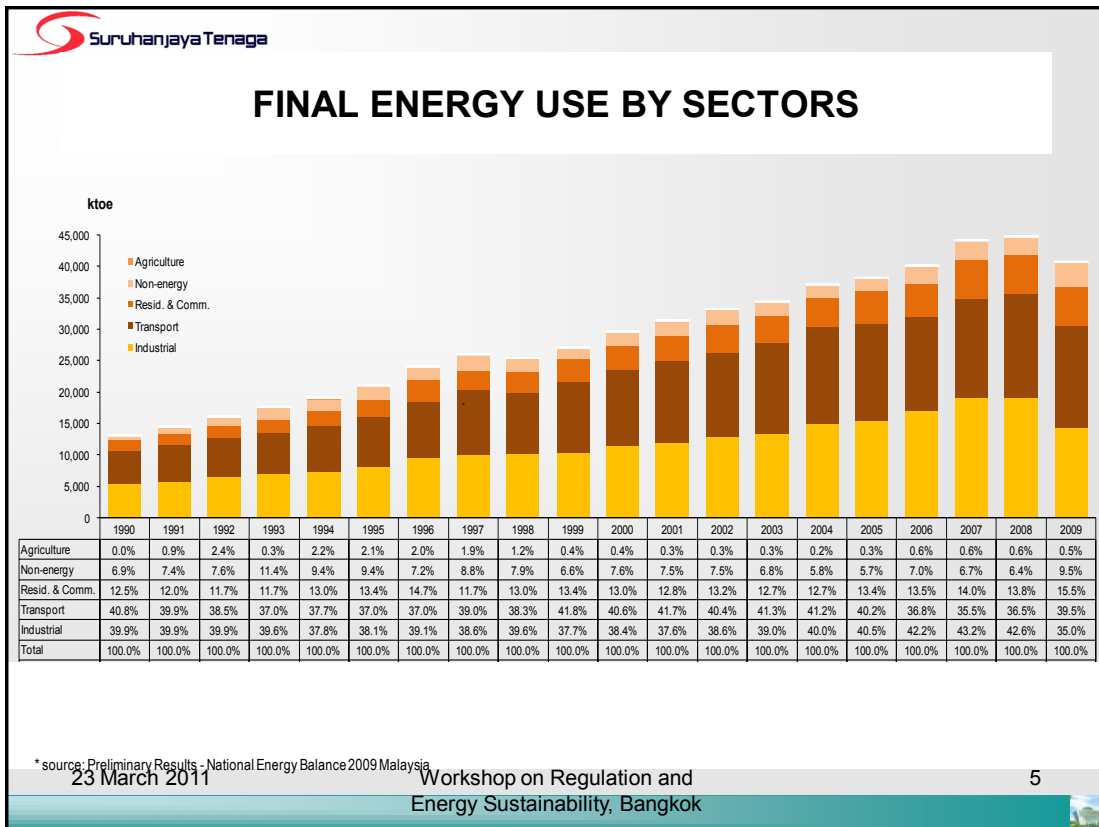
## COMMERCIAL ENERGY SUPPLY




\* source: Preliminary Results - National Energy Balance 2009 Malaysia  
23 March 2011

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Energy Sustainability, Bangkok

4




 Suruhanjaya Tenaga

### FUEL MIX IN ELECTRICITY GENERATION (%)

YEAR	OIL	COAL	GAS	HYDRO	OTHERS	TOTAL (GWHR)
1990	41.9	13.8	26.2	17.8	0.3	22,768
1995	11.0	9.7	67.8	11.3	0.2	41,813
2000	4.2	8.8	77.0	10.0	0.0	66,909
2005	2.2	21.8	70.2	5.5	0.3	94,030
2009	2.4	32.5	58.0	5.9	1.2	109,739
2010	1.7	40.0	52.7	5.5	0.1	114,310

23 March 2011 Workshop on Regulation and Energy Sustainability, Bangkok 7

 Suruhanjaya Tenaga

### Energy Industry Challenges

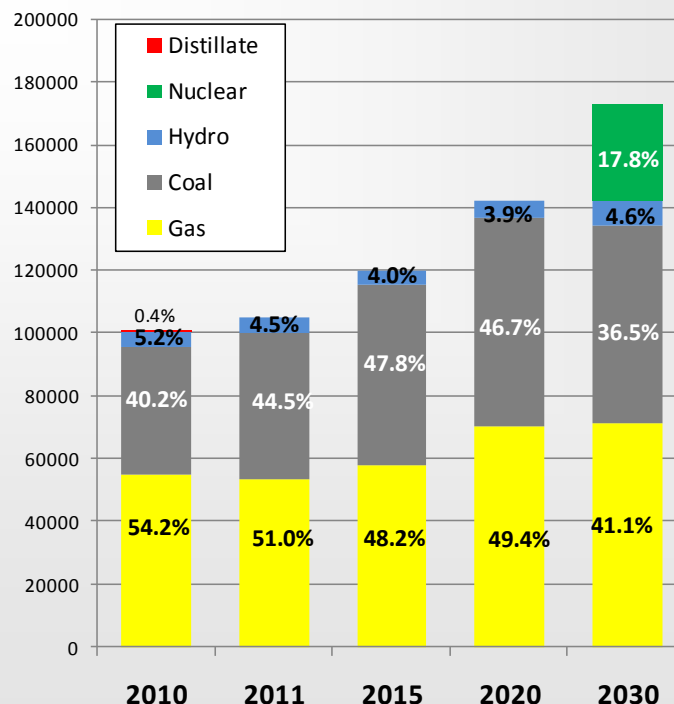
- Reducing fuel subsidies in line with the consumer affordability;
- Setting appropriate fuel prices;
- Enhancing industry competitiveness;
- Maximizing fuel economics potential i.e. LNG for export vs domestic used; and
- Materializing nuclear as one of fuel mix options.

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# Challenges

- **Balanced fuel mix vs. market-driven pricing**
  - Affordable tariff to consumer
  - Ensuring efficient utilisation
- **Demand side management**
- **Supply management**
  - Coal importation
  - Depleting indigenous gas
  - Logistics management
  - High demand growth in China, India, Indonesia and other developing countries
- **Intensifying renewable energy utilisation**


## Fuel Mix Projection □ Peninsular Malaysia





# GOVERNANCE FRAMEWORK

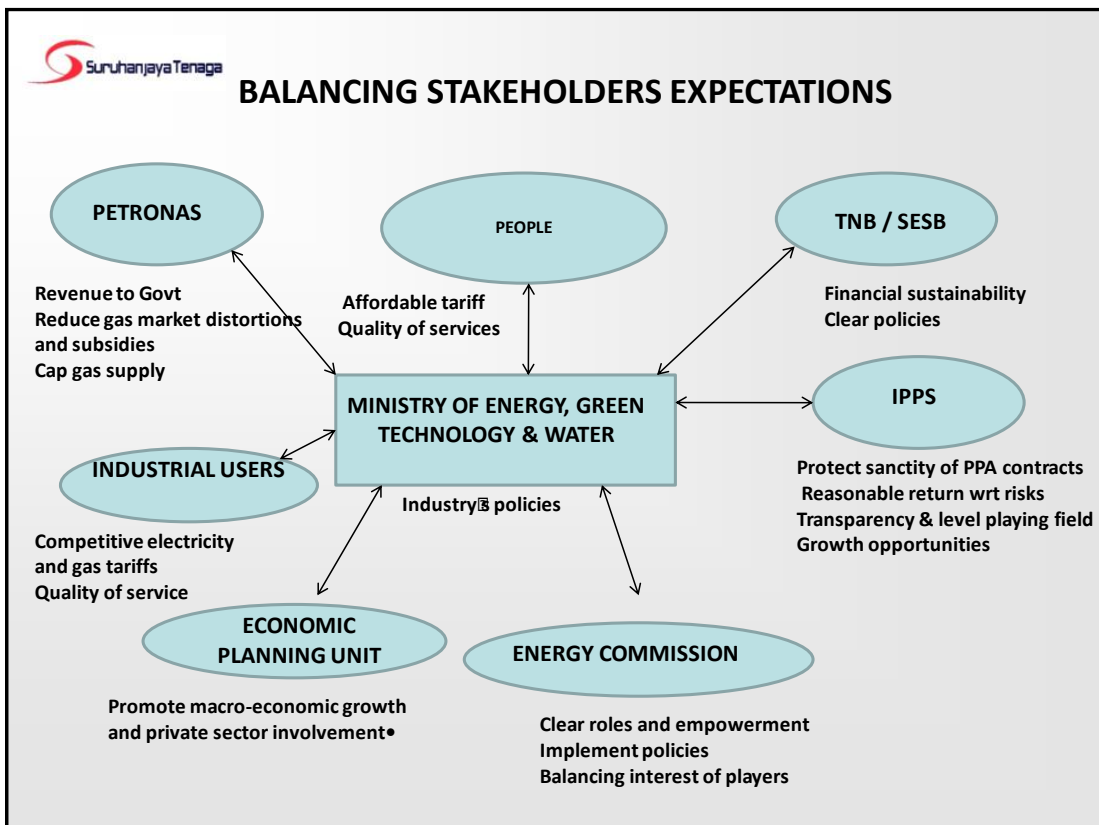
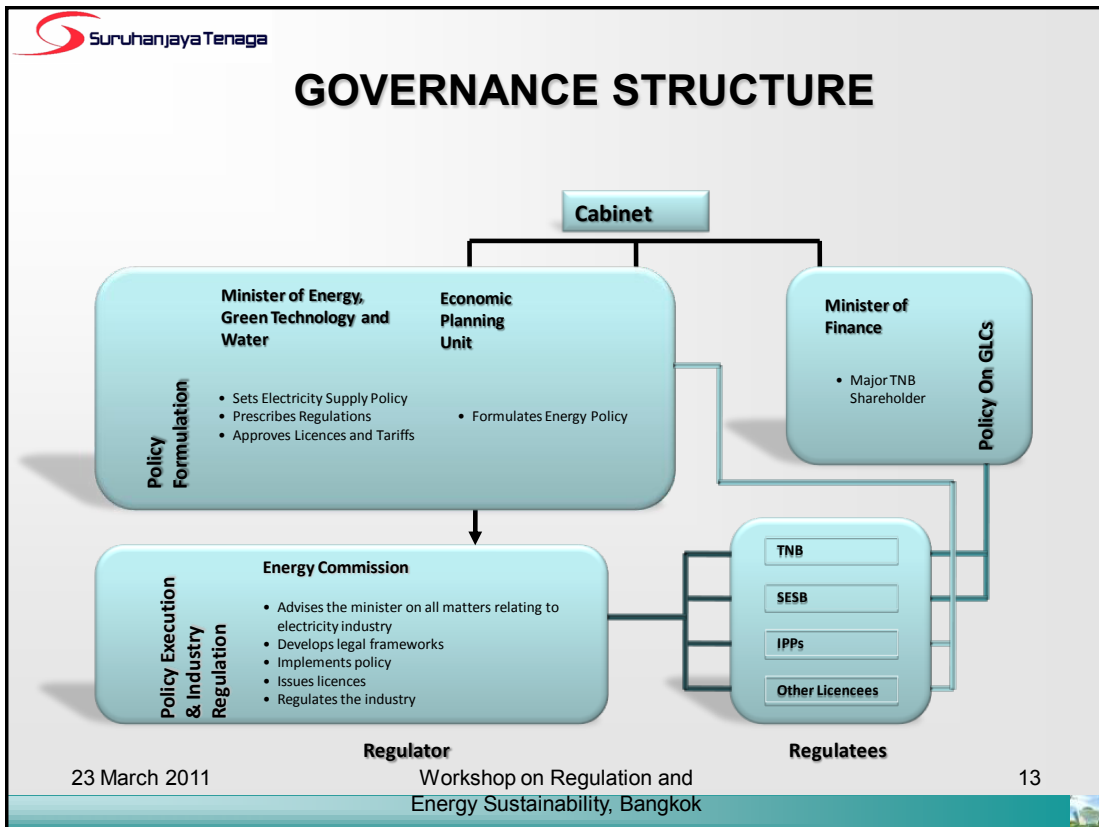
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## MAIN FUNCTIONS OF THE ENERGY COMMISSION [under Energy Commission Act 2001]

- Advise Minister on all matters concerning energy supply activities
- Implement, enforce and review energy supply laws (Electricity Supply Act 1990, Gas Supply Act 1993 and regulations)
- Promote efficiency, economy and safety in electricity and piped gas supply industries
- Promote competition and prevent misuse of monopoly power in electricity and piped gas supply industries
- Promote renewable energy and conservation of non- renewable energy
- Promote research and development of new techniques relating to supply and use of electricity and piped gas
- Promote self-regulation

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## Development in Electricity Supply Industry

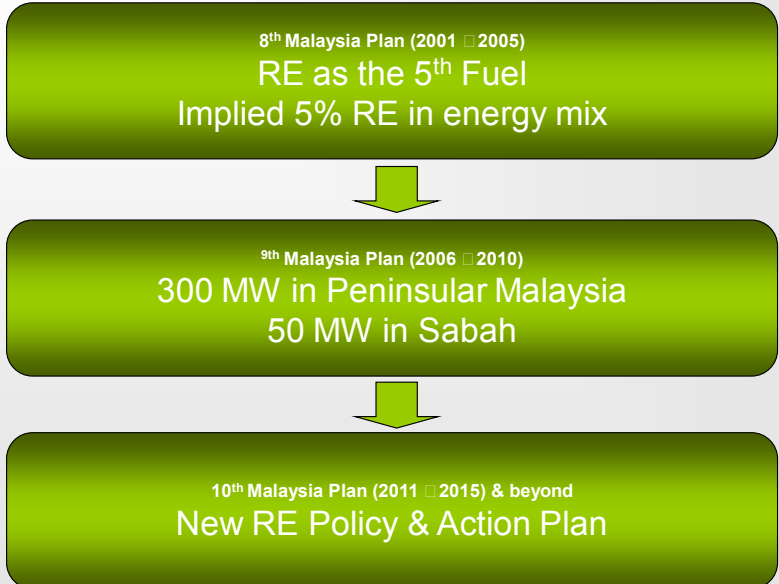
- Competitive Bidding for new 1000MW coal-fired power plant.
- Incentive Based Regulation
- Activity based licensing
- Guaranteed Service Level (GSL) / Minimum Service Level (MSL)
- Ring fencing of the Grid System Operator
- Revision of the Grid Code
- New Distribution Code

## USE OF RENEWABLE ENERGY RESOURCES




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## RE DEVELOPMENT IN MALAYSIA



```
graph TD; A["8th Malaysia Plan (2001 - 2005)  
RE as the 5th Fuel  
Implied 5% RE in energy mix"] --> B["9th Malaysia Plan (2006 - 2010)  
300 MW in Peninsular Malaysia  
50 MW in Sabah"]; B --> C["10th Malaysia Plan (2011 - 2015) & beyond  
New RE Policy & Action Plan"]
```


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## ISSUES AFFECTING RENEWABLE ENERGY UPTAKE

- Existence of market failure
- Constraints
- Lack of proper pricing mechanism
- Absence of regulatory framework
- Lack of institutional measures

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## SREP PROGRAMME

**Small Renewable Energy Power (SREP) Programme**


- Launched in 2001
- Objectives:**

To encourage production of RE by small power generators and allow the sale of generated electricity to utilities
- Administrative details:**

  - Special Committee on Renewable Energy (SCORE) chaired by the Ministry of Energy, Green Technology & Water was set up to coordinate the implementation of SREP
  - A secretariat which functions as a One-Stop Centre for the Programme has also been set up at Suruhanjaya Tenaga (ST) to help facilitate the industry's participation in the Programme.

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## RE POLICY AND ACTION PLAN

The Cabinet Meeting on 2 April 2010 had approved the:

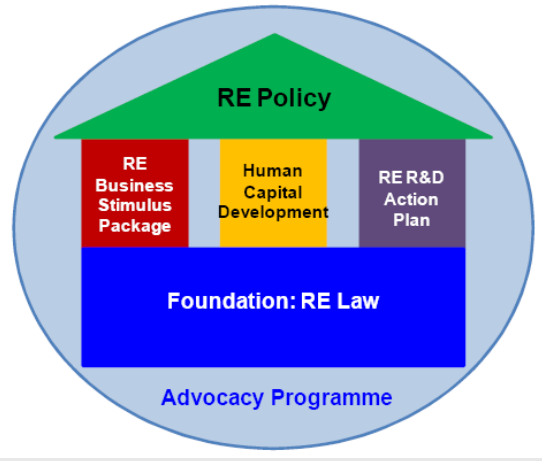
- i. Implementation of the new RE Policy and Action Plan;
- ii. Implementation of *Feed-in Tariff* (FiT) mechanism;
- iii. Establishment of the RE Fund; and
- iv. Establishment of a new statutory body as the implementing agency for RE
  - **Sustainable Energy Development Authority (SEDA)**

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## RE POLICY AND ACTION PLAN



The diagram illustrates the structure of the RE Policy and Action Plan. It is shaped like a house within a circle. The roof is a green triangle labeled 'RE Policy'. Below the roof are three vertical pillars: a red one labeled 'RE Business Stimulus Package', a yellow one labeled 'Human Capital Development', and a purple one labeled 'RE R&D Action Plan'. These three pillars sit on a blue rectangular base labeled 'Foundation: RE Law'. Below the entire house structure is the text 'Advocacy Programme'.

Synergies of RE Action Plan (5 strategic thrusts) leading towards a successful RE Policy

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## RE POLICY AND ACTION PLAN

### Strategic Thrusts

1. Introduce Legal and Regulatory framework
2. Provide Conducive Business Environment for RE
3. Intensify Human Capital Development
4. Enhance RE Research and Development
5. Create Public Awareness and RE Policy Advocacy Programmes

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## RE POLICY AND ACTION PLAN

### Strategic Thrust 1: Introduce Appropriate Legal Framework:

- A new RE Act
- Feed-in Tariff (FIT)
- RE Fund (and Professional Fund Manager)
- FIT Implementing Agency
- Responsibilities and obligations on power utilities and RE developers

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## RE POLICY AND ACTION PLAN

### Strategic Thrust 2: Creating a Conducive Business Environment for RE Business:

- Promotion of RE business  SMEs and manufacturing
- Long term low interest financing
- Standard evaluation process
- Fiscal incentives
- Special incentives for locally developed R&D
- Incentives to promote local content
- RE Centre for SMEs

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24

## RE POLICY AND ACTION PLAN

### Strategic Thrust 3: Intensify Human Capital Development:

- RE in technical and tertiary curricula
- RE training institutes and centres of excellence
- Pool of experts to fulfil local and overseas market
- Fiscal relief for RE courses
- Financial incentives for training programmes

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## RE POLICY AND ACTION PLAN

### Strategic Thrust 4: Enhance RE Research and Development:

- RE R&D Action Plan □ reduce cost of technology and promote wider application
- Coordination and cooperation in technology and economic research between government and private sector
- Strong linkages between local and international research institutes
- Development of RE innovations

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## RE POLICY AND ACTION PLAN

Strategic Thrust 5: Create Public and Stakeholder Awareness and RE Policy Advocacy Programmes:

- Effective and continuous information dissemination
- Relationship with media, NGOs and private entities
- Demonstration programmes
- Awareness in primary and secondary schools
- Periodic monitoring and evaluation of RE developments

## RE POLICY AND ACTION PLAN

### Policy Statement

Enhancing the utilisation of indigenous renewable energy resources to contribute towards national electricity supply security and sustainable socio-economic development

## RE POLICY AND ACTION PLAN

### Objectives

1. To increase RE contribution in the national power generation mix
2. To promote the growth of the RE industry and increase its contribution towards the national economy
3. To enhance competitiveness of RE
4. To conserve the environment for future generations
5. To enhance awareness on the role and importance of RE

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29


## RE POLICY AND ACTION PLAN

- Goals:
  - 2015: 985 MW (6%)
  - 2020: 2,080 MW (11%)
  - 2030: 4,000 MW (17%)

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## RE Current Status


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### STATUS OF SREP Projects (as at 1 March 2011)

No.	Energy Sources	No. of Approved Projects	Grid Connected Capacity (MW)	Remarks
1	Biomass			
	Empty Fruit Bunch	16	158	4 projects with 40MW are already operational
	Wood Chips	1	5	
	Rice Husk	1	10	
	Municipal Solid Waste	1	5	This project is already operational
2	Landfill Gas	2	3	1 project of 2MW is already operational
3	Biogas (agro-based)	6	15.85	2 projects of 2.95MW already operational
4	Mini-hydro	12	67.7	4 projects with 12.5MW already operational
5	Wind & Solar	0	0	
	<b>Total</b>	<b>39</b>	<b>264.55</b>	<b>12 projects with total capacity of 62.45 MW are already operational</b>

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32


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## MALYSIAN BUILDING INTEGRATED PHOTOVOLTAIC (MBIPV) PROJECT

**Objective:** To reduce GHG emission by reducing long-term cost of BIPV technology via development of a sustainable BIPV market

- ST is the main supporting role in the provision of cash support to the project □ providing total fund of approximately RM16.15 million;
- ST acts as Chairman of the Project Review Committee (PRC) to monitor and evaluate successful implementation of the project activities and outcomes;
- Suria 1000 Program □ provides direct opportunities to public & industry to be involved in RE initiatives. As at 30 June 2010, projects with total capacity of 1,524 kWp were approved; whereby 488 kWp were commissioned.

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## CONCLUSIONS

- Development of RE projects not very encouraging
- RE Policy and Action Plan being established
- Ambitious goals being set

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The logo for Suruhanjaya Tenaga, featuring a red stylized 'S' followed by the text 'Suruhanjaya Tenaga' in black.

**THANK YOU**

23 March 2011

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Energy Sustainability, Bangkok

35

A small image of a modern building with a glass facade, located in the top right corner of the slide.







**Plenary Session on  
“Energy Security: Managing Demand through  
Efficiencies”**

Energy Regulators Forum  
Bangkok, Thailand  
**Smart Grid & Demand Response**

Susan K. Ackerman,  
Commissioner  
Oregon Public Utility Commission  
March 23, 2011



**Smart Grid & Demand Response**

- Why the White House is excited by Smart Grid:
  - Climate Change: helps to integrate renewable (but variable) generation.
  - Efficiency and Cost Reduction: allows utilities to use load management to delay or defer expensive investment
  - Reliability: if the entire electric grid is automated with new technology, then:
    - Reduced chance of outages
    - Faster recovery when there are outages



## Smart Grid & Demand Response

- Conversation in the US substantially about residential consumers:
  - Smart meters
  - Pricing regimes that send signals to customers to reduce demand
  - Demand response programs to reduce peak demand or manage timing of new investment
  - Consumer goods that can respond to price signals
  - Tools to help consumers manage energy use



3

## Smart Grid & Demand Response

- In the US, active coordination between federal government (White House) and states
- Differing jurisdictional responsibilities:
  - Federal government: overall policy; setting standards such as inter-operability
  - State regulators: ground level implementation through evaluation of utility smart grid investments.
- Some tension: how do we get it done but get it right?



4

## Smart Grid & Demand Response

- View from the states:
  - Agree with White House about Smart Grid promise
  - But, state regulators have legal obligation to protect consumers
  - Many detailed issues for state regulators: privacy concerns, consumer education, benefits must outweigh costs, need for cyber-security
  - Technical difficulties of merging old and new technology
  - *State regulators will treat smart grid investments just like any other utility investment: critically.*



5

## Smart Grid & Demand Response

- Smart grid is a significantly bigger issue than smart meters and demand response
- Smart grid is a multi-faceted technological conversion and substitution of old technology with new technology
- This conversion will be evolutionary, not revolutionary
- It will take time



6

## Smart Grid & Demand Response

- Conclusions:
  - It may not be optimum to focus on small energy users right now
  - Focus instead on
    - automating the electric grid infrastructure
    - creating demand response programs for large energy users
    - Integrating renewable resources
  - Small energy users will eventually get involved



7

## Smart Grid & Demand Response

Questions?



8

# An Intelligent Energy System Singapore's Smart Grid Initiative

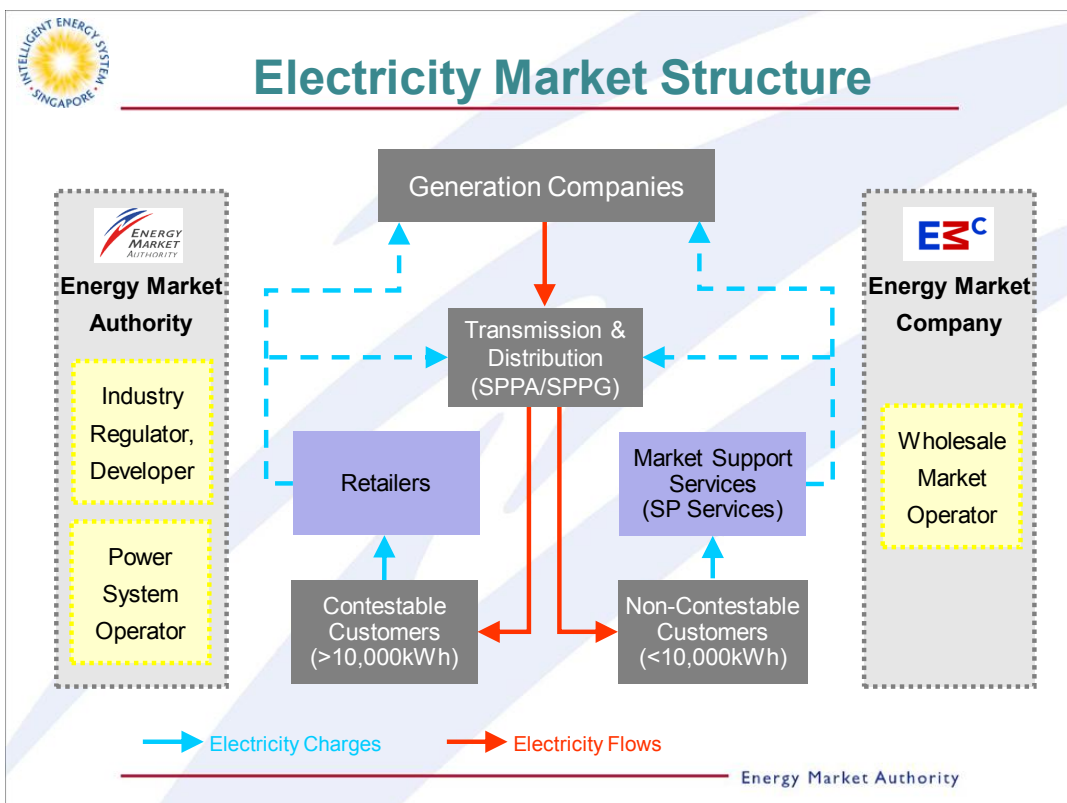
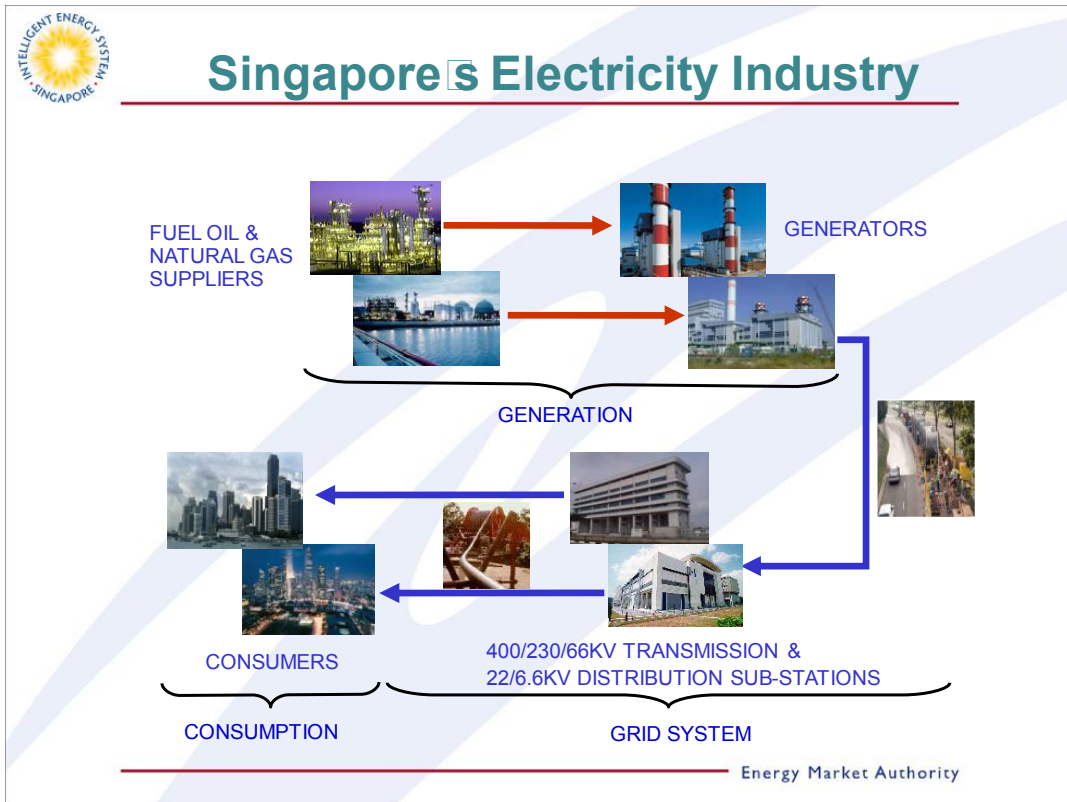
*Energy Regulators Forum on Regulation and Energy Sustainability  
Bangkok, 23 March 2011*

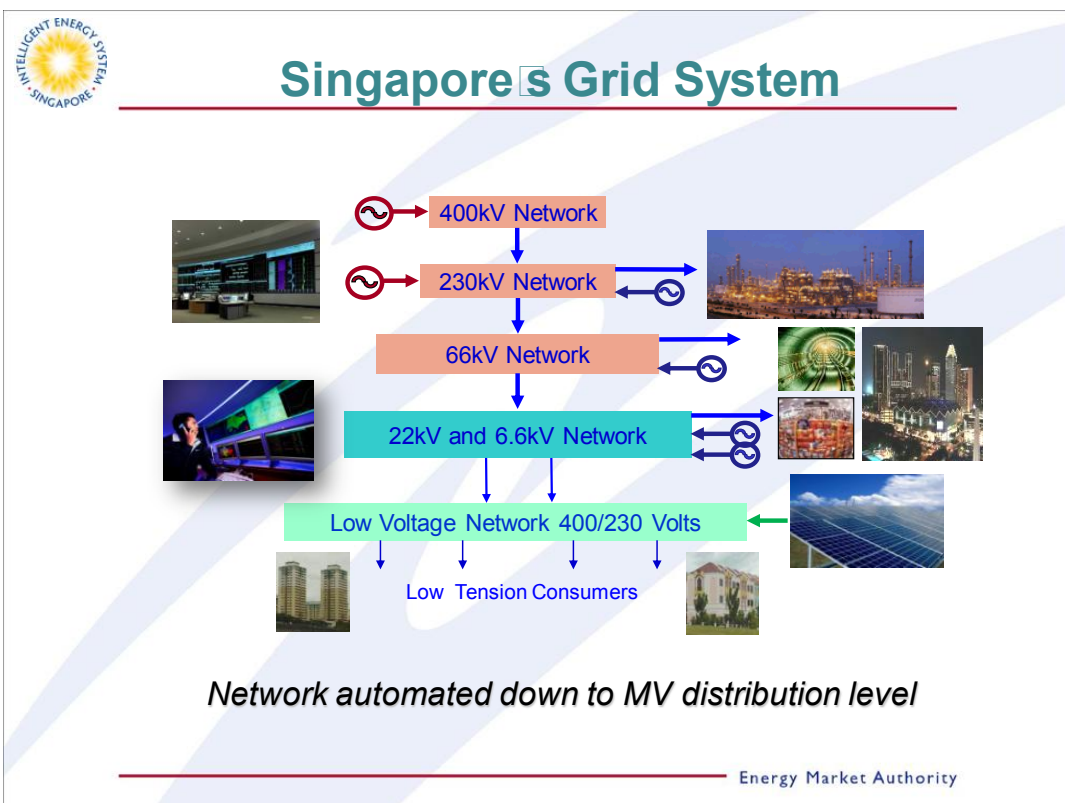
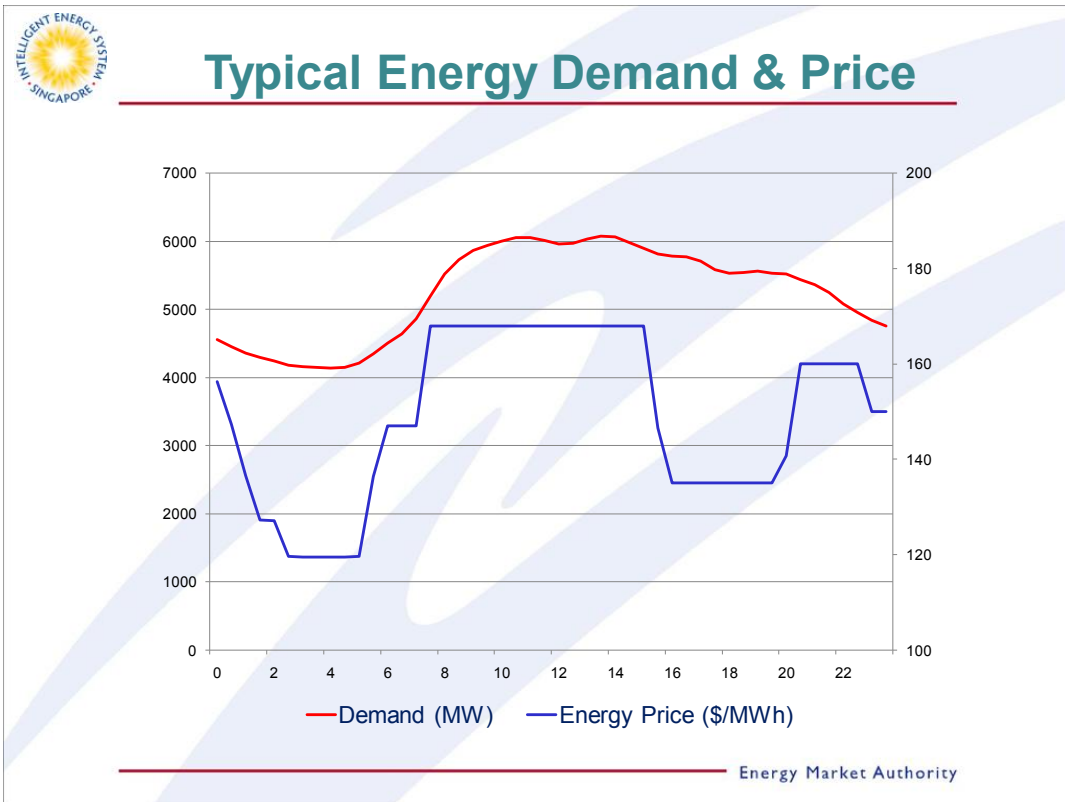


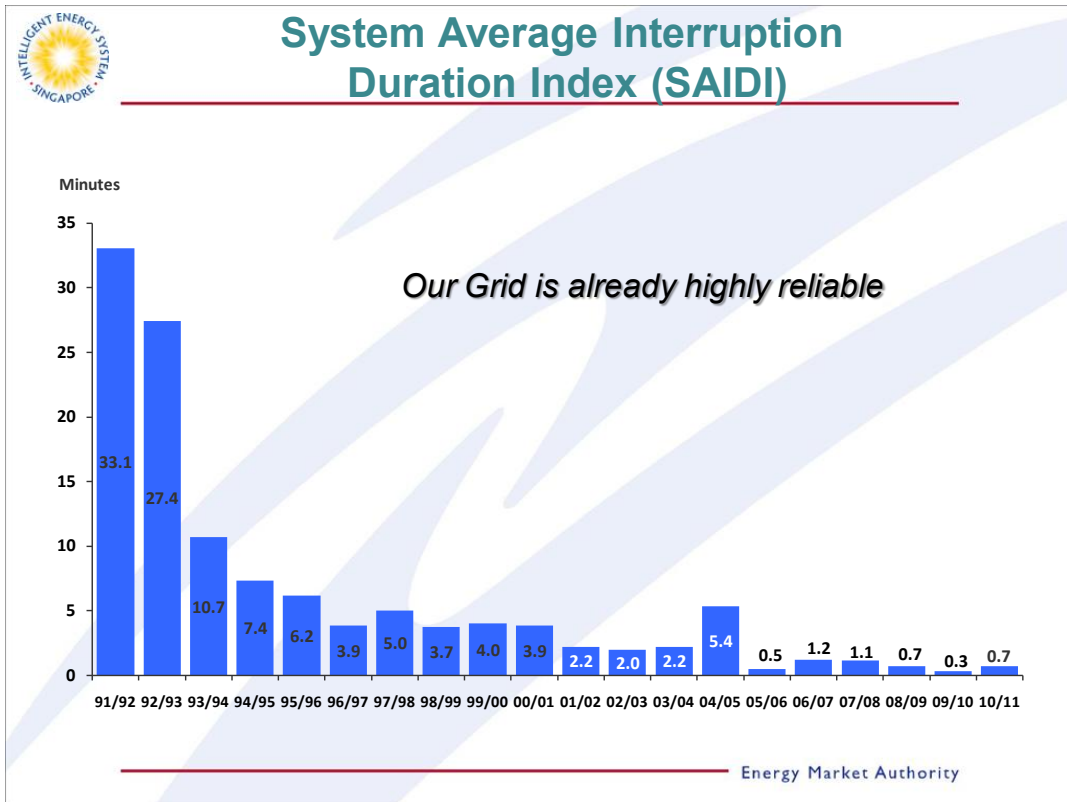
## Agenda

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- Background on Singapore's System
- The Intelligent Energy System (IES)
- The Pilot Project – challenges & status









## Key Drivers

- ✓ Technology assessment for a scalable end-to-end Advanced Metering Infrastructure (AMI) solution
- ✓ Enable the management of Distributed Energy Resources including renewable and embedded generation
- ✓ Enable the integration of new initiatives such as demand response and Electric Vehicles (G2V and V2G)
- ✓ Integration of new Outage Management System (OMS) to enhance management of power outage

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**INTELLIGENT ENERGY SYSTEM SINGAPORE**

## What will the IES mean for Singapore?

We will bring the capabilities of our power grid to the next level and ensure that our electricity infrastructure is ready for the future

HOUSEHOLD	BUSINESS	GRID OPERATOR	RESEARCH & DEVELOPMENT
<ul style="list-style-type: none"> <li>Choice of electricity retailer and pricing plan</li> <li>More information to monitor and manage energy usage</li> <li>Better control of major home appliances to reduce energy usage</li> </ul>	<ul style="list-style-type: none"> <li>Choice of electricity retailer and pricing plan</li> <li>More information for building owners and occupants to manage energy usage</li> <li>Better control and automate systems at the building level to reduce energy usage</li> </ul>	<ul style="list-style-type: none"> <li>Effective communication with households and businesses to enhance delivery of electricity</li> <li>Enhanced capability to detect and respond promptly to localised power outages</li> <li>Easier integration of new energy sources into the grid</li> </ul>	<ul style="list-style-type: none"> <li>Develop and test promising smart grid applications and technologies for commercialisation</li> <li>Opportunities for the research community to test-bed energy solutions in real-world environments.</li> </ul>

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**INTELLIGENT ENERGY SYSTEM SINGAPORE**

## An Intelligent Energy System

The diagram illustrates the components of an Intelligent Energy System. It shows a flow from Generation to Transmission to Distribution to Consumer. This flow is supported by SCADA/EMS, SCADA/DMS, and AMI. Consumer Choices and Consumer Expectations are also shown, along with their associated benefits.

Consumer Choices	Accessible	Flexible
	<ul style="list-style-type: none"> <li>Embedded generation</li> <li>Renewable energy</li> <li>Energy storage</li> </ul>	<ul style="list-style-type: none"> <li>Demand response</li> <li>Home automation</li> <li>Building management</li> </ul>

Generation → Transmission → Distribution → Consumer

SCADA/EMS ← SCADA/DMS ← AMI

Reliable	Economic	Consumer Expectations
<ul style="list-style-type: none"> <li>7x24 monitor &amp; control</li> <li>Outage detection and supply restoration</li> </ul>	<ul style="list-style-type: none"> <li>Network Optimization</li> <li>Assets utilization</li> </ul>	

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## Pilot Project Approach

- ❑ Establish technical solutions for roll-out
- ❑ Quantify the costs and benefits
- ❑ 4500 smart meters to be deployed
- ❑ Nanyang Technological University to be the focal point, where the full suite of applications and solutions will be tested



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## Key Phases of the IES Pilot

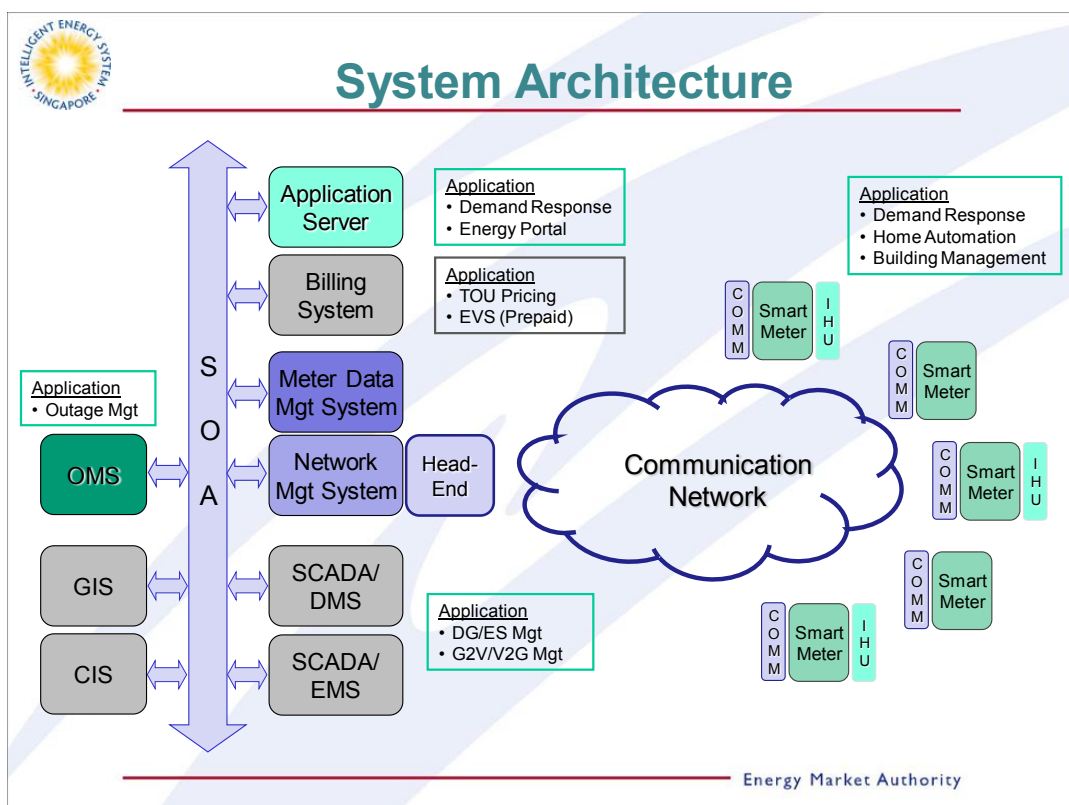
- ❑ Phase 1 – develop backend systems and infrastructure
  - ✓ Commenced in October 2010
  - ✓ Expected to be completed by mid 2012
- ❑ Phase 2 – evaluate customer applications which ride on advanced metering infrastructure
  - ✓ Expected to commence in Q1 2012 and completed by mid 2013

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**Phase 1 □ Developing the Enabler**

- Establish two-way data communication
  - ✓ advanced metering infrastructure (AMI)
- Develop applications to ride on AMI
  - ✓ time-of-use tariff
  - ✓ distributed generation management
  - ✓ demand response and energy management
  - ✓ outage management
  - ✓ integration of EV charging and V2G

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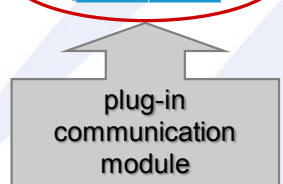
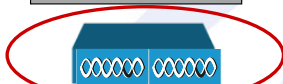
## Design Consideration

- ❑ Design with the end in mind
- ❑ Ability to integrate new technologies in future
- ❑ Leverage industry-adopted standards
- ❑ Data live in one place
- ❑ Utilise standard/best-fit functionality and avoid customisations
- ❑ Customisations developed outside the core system

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## Smart Meter Open and Modular




### Basic metering:

- ✓ Half-hour interval metering
- ✓ At least 30 days interval data
- ✓ DLMS-COSEM compliance
- ✓ Remote turn-on and cut-off
- ✓ Prepaid and postpaid functions
- ✓ Alarms – tampering, power outage

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## Smart Meter Communication



- ✓ Access meter data via DLMS-COSEM protocol
- ✓ 2-channel communication gateway
- ✓ able to pair different communication method

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## Communication Concept

The diagram illustrates the communication concept across three network layers: Home Area Network, Smart Meter Network, and Utility Network. In the Home Area Network, smart meters are connected to household appliances. In the Smart Meter Network, meters are connected to a Data Concentrator via PLC/RF MESH (Last-mile point-to-multipoint), Wireless (3G, 4G, WiMax point-to-point), and Fixed Broadband (IP VPN point-to-point). The Data Concentrator connects to the Utility Network via Fixed Broadband (IP VPN point-to-point) and Wireless (3G, 4G, WiMax point-to-point). The Utility Network includes a Meter Network Management System connected to a WAN.

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## Phase 2 □ Engaging the Consumers

- Applications trial with the “enabler” infrastructure
  - ✓ Commercial / industrial / household consumers
  - ✓ Include CleanTech Park and Eco-Precinct
- Electricity retailers offer to consumers
  - ✓ Time-varying packages
  - ✓ Value added services such as energy efficiency measures riding on Building Management Services and Home Automation Systems

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## Phase 2 □ Challenges

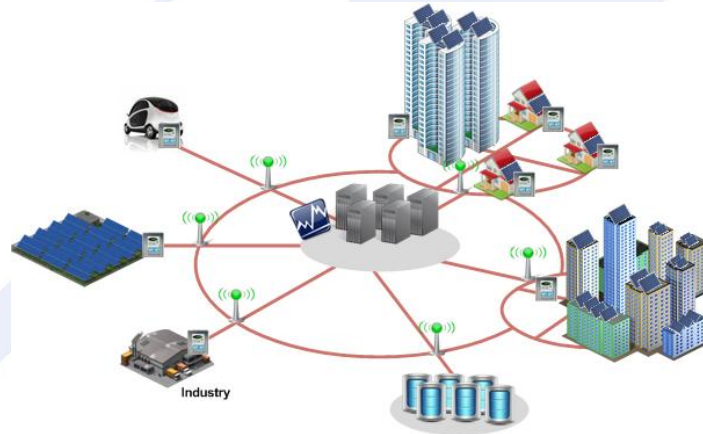
- Engaging the consumers
  - benefits
- Engaging the retailers and service providers
  - business model
  - Regulatory framework revision
    - paradigm shift

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## Conclusion

*Centrally managed intelligent communications interconnects various smart grid technologies*



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**Plenary Session on  
“WEC Sustainability Assessment”**



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## The presentation will cover three topics

- WEC policy assessment programme approach
- Definition of energy sustainability
- Country assessment objective and approach
- Thailand's performance

## Quotes from the foreword of the report:

Now more than ever, we must work to find a sustainable path that reconciles economic growth, protection of the environment and greater energy equity among peoples.

We can do this and we have the technologies we need at hand.

The real shortage today, however, relates to governance. We need effective rules and smart policy frameworks to update our energy policies and ensure that the right resources and technologies are available in the right place, at the right time... and at the right price.

## Quotes from the foreword of the report:

In sum, innovation in terms of policies, institutions and governance will be just as important as technological innovation ..

The challenge is now to design sound and effective public policies to deliver the national objectives .

This second edition of our yearly Energy and Climate Policy Assessment is WEC's contribution to meeting the challenge of designing new energy governance with sound and effective public policies.

## The WEC policy assessment programme is examining approaches taken by countries to address near- and long-term challenges

### Challenges for policymakers

- Meeting demand driven by population and economic growth
- Driving results from climate change mitigation measures
- Reconciling the influence of multiple agendas on energy policy
- Balancing short-term reliability expectations with long-term transformations

### Challenges for the energy industry

- Optimising portfolios, service delivery and cash flows in line with evolving policy choices
- Ensuring timely and on-budget delivery of new, sustainable infrastructure
- Successfully deploying capital in a weak economic environment



## Key results from assessments

Among its numerous findings, two seem of particular importance.

The first is the critical need to factor in thorough assessment of technologies to energy policy making ) *(planning on different roll out of mature and immature technologies, R&D ..)*

The second element relates to the way policies can encourage our behaviours and habits to change. *(norms and standards, real energy prices vs subsidies, smart grids) . . .*

## The investigation of country policymaking starts with the World Energy Council's understanding of energy sustainability

<p>Ⓐ</p> <p><b>Energy security</b></p>	<ul style="list-style-type: none"> <li>• Management of primary energy supply from domestic and external sources and the reliability of energy infrastructure</li> <li>• Ability of participating energy companies to meet demand</li> <li>• <i>Exporting countries</i>: revenue security from external sales markets</li> </ul>
<p>Ⓑ</p> <p><b>Social equity</b></p>	<ul style="list-style-type: none"> <li>• Accessibility of energy to the population</li> <li>• Affordability of energy for domestic and industry consumers</li> </ul>
<p>Ⓒ</p> <p><b>Environmental impact mitigation</b></p>	<ul style="list-style-type: none"> <li>• Achievement of supply- and demand-side efficiencies</li> <li>• Development of energy supply from renewable and other low-carbon sources</li> </ul>

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7

Promoting sustainable energy for the greatest benefit of all

## The assessment programme aims to produce an annual report that focuses on topical issues

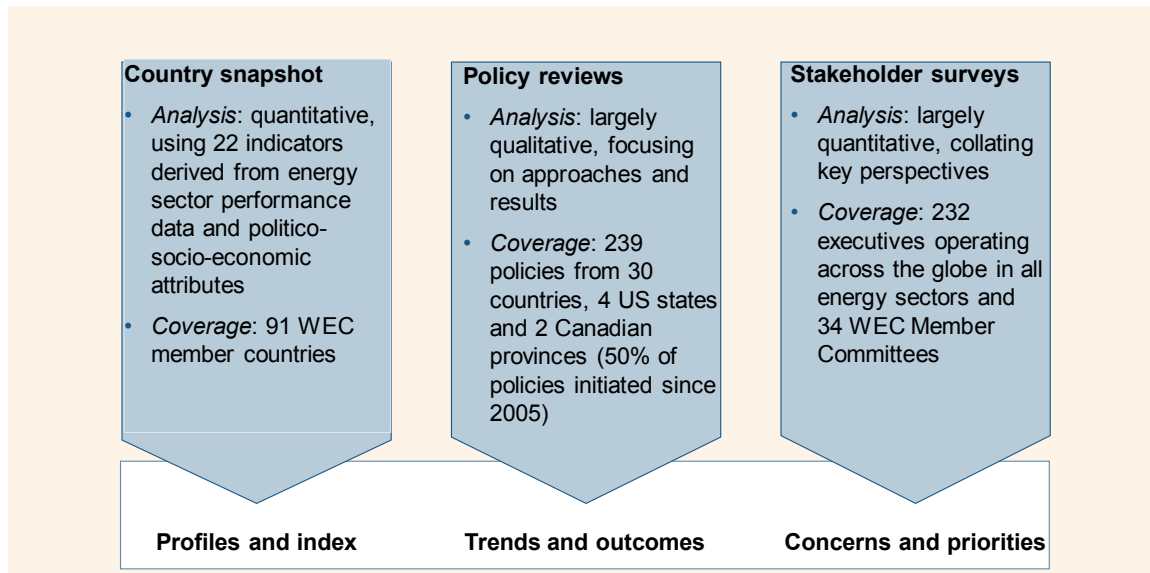
<b>Programme objectives</b>	<ul style="list-style-type: none"> <li>• <b>Generate insights into different policy decisions</b> and implementation across the globe</li> <li>• <b>Stimulate dialogue within the policymaking community</b> and between policymakers and the energy industry</li> <li>• <b>Consider what lessons can be learnt</b> and how (components of) good policies can be replicated</li> </ul>	<b>2010 report contents</b>	<ul style="list-style-type: none"> <li>• <b>Ensuring supply</b> □ trends in renewable energy, nuclear power, and gas supply policies</li> <li>• <b>Managing demand</b> □ securing energy efficiency, reducing emissions intensity</li> <li>• <b>Investment</b> □ challenges and innovative solutions</li> <li>• <b>Cross-cutting issues</b> □ sustainability trade-offs, stability versus evolution, international relationships</li> </ul>
<b>Research challenges</b>			
<ul style="list-style-type: none"> <li>• <b>Breadth</b> of the sustainability agenda</li> <li>• <b>Width</b> of geographical scope, including the different resource and economic positioning of 91 WEC member countries</li> <li>• <b>Quality and comparability</b> of data across countries</li> </ul>			

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Promoting sustainable energy for the greatest benefit of all

## The 2010 analysis had three core components



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Promoting sustainable energy for the greatest benefit of all

## The index is divided between energy performance measures and contextual measures relating to policymaking capacity

### Index structure

Indicator type	Dimension	
<b>1</b> Energy performance - Dimensions of sustainability	<b>1</b> Supply-demand balancing	• How well is the country managing its energy needs and the resources available to it?
	<b>2</b> Social equity	• How accessible and affordable is energy for the country's population?
	<b>3</b> Environmental impact mitigation	• How 'clean' is the country's economy and energy infrastructure?
<b>2</b> Contextual performance	<b>1</b> Political strength	• How robust is the country's policymaking apparatus in order to support the preparation and implementation of energy policy?
	<b>2</b> Societal strength	• How developed is the country in terms of social wellbeing in order to support energy policy and industry enhancements?
	<b>3</b> Economic strength	• How capable is the country in terms of being able to support enhancements to energy infrastructure?

- 22 main indicators spanning six dimensions
- Over 60 sub-indicators contributing to the main indicators
- 23 indicators from 2009 reused

## The 2010 WEC Energy Sustainability Country Index was formed from normalised country scores against 22 indicators across six dimensions

	Axes	Dimensions	Indicators
Overall country result	1 Energy performance 75%	1 Energy security 25%	1. Consumption growth 2. Ratio of energy production to consumption 3. Wholesale margin on gasoline 4. Diversity of electricity production 5a Exporters □ Dependence on and diversity of energy exports 5b Importers □ Oil reserve stocks
		2 Social equity 25%	1. Affordability of retail gasoline 2. Affordability of electricity relative to access
		3 Environmental impact mitigation 25%	1. Energy intensity 2. Emissions intensity 3. Effects on air and water 4. Efficiency of electricity production
	2 Contextual performance 25%	1 Political strength 3.3%	1. Political stability 2. Regulatory quality 3. Effectiveness of government
		2 Societal strength 3.3%	1. Control of corruption 2. Rule of law 3. Quality of education 4. Quality of health
		3 Economic strength 3.3%	1. Macro-economic stability 2. Cost of living expenditure 3. Availability of credit to the private sector

## Major Source of Information/Data

Acronym	Name
WB	World Bank
WEF	World Economic Forum
WGI	World Governance Indicators
IEA	International Energy Agency
EIA	Energy Information Administration
IMF	International Monetary Fund
Yale EPI	Yale Environmental Performance Index
HDI	Human Development Index
GTZ	Gesellschaft für Technische Zusammenarbeit
CIA	Central Intelligence Agency Factbook

## Energy Index Structure

### Energy Performance: Energy Security (supply-demand balancing)

Indicator	Component Data
1. Consumption growth	Total primary energy consumption (TPEC) compound annual growth rate (2002 – 2007). (EIA)
2. Ratio of energy production to consumption	Ratio of TPEP to TPEC. (EIA)
3. Wholesale margin on gasoline	Effective difference between retail price of petroleum products (super gasoline) and wholesale price (Brent crude) (GTZ)
4. Diversity of electricity production	Shannon index for diversity of electricity generation assets (EIA)
5. <i>Importers</i> – Oil reserve stocks	Oil stocks in days given physical oil stocks and usage (JODI)

## Energy Index Structure

### Energy Performance: Social Equity

Indicator	Component Data
1. Affordability of retail gasoline	Price of super gasoline – Unleaded octane 95 – Tax included (GTZ)
2. Affordability of electricity relative to access	Household electricity expenditure data divided by cost of housing, water, electricity, gas and other fuels relative to electrification rate. (IEA, HDI, WB)

## Energy Index Structure

### Energy Performance: Environmental Impact Mitigation

Indicator	Component Data
1. Energy intensity	TPEC relative to GDP and population (EIA, IMF)
1. Emissions intensity	CO <sub>2</sub> emissions relative to GDP and population (EIA, IMF)
3. Effects on air and water	Effects of pollution on air and water (Yale EPI)
4. Efficiency of electricity production	Grams of CO <sub>2</sub> from heat and electricity generation per kWh (IEA)

## Energy Index Structure

### Contextual Performance: Political Strength

Indicator	Component Data
1. Political stability	Perceptions of likelihood that the government will be destabilized or overthrown by unconstitutional or violent means (WGI)
2. Regulatory quality	The ability of government to formulate and implement sound policies and regulations that permit and promote private sector development (WGI)
3. Effectiveness of government	Quality of public services, civil service and the degree of its independence from political pressures, quality of policy formulation and implementation, and credibility of government's commitment to such policies (WGI)

## Energy Index Structure

### Contextual Performance: Societal Strength

Indicator	Component Data
1. Control of corruption	Extent to which public power is exercised for private gains (WGI)
2. Rule of law	Extent to which agents have confidence in and abide by the rules of society, in particular the quality of contract enforcement, the police and the courts, as well as likelihood of crime and violence. (WGI)
3. Quality of education	Secondary and tertiary enrolments, education expenditure, quality of education system, quality of math and science education, quality of management in schools, internet access in schools, local availability of specialized research and training services, extent of staff training (WEF)
4. Quality of health	Business impact of malaria, malaria incidence, business impact of tuberculosis, tuberculosis incidence, business impact of HIV, HIV prevalence, infant mortality and life expectancy (WEF)

## Energy Index Structure

### Contextual Performance: Economic Strength

Indicator	Component Data
1. Macro-economic stability	Government deficit/surplus, national savings rate, interest rate spread and government debt (WEF)
2. Cost of living expenditure	Household spending on housing, water, electricity, gas and other fuels divided by individual consumption spending (WEF)
3. Availability of credit to the private sector	Financial resources provided to private sector through loan, purchases of nonequity securities, trade credits and other accounts receivable <input type="checkbox"/> that establishes a claim for repayment (WB)

## Thailand's Performance for Each Indicator

### 1. Energy Performance

(Score normalized from 0 – 10, ranking out of 91 countries)

Energy Security	Score	Rank
1. Consumption growth	2.64	67
2. Ratio of energy production to consumption	4.66	49
3. Wholesale margin on gasoline	0.10	89
4. Diversity of electricity production	4.02	55
5. Importers – Oil reserve stocks	0.64	30/32
<b>Average</b>	<b>2.41</b>	<b>82</b>

## Thailand's Performance for Each Indicator

### 1. Energy Performance

Social Equity	Score	Rank
1. Affordability of retail gasoline	7.36	26
2. Affordability of electricity relative to access	7.83	21
<b>Average</b>	<b>7.60</b>	<b>21</b>

## Thailand's Performance for Each Indicator

### 1. Energy Performance

Environmental Impact Mitigation	Score	Rank
1. Energy intensity	3.07	63
1. Emissions intensity	3.18	62
3. Effects on air and water	3.91	59
4. Efficiency of electricity production	3.80	60
<b>Average</b>	<b>3.49</b>	<b>68</b>

## Thailand's Performance for Each Indicator

### 2. Contextual Performance

Political Strength	Score	Rank
1. Political stability	1.41	79
2. Regulatory quality	4.83	48
3. Effectiveness of government	4.34	52
<b>Average</b>	<b>3.53</b>	<b>58</b>

## Thailand's Performance for Each Indicator

### 2. Contextual Performance

Societal Strength	Score	Rank
1. Control of corruption	3.18	63
2. Rule of law	4.45	51
3. Quality of education	2.94	66
4. Quality of health	4.76	51
<b>Average</b>	<b>3.83</b>	<b>52</b>

## Thailand's Performance for Each Indicator

### 2. Contextual Performance

Economic Strength	Score	Rank
1. Macro-economic stability	8.11	22
2. Cost of living expenditure	9.78	3
3. Availability of credit to the private sector	7.29	24
<b>Average</b>	<b>8.39</b>	<b>5</b>

## Summary

- Overall, Thailand ranked 57 out of 91 (rank 14 out of 22 in Group C, GDP between \$6,000-\$14,300)
- Looking at the dimensions in energy performance:
  - Supply-Demand Balancing Thailand ranked 82,
  - Social equity Thailand ranked 21,
  - Environmental Impact Mitigation Thailand ranked 68
- Dimensions in contextual performance
  - Political strength: 58
  - Social strength: 52
  - Economic strength: 5

## Summary

Strength	Weakness
Social equity (energy affordability)	Consumption growth
Macro-economic stability	Energy intensity
Cost of living expenditure	Wholesale margin on gasoline
Availability of credit to the private sector	Political stability
	Control of corruption
	Quality of education

## Summary

- Index is based on data from 2007, going forward there is great potential for Thailand to move up in all dimensions of the index
- Full details of the indicators and sources are on the WEC website at

[www.worldenergy.org/documents/index\\_2010.xls](http://www.worldenergy.org/documents/index_2010.xls).

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Thank you for your kind attention

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