



**SIEMENS**

**University of Pittsburgh**

**7<sup>th</sup> Annual Electric Power Industry Conference**

**Power System Modeling and Analysis  
Development for Clean Energy  
Integration Panel Session**

**Brian Gemmell, PhD**

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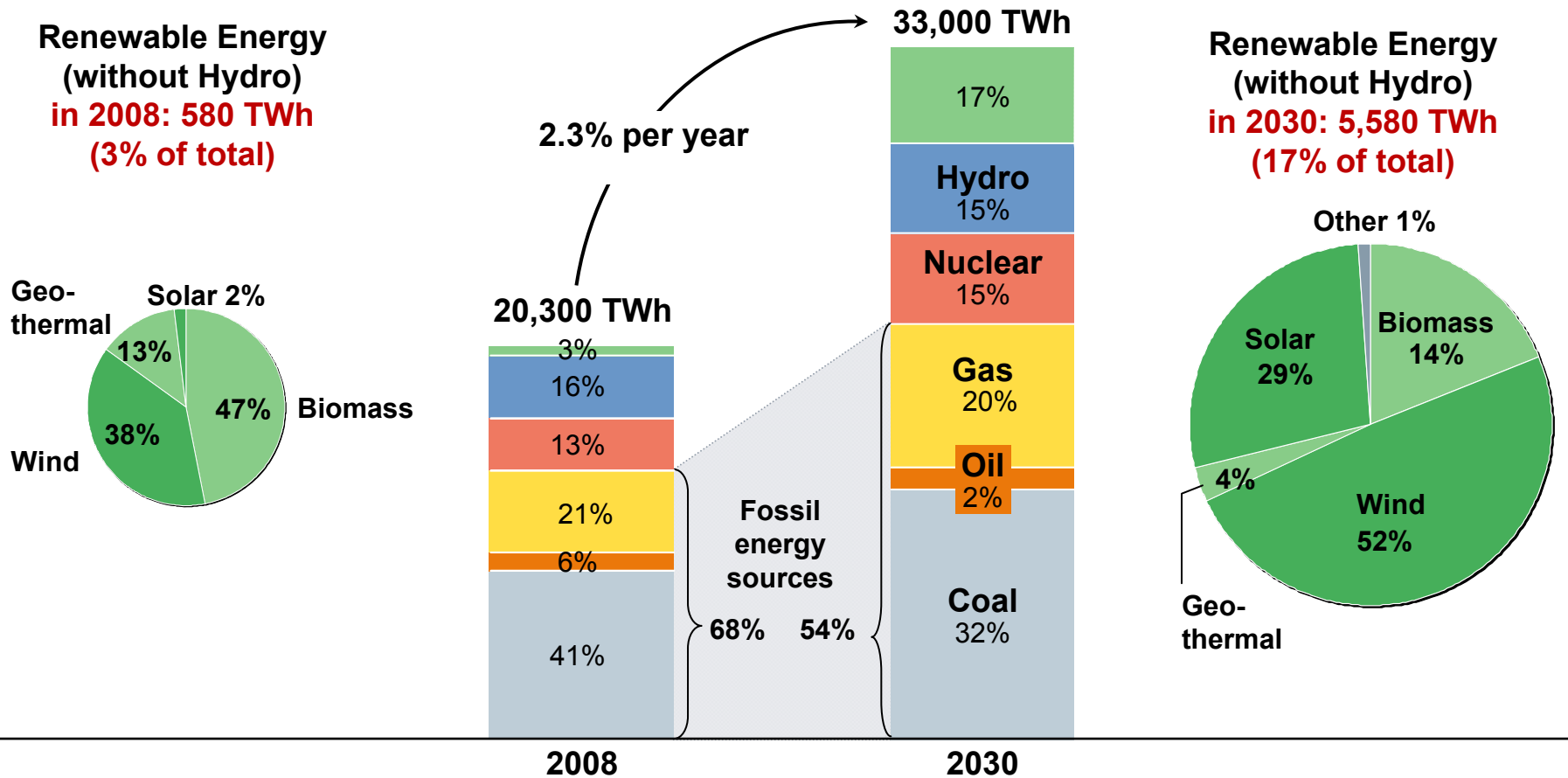
**General Manager, Siemens PTI, Schenectady, NY**

# Future for Power Generation Siemens' Global View



Fossil energy sources remain dominant, but renewable energy becomes more important

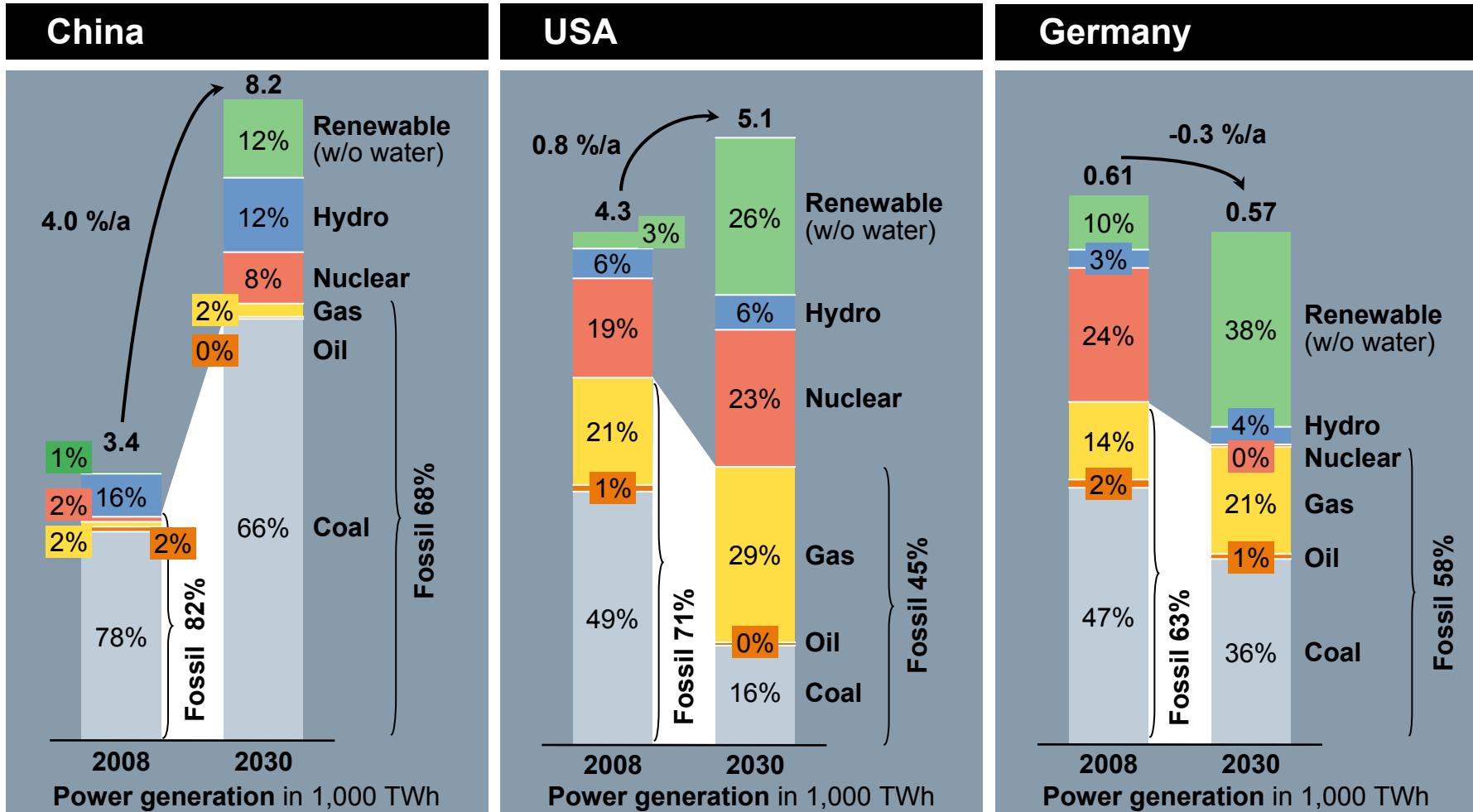
## Power Generation (in TWh)



Source: Siemens

# Future for Energy Consumption – Some Examples

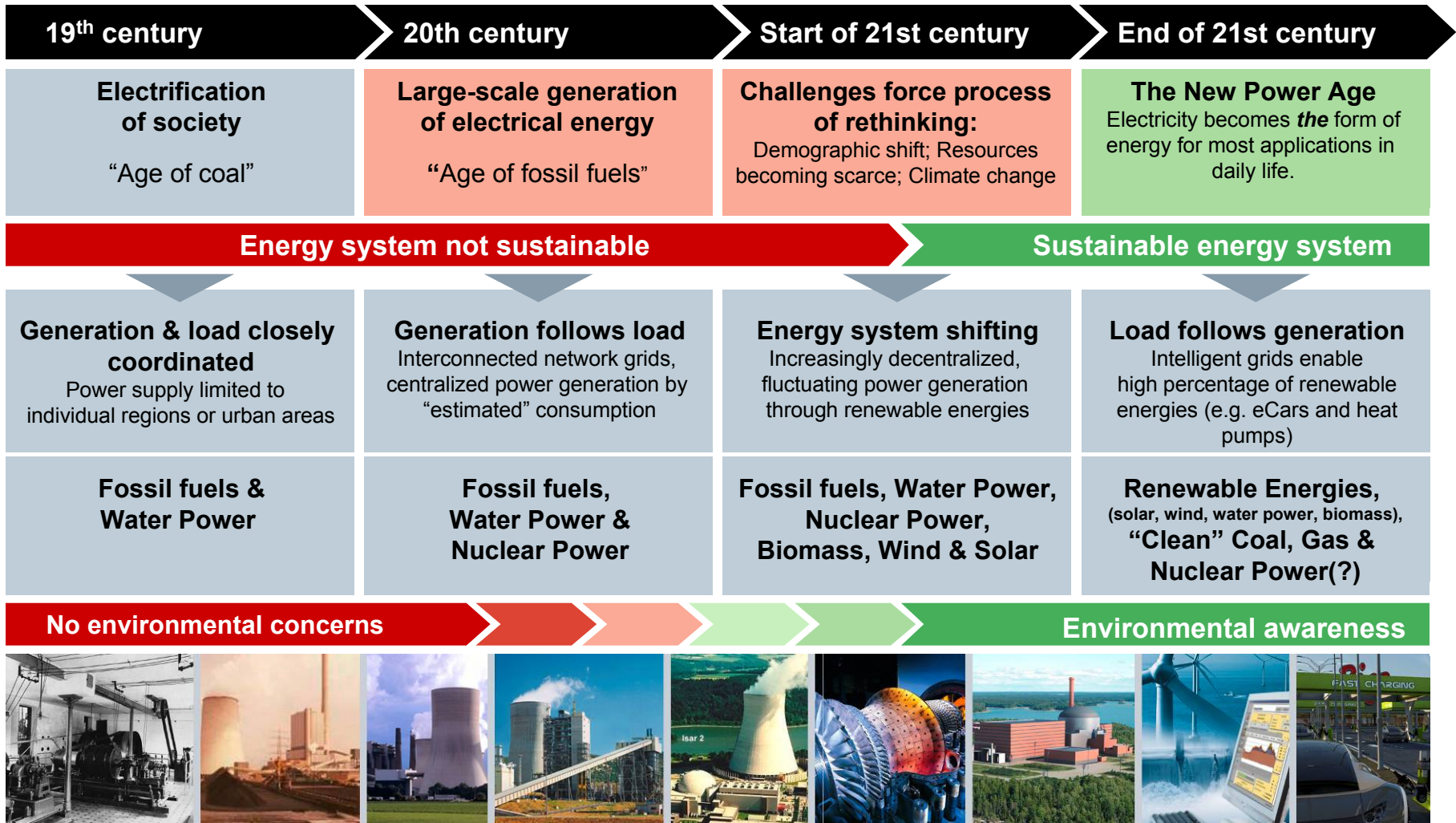
## Siemens' Global View



Source: Siemens

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Siemens Power Technologies International

# A Paradigm Shift leading to a Sustainable Energy System

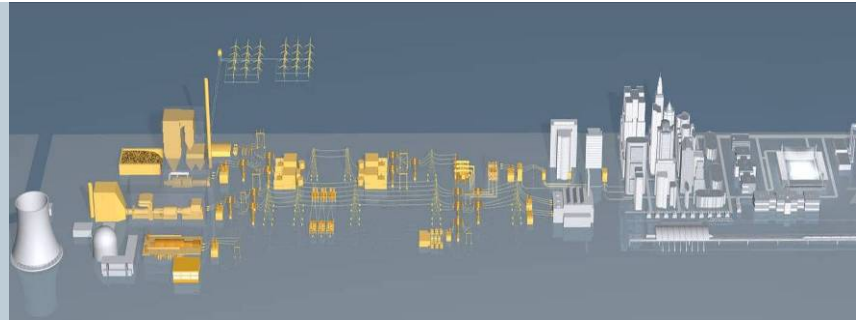


# Three steps to Sustainable Energy Supply

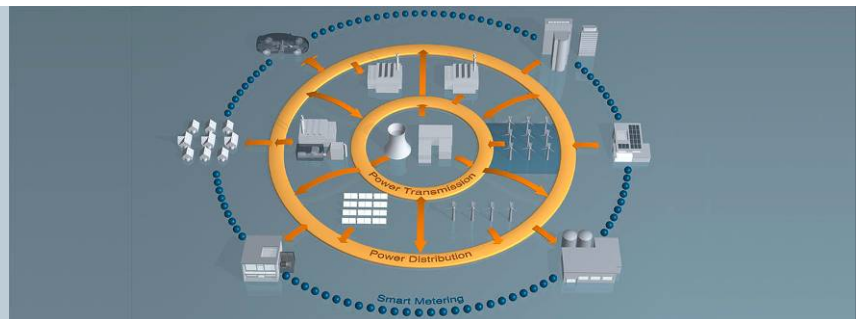
## 1 Optimization of the energy mix



## 2 Efficiency increases along the entire energy chain



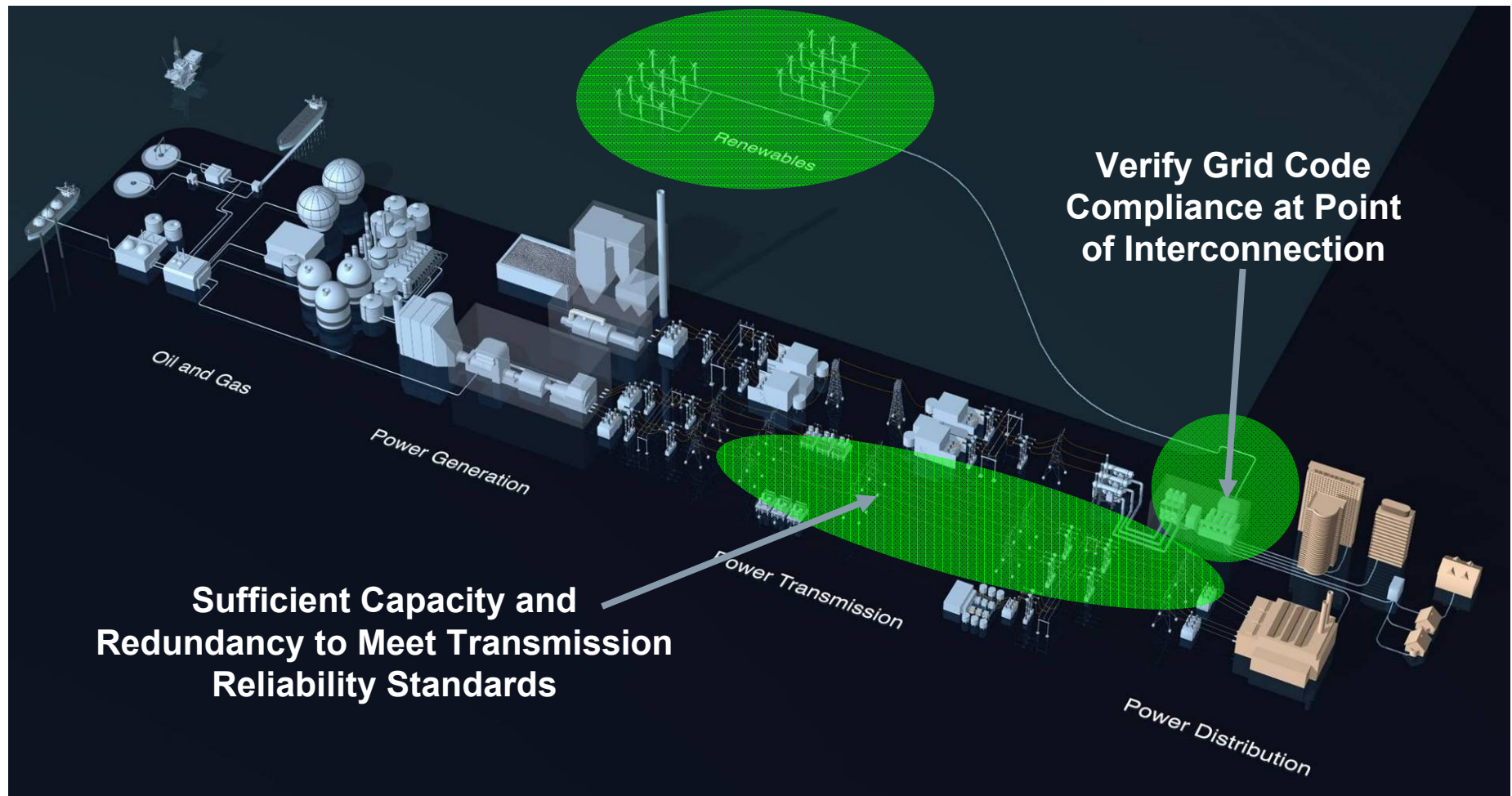
## 3 Systemic optimization / Smart Grid





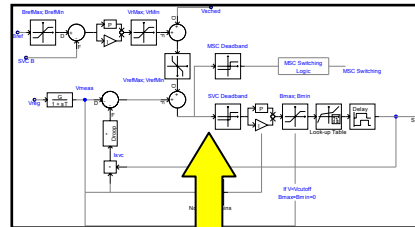
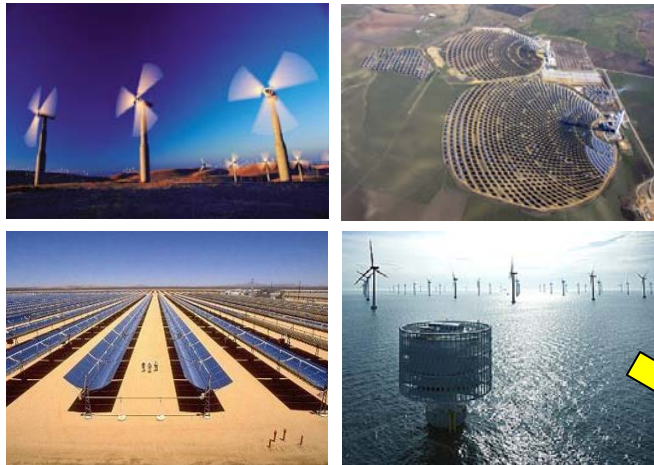
# Clean Energy Integration Grid Code and Reliability – The Basics

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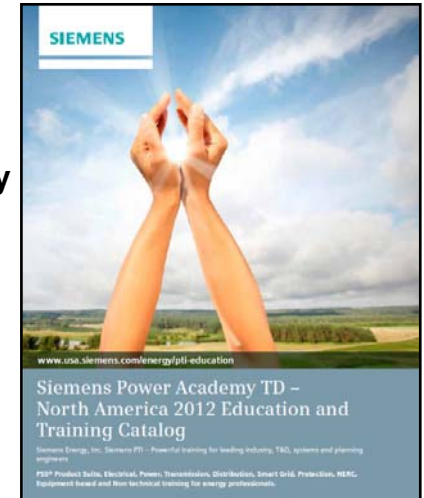
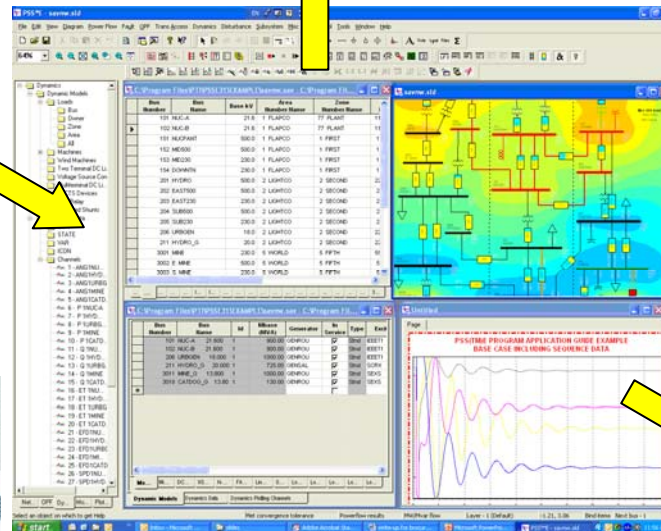


# Why is Power System Modeling and Analysis Development Important?

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Technology Models



**RES-00**

**Site Scoping Study for Selecting the Point of Interconnection of 600 MW of New Generation into the PJM Area**

Prepared for  
**Mirant Corporation**

Submitted by:  
Jose Daconis, Senior Staff Consultant  
Shadrack Orero, Staff Consultant

March 31, 2009  
Siemens PTI Project Number P21-113354

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## Specific Wind Model Development

*PSS®E wind simulation packages developed and supported by Siemens PTI:*

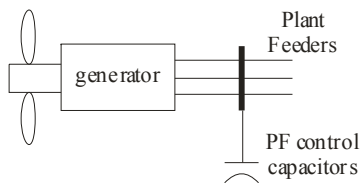




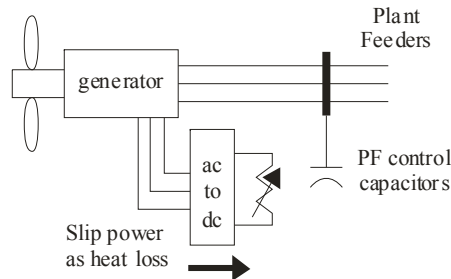
# Generic Wind Models

- Type 1 – conventional directly connected induction generator
- Type 2 – wound rotor induction generator with variable rotor resistance
- Type 3 – doubly-fed induction generator
- Type 4 – full converter interface

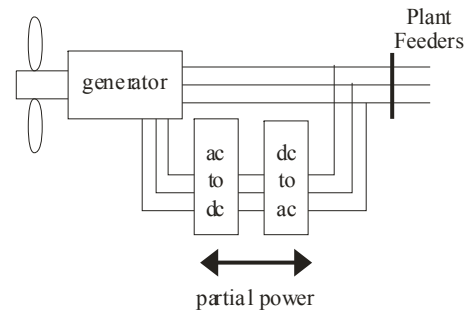
Type 1



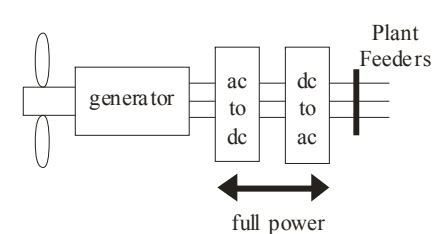
Type 2



Type 3



Type 4



Next generation of generic models based on feedback from manufacturers and field tests

# Delivering Power from Remote or Off-Shore Wind Farms

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Keeping Up-to-Date with  
Wind Turbine Development



**First floating wind turbine buoyed off Norway 2.3MW, 7.4 miles off-shore in 721ft deep – from Siemens**

New Voltage Source Converter  
based HVDC Technology



**HVDC Plus from Siemens**