APERC's Research Activities: Outlook 5th edition

Projection of Renewable Energy Supply in the APEC Region

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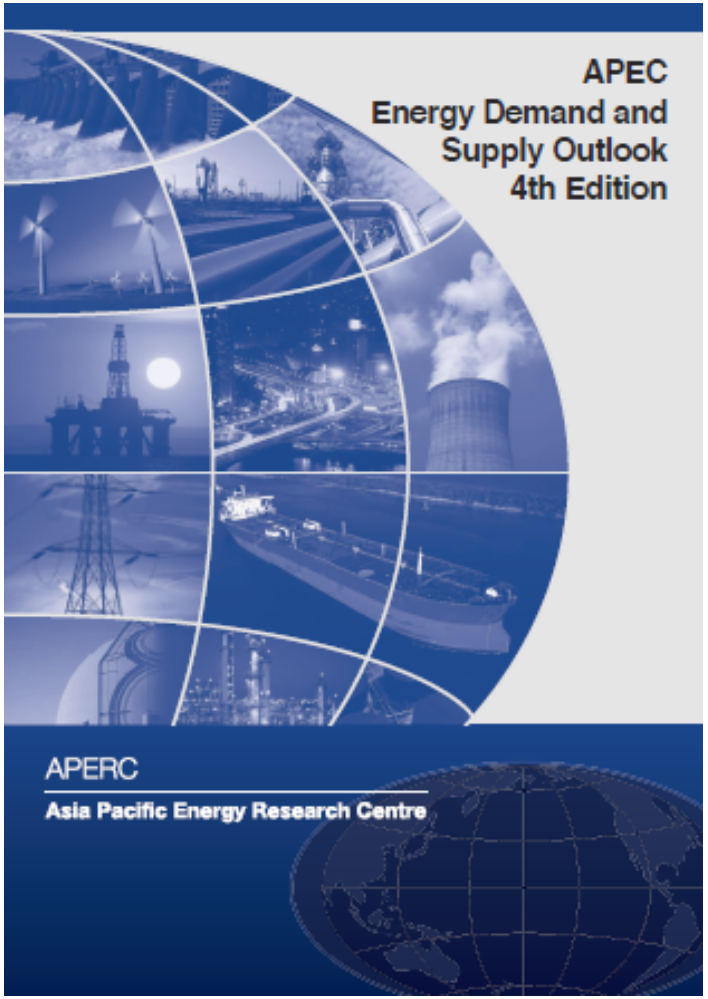
Asia-Pacific
Economic Cooperation

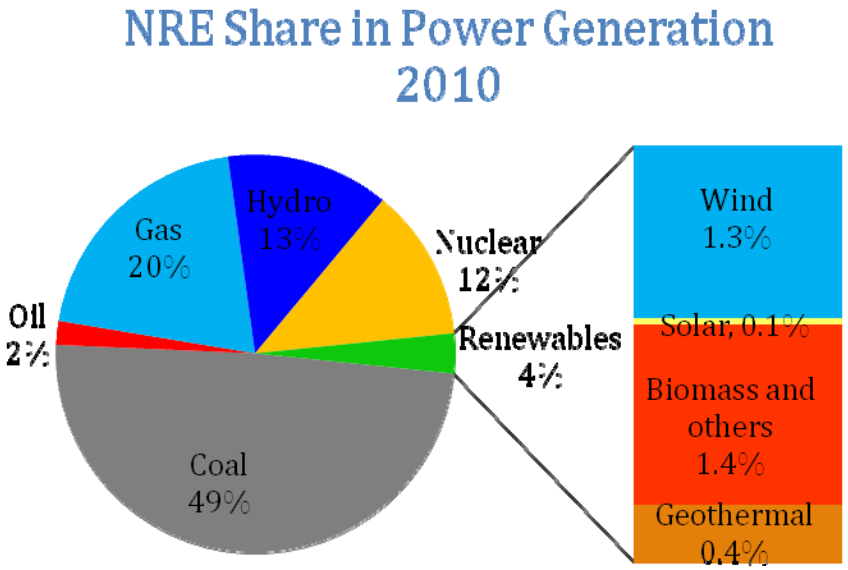
APEC Energy Outlook

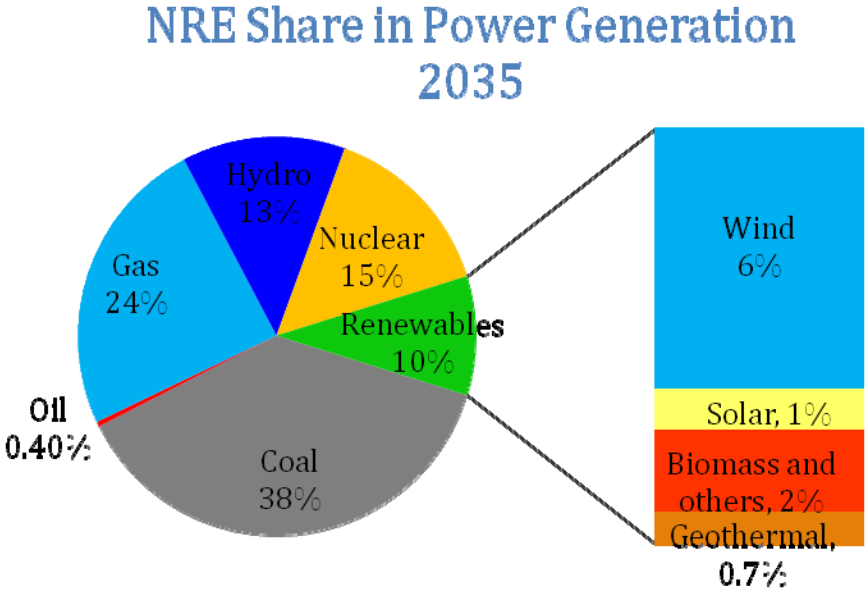


- APERC has historically produced an *APEC Energy Demand and Supply Outlook* every 2 or 3 years
- 5th edition is likely to be published in February 2013
- "Business As Usual" (BAU) – Assumes existing policy continues, including policies in process of implementation
- Three Alternative Cases:
  - High Gas Case
  - Better Urban Planning
  - Virtual Clean Car Race

New Renewable Energy (NRE) Goes Mainstream

- *New Renewable Energy (NRE) goes mainstream* led by continued policy support and technology cost reduction
- By 2035 NRE energy output will reach **10%** of power generation in APEC
- Wind energy leads but solar energy rises quickly



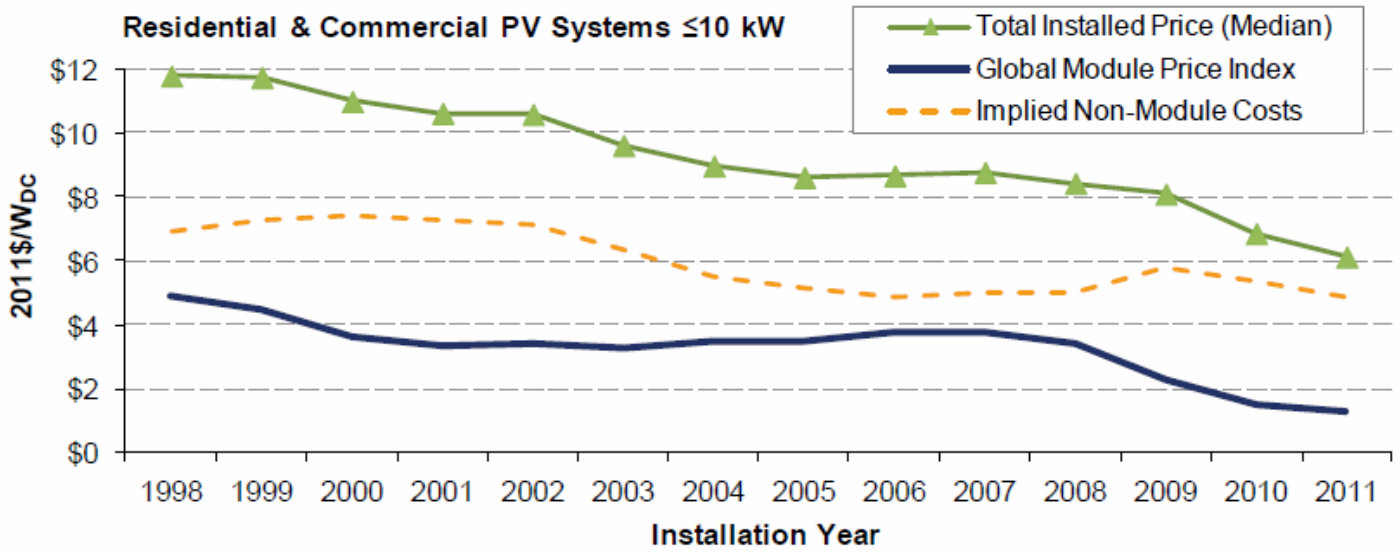


APEC Renewable Energy Policy Support is Robust

1. ***Feed-in-tariffs*** – utilities required to buy electricity from renewables at a guaranteed price
2. ***Renewable portfolio standards*** – Requirement of utilities to obtain a minimum fraction of their electricity from renewable sources
3. ***Carbon pricing*** – Tax on CO_2 emissions, which discourages the use of fossil fuels
4. ***Regulations limiting greenhouse gas emissions*** – Laws which prohibit the level of GHG emissions on certain fossil generation

Decline in PV Solar Costs Continues

- Oversupply of PV modules caused a large drop (~70%) in prices between 2008-2011
- Low to negative profitability of PV module manufactures will slow future module cost reductions
- Installation costs are the major expense

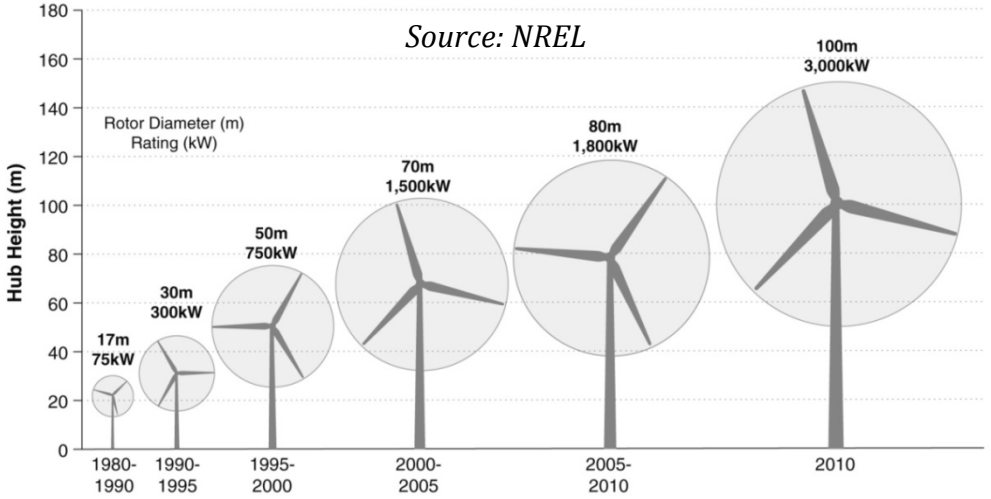


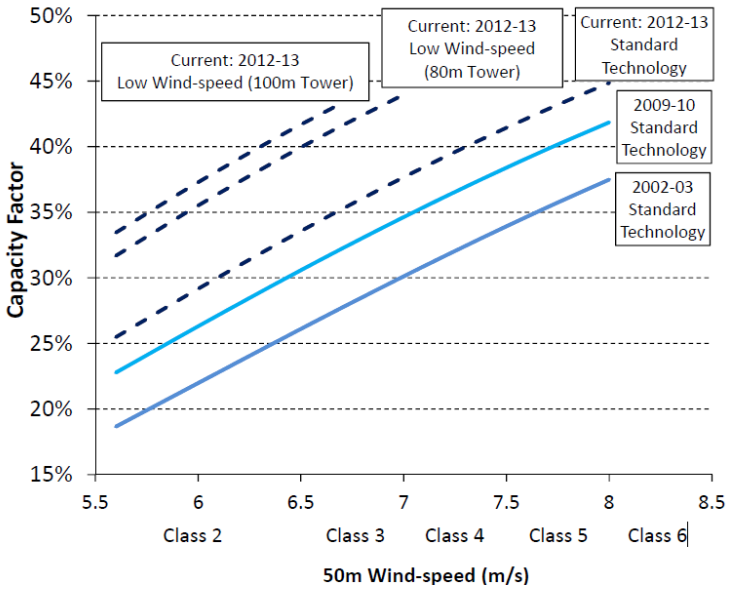
Source: Lawrence Berkeley Lab (2012), Tracking the Sun V

Wind Energy Technology Still Improving

- Cost competition from China continues to reduce wind turbine margins
- Technology innovation with ***lighter*** and ***larger*** turbines and higher energy capture
- Carbon fiber replacing steel reducing installation costs
- Offshore super turbines development ~10MW

Source: NREL

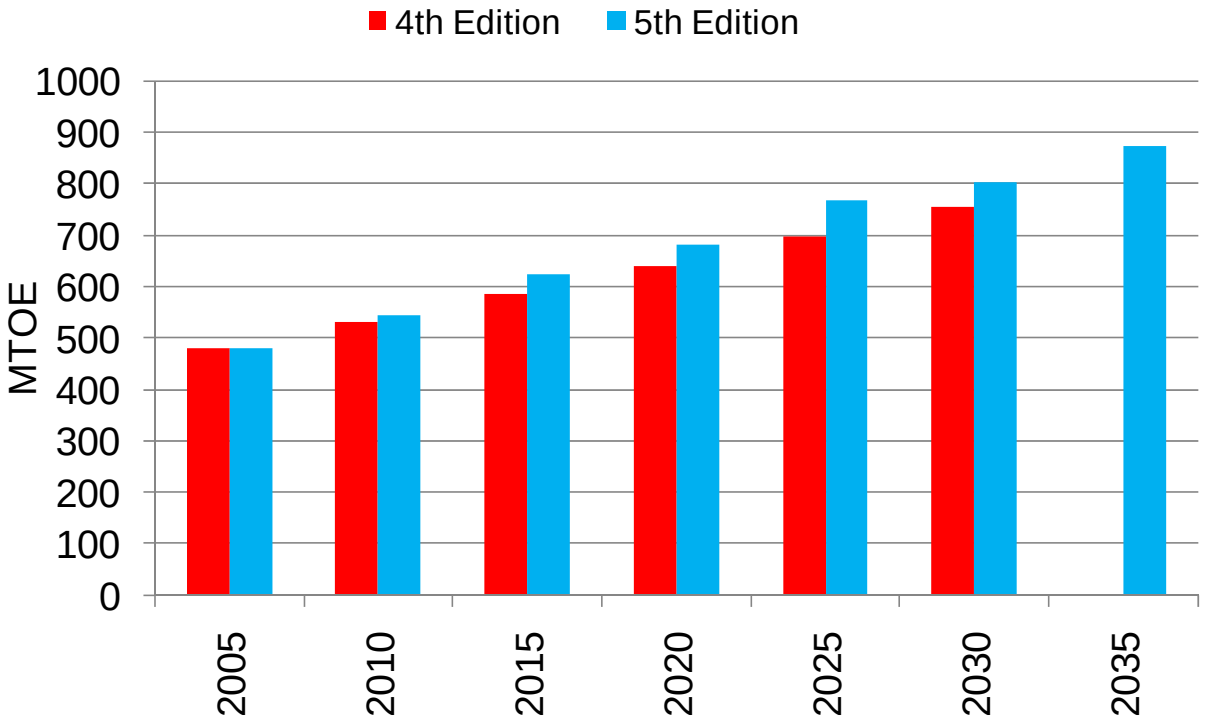




Source: Wiser et al. 2012 Recent Developments in the Levelized Cost of Energy From U.S. Wind Power Projects

Outlook for Renewable Energy has Improved

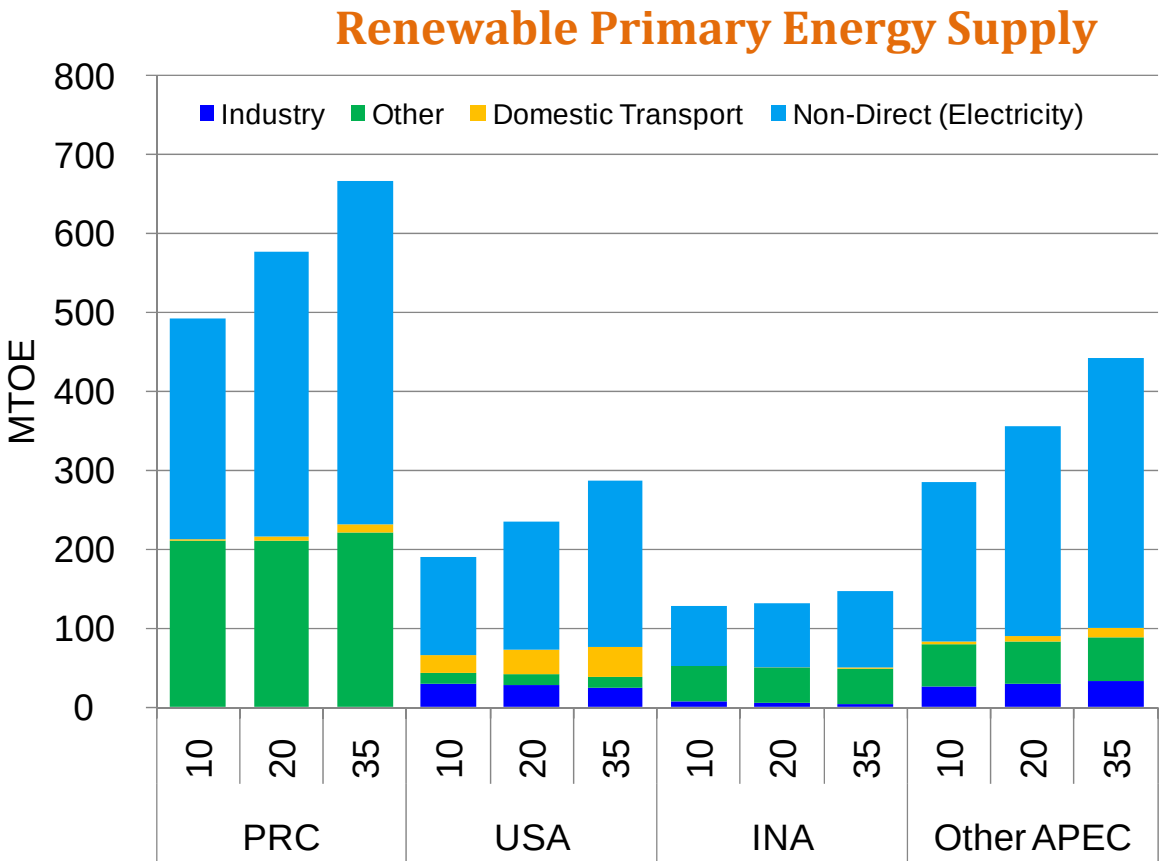
- Higher projection of NRE growth than our last edition in 2009
- China and the USA account for much of the expected growth



Source: APERC Analysis

Electricity Sector Leads Growth in Renewables

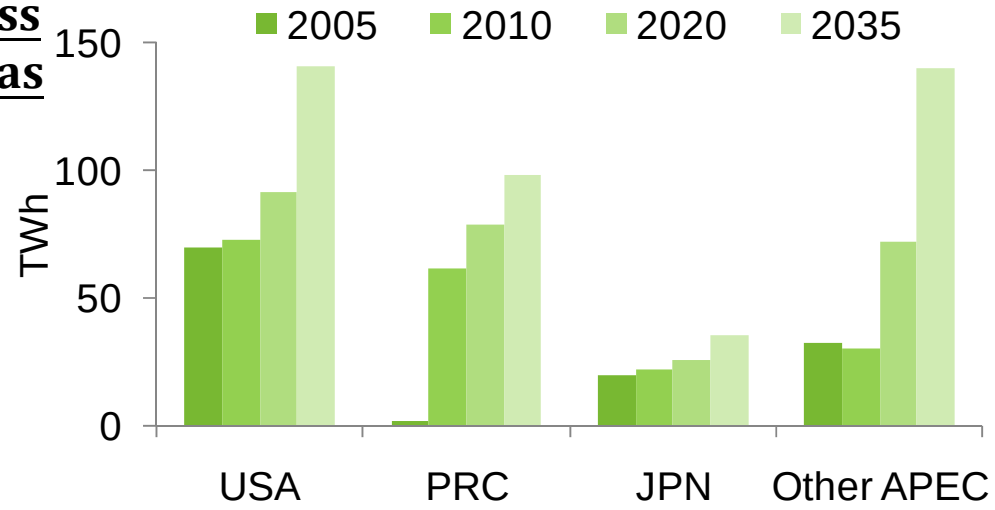
- **High growth** in renewable energy in the *electricity sector*
- Biomass for cooking and heating usually large in early economic development
- Growing use of geothermal/solar for direct heating



Source: APERC Analysis

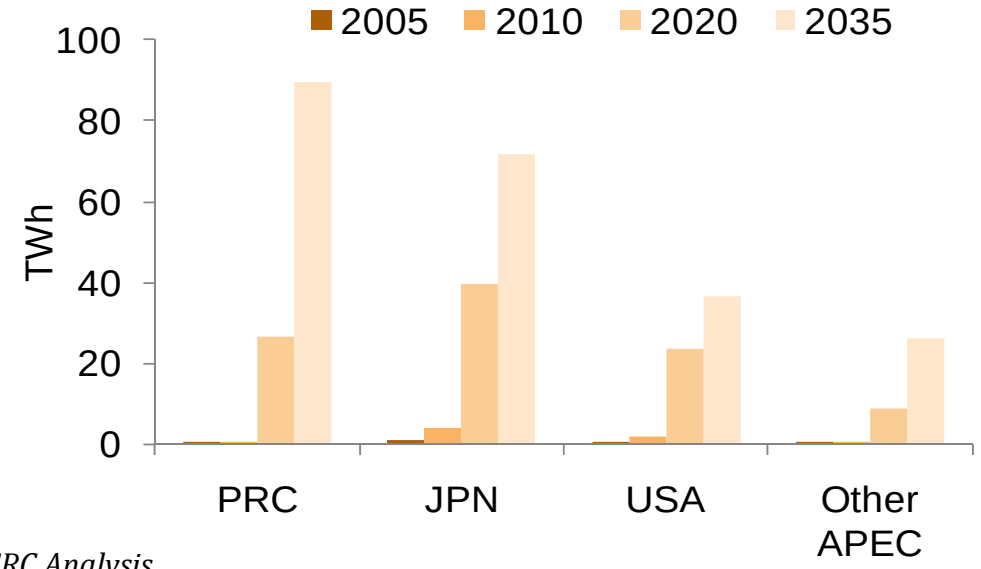
APEC NRE Outlook in the Power Sector by Technology

Biomass & Biogas



- US EPA regulations on Coal emissions will increase the blending of biomass
- Growth projected within a number of APEC economies

Solar

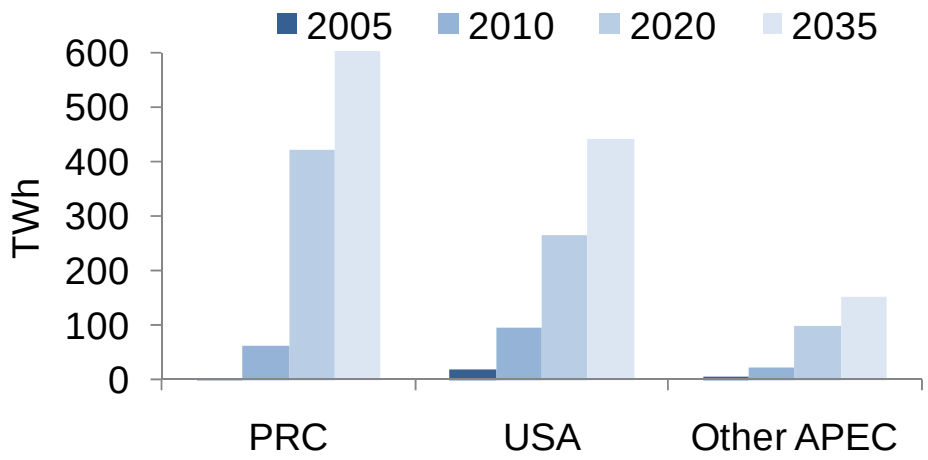


- Solar installations lead by China, Japan and US
- Strongly supported by policy incentives

Source: APERC Analysis

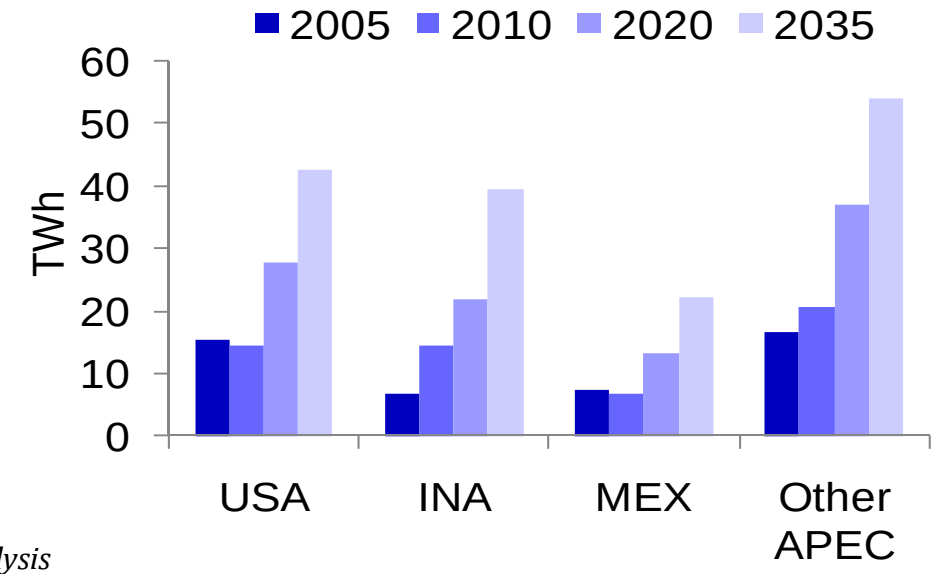
APEC NRE Outlook in the Power Sector by Technology

Wind



- Rapid wind energy growth in China and US continues
- Wind energy moves mainstream in many APEC economies

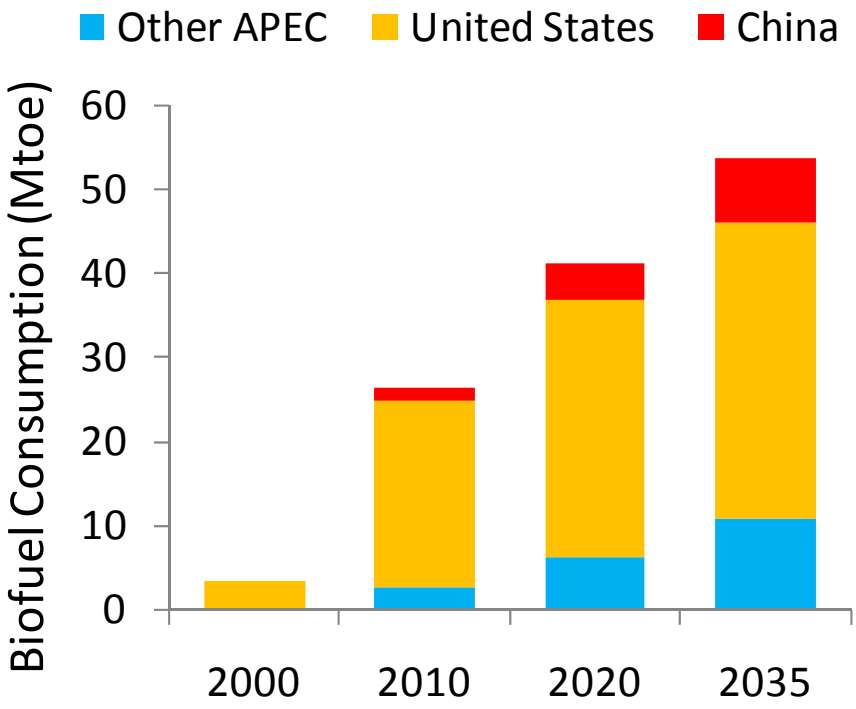
Geothermal



- Geothermal gains traction from attractive economics
- Conventional resource potential is limited

Source: APERC Analysis

Moderate Growth in Biofuels

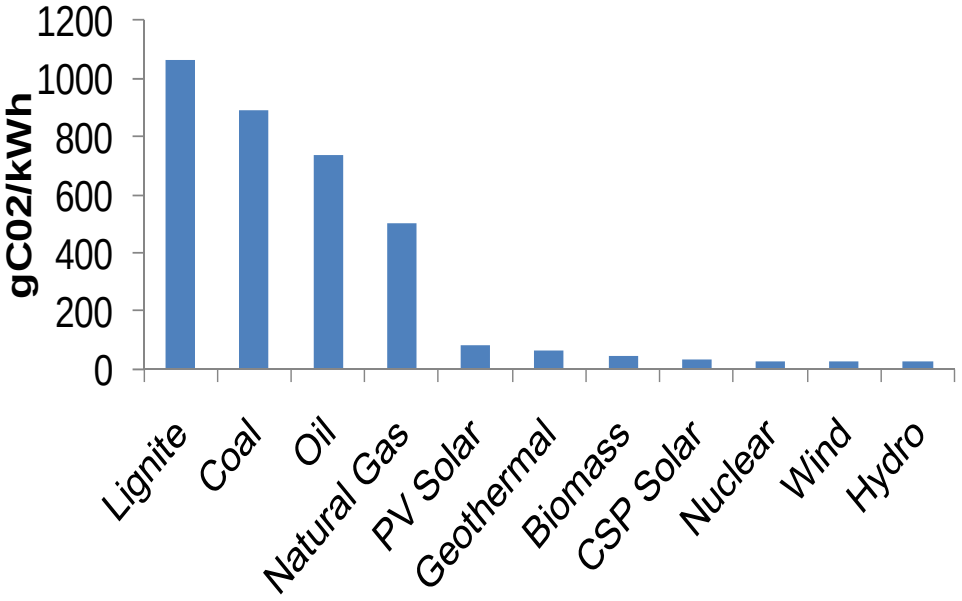


Source: APERC Analysis

- Biofuels for transport constrained by current biomass resource
- 2nd generation (forest based) resources in APEC are immense but the technology is expensive
- Limited production of cellulosic biofuel expected from USA post 2020

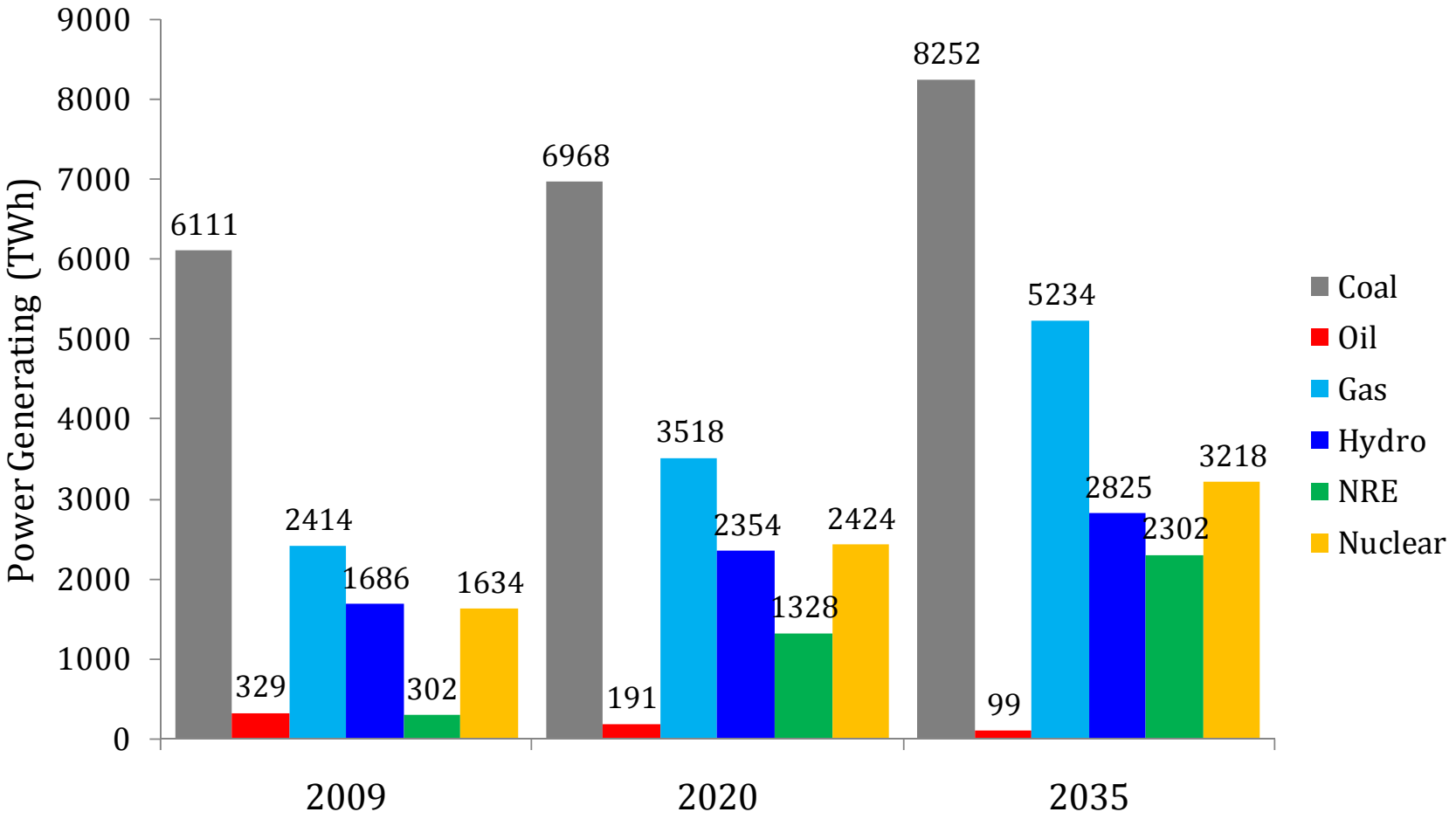
Putting to Rest Lifecycle Emissions Concerns of Renewable Generation

- Emission from PV solar has declined with advances in manufacturing
- Clear difference in lifecycle CO_2 emissions between fossils and renewables
- Lifecycle emissions from natural Gas are 5x higher than PV Solar



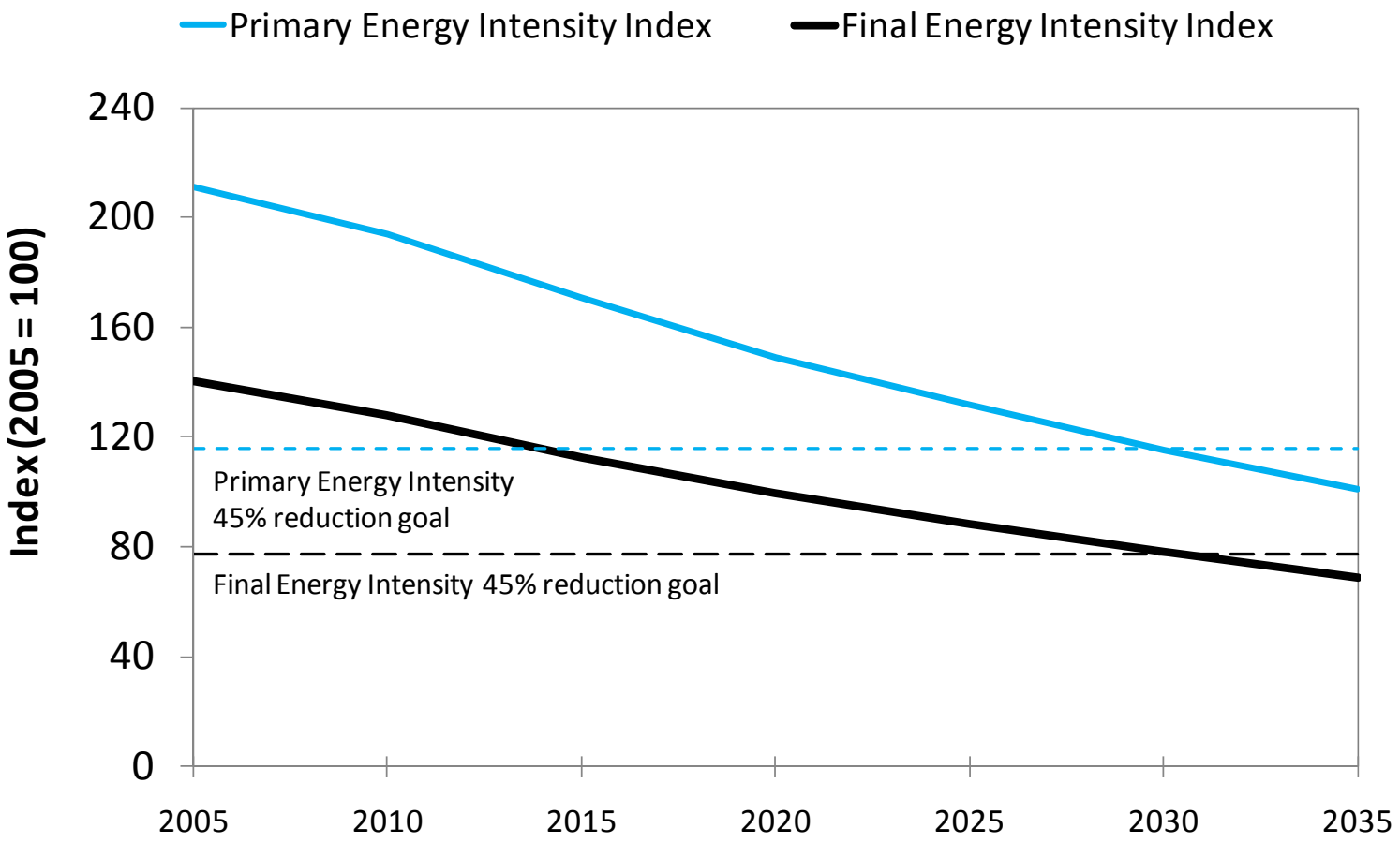
Source: Adapted from WNA (2010) and (IPCC, 2011 p.732)

But Coal is still Increasing in the APEC Power Sector



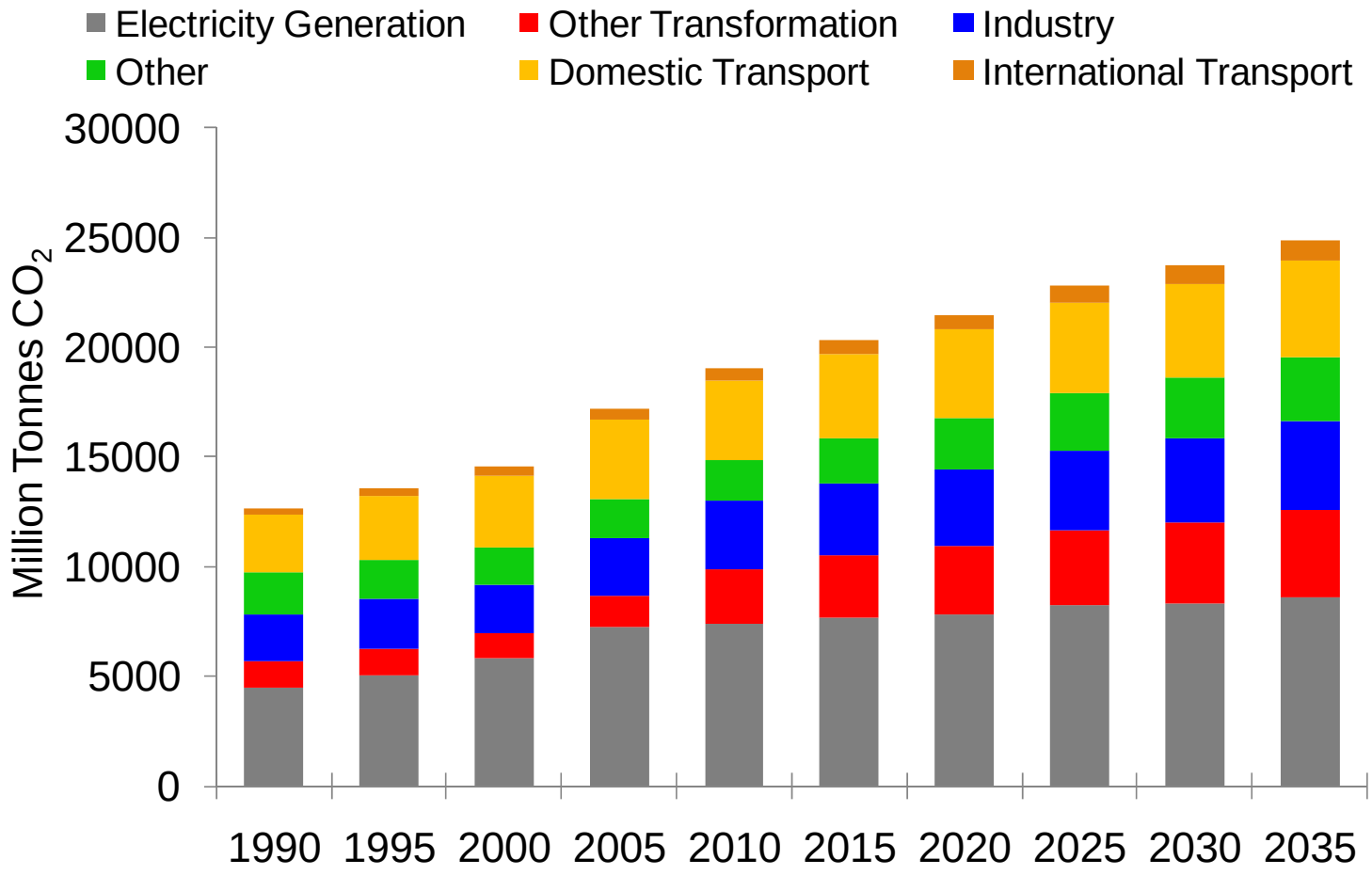
Source: APERC Analysis

APEC Emissions Intensity Goal looks Plausible



Source: APERC Analysis

APEC CO_2 Emissions Still Increasing



Source: APERC Analysis

Thank you for your attention

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