



Session 4: APERC's Research Activities

B-2. APEC Energy Demand and Supply Outlook

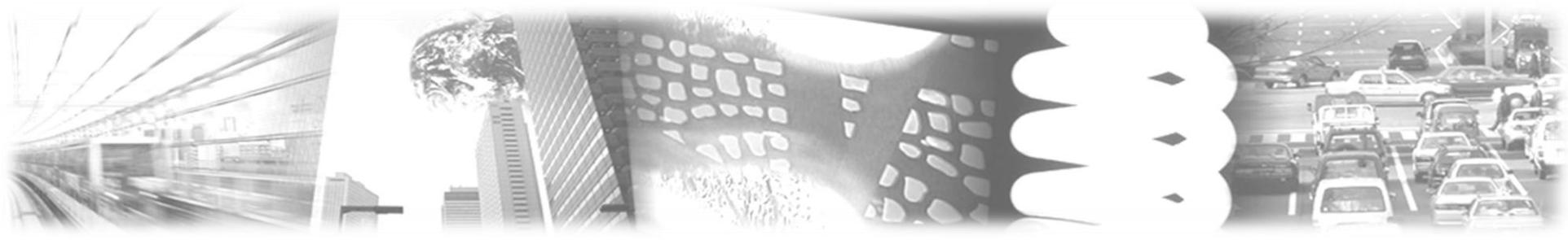
Aishah Mohd Isa, Ph.D (APERC)

**The 24th Meeting of the Expert Group on Energy Data Analysis (EGEDA)
Jeju, Korea, 10~12 October, 2012**

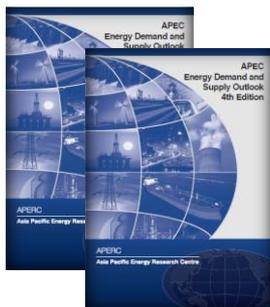


Asia-Pacific
Economic Cooperation

Introduction to the Outlook Project



Overview of the Outlook Project



- Work now underway on the 5th edition of the *APEC Energy Demand and Supply Outlook*, to be published in **late 2012**
- A **25 year look-ahead** (2010-2035) that draws on expertise of APERC researchers as well as other expert advice

Volume 1:

Overall APEC Demand and Supply

- Summary of Key Trends
- Overview of APERC's model
- Overall APEC Final Energy Demand by Sector
- Overall APEC Primary Energy Supply by Fuel Type
- APEC Energy Investment Overview
- APEC Carbon Emissions

Volume 2:

Discussion of specific APEC economies

- Introduction to the economy's
 - Energy demand
 - Energy resources
 - Energy policies
- Business-as-Usual Scenario
- Alternative Scenarios
 - High Gas Scenario
 - Improved Urban Planning
 - Virtual Clean Car Race

Goals and Milestone of the Outlook Project

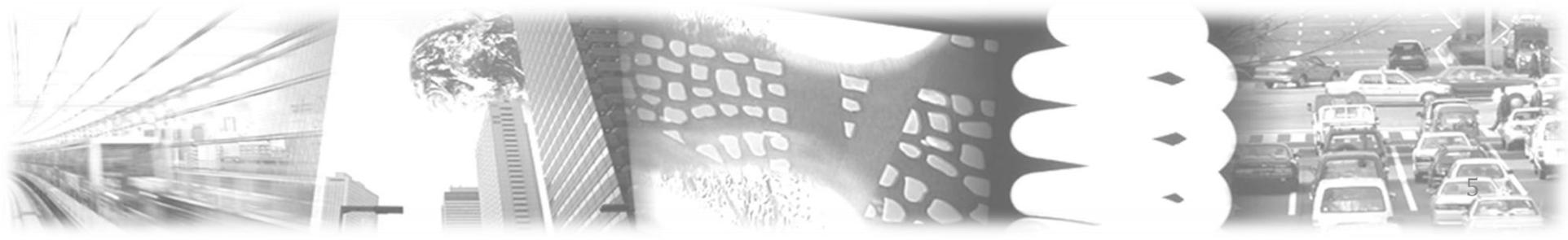
Goals of the Outlook Project

- Help facilitate APEC cooperation by providing policymakers with
 - A **useful reference work** on energy in the APEC region
 - A **statistically-supported review** of the **challenges and opportunities** facing the APEC economies individually and as a region
 - Provide **useful suggestions and inspiration** to policymakers in APEC economies who wish to pursue more sustainable energy policies
 - **Demonstrate the benefits** that alternative policies might have on energy security, environmental protection, energy costs, etc

Outlook Milestones

- Provisional results have been presented at several APEC meetings
 - EWG 43 in Malaysia and EMM 10 in Russia
- We are in the midst of finalizing and documenting our results
- Economy Reviews will then be submitted for peer review

Overview of the Outlook Business-as-usual (BAU) Models



Business-as-usual (BAU) Key Assumptions

APEC Energy Demand Drivers:

1. Volatility in the Oil Market
2. Climate Change
3. Rapid Growth of Developing Economies
4. The Continuing Economic Crisis
5. The Fukushima Nuclear Accident
6. Advances in Technology

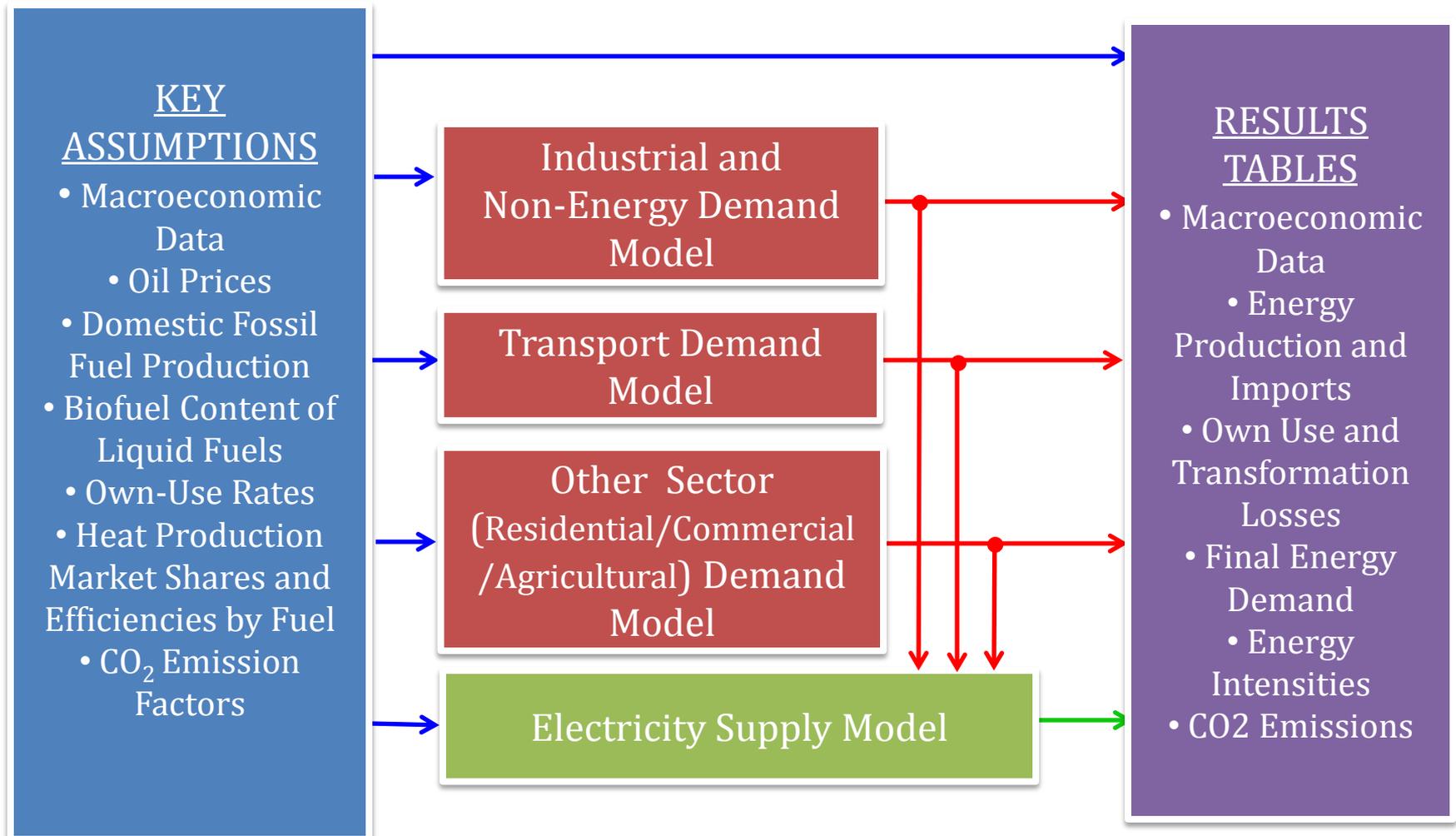
What is considered BAU?

Energy Policies: Only existing policies are considered.

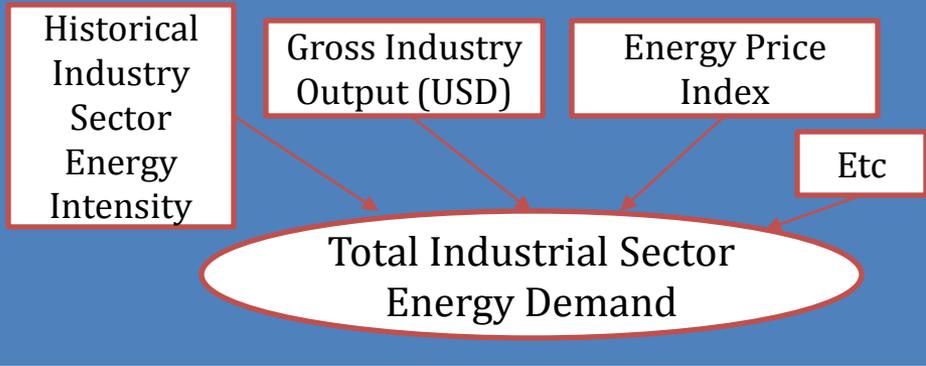
GDP and Population: Continued economic and population growth assumed for the long term. For developing economies, there will be increasing use of commercial fuels and motorized vehicles and better access to electricity.

Oil Prices: IEA's oil projections are adopted for this *Outlook*.

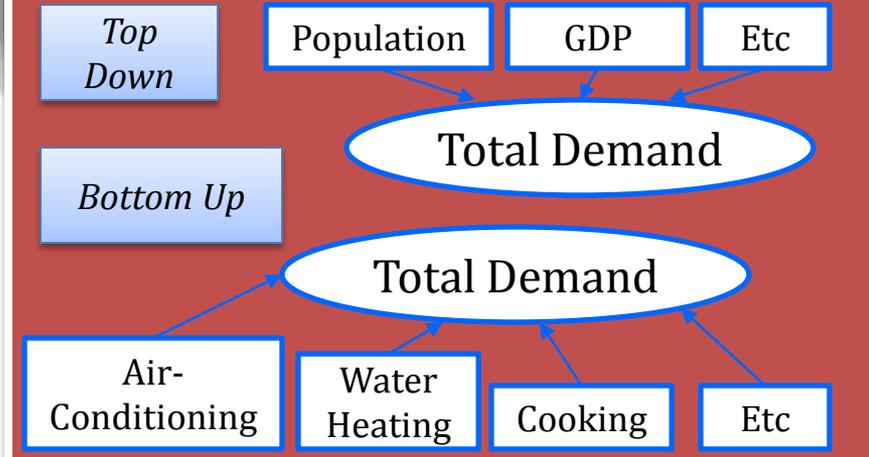
Overall Model Structure



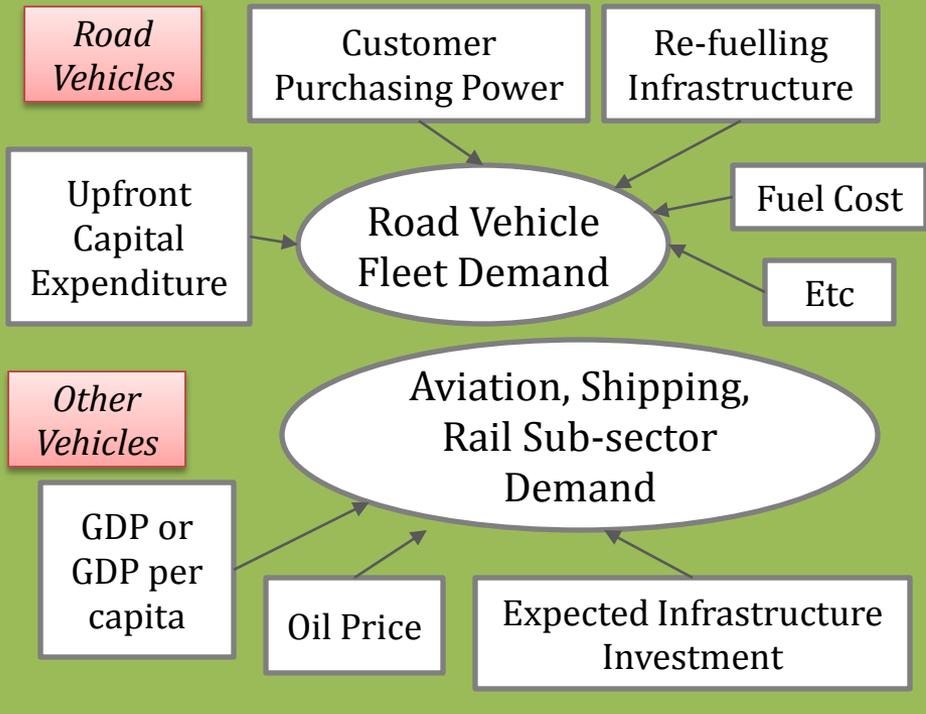
Industrial Sector Model



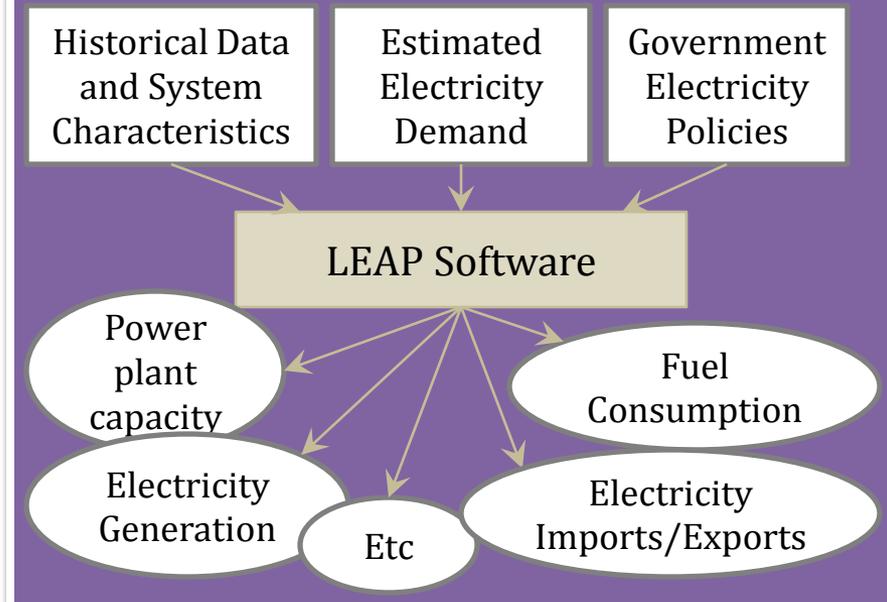
'Other' Sector Model



Transport Sector Model

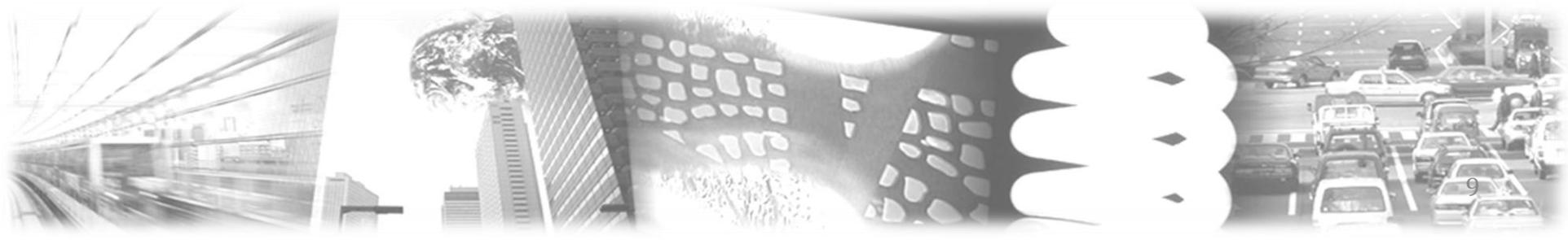


Electricity Model



Alternative Models

1. High Gas Scenario
2. Alternative Urban Development Scenario
3. Virtual Clean Car Race



High Gas Scenario - Introduction

Background

1. How much additional gas production might be available if existing constraints on gas production and trade were reduced?
2. How can the high gas availability benefit APEC economies?

Some Potential Constraints on Gas Production and Trade

1. Policies requiring domestic price of gas below market levels
2. Limited technologies for gas development, especially unconventional and deepwater gas developments
3. Policies restricting export of gas
4. Policies limiting competition in gas development (monopolies or restricting foreign participation)
5. Slow and cumbersome regulatory approvals and land access processes for gas producers

High Gas Case Scenario - Model

Additional Gas Production Estimation

- For each economy, the amount of additional gas production is determined by **actual reserves**
 - Government's estimations
 - Independent studies

Additional Gas Utilization

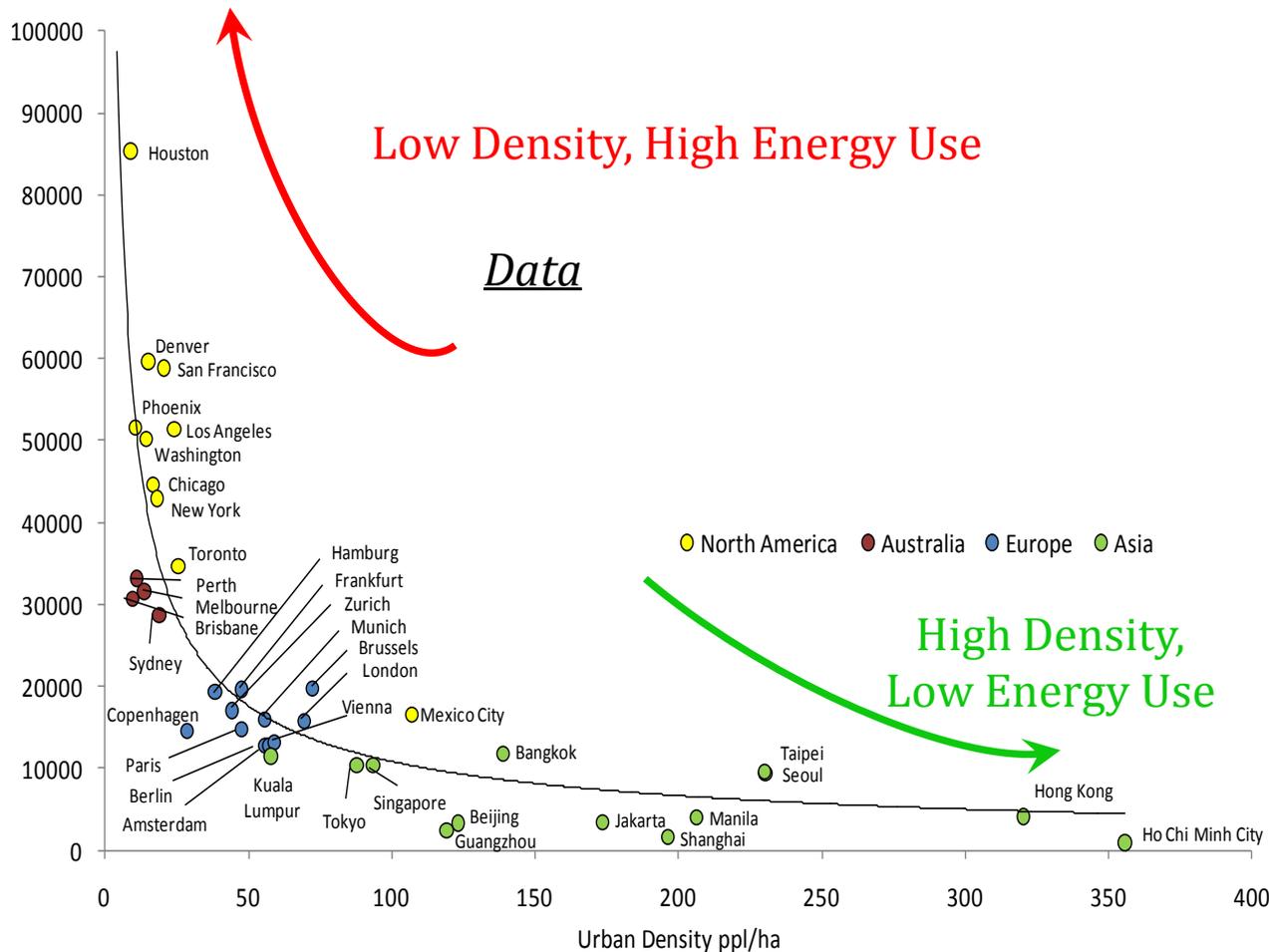
- For our study, in high gas availability situation, an economy could choose to
 - **Export or import** more gas
 - **Burn less coal** in the power generation sector

Benefits of High Gas Availability

- Exporting more gas would **boost economic benefits**
- Burning less coal (in power generation) would **reduce local air pollution and CO₂ emissions**

Alternative Urban Development Scenario - Introduction

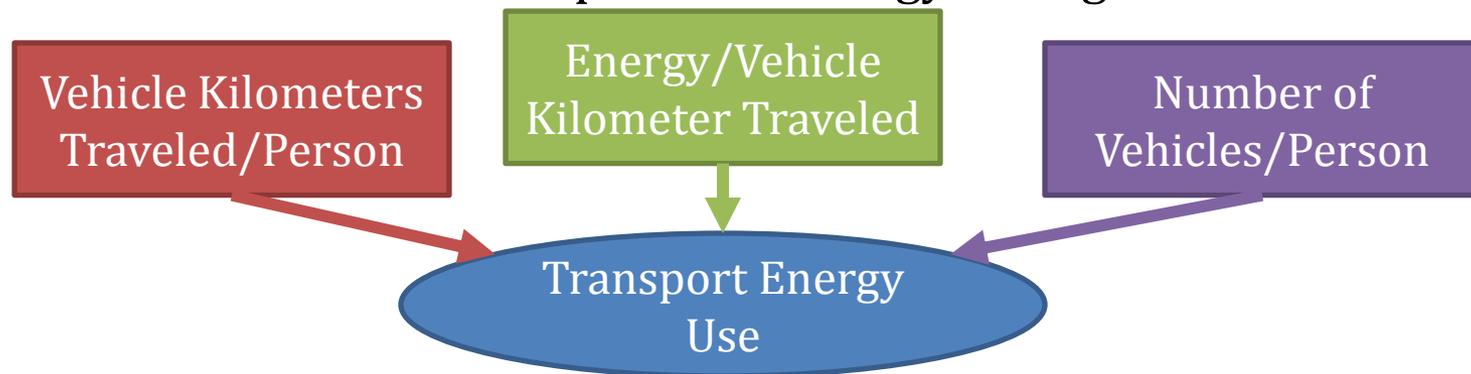
Megajoules per capita



- There is a clear relationship between compact cities with low transport energy demand
- Note that we are **not** claiming that population density alone is the *cause* of low-energy urban design
- Is urban design the key to reducing oil dependency?

Alternative Urban Development Scenario - Model

- The interaction between urban planning and vehicle transportation was modeled to assess the potential energy savings:



- Three sensitivity cases (and one BAU case) were modeled:
 - **Business-as-usual (BAU)** - Urban density continues to decline at the historical world average of 1.7% per annum.
 - **High Sprawl (HS)** - Urban density declines at 3.4% per annum (or twice the historical average), leading to rapid urban area expansion.
 - **Constant Density (CD)** - Urban density is maintained at a constant level (2009) where city expansion is in line with population growth.
 - **Fixed Urban Land (FUL)** - Urban land area is fixed and population growth is contained inside existing urban boundaries.

Virtual Clean Car Race - Introduction



Ministerial Joint Statement
7th APEC Transportation Ministerial Meeting

To promote energy efficient transport, priority will be given to **developing and promoting fuel efficient transport practices**, including the use of **alternative fuels** as well as the development of corresponding **energy efficient transport infrastructure**.

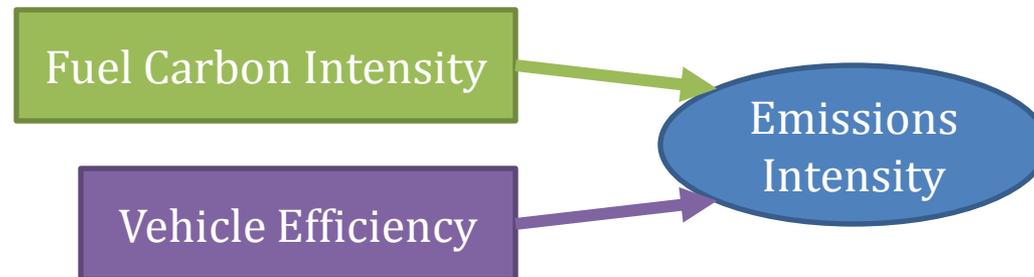
Background

- The adoption of alternative vehicles and alternative fuels has obvious oil savings benefits.
- **But what about the impact on CO₂ emissions from fuel production?**
 - For example, for hydrogen or electricity production

Virtual Clean Car Race - Model

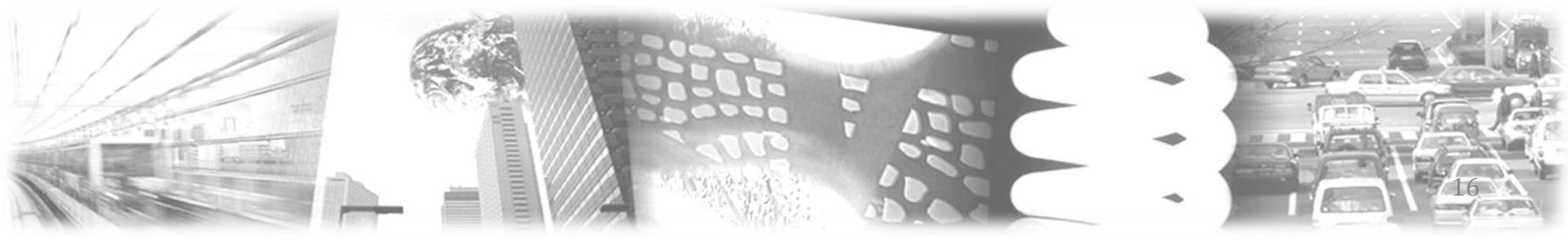
Key Assumption

Accelerated adoption of light vehicle alternative technologies where sales of alternative vehicles in each transition increase incrementally from the same as BAU in 2013 to 50% above BAU in 2020 and thereafter.

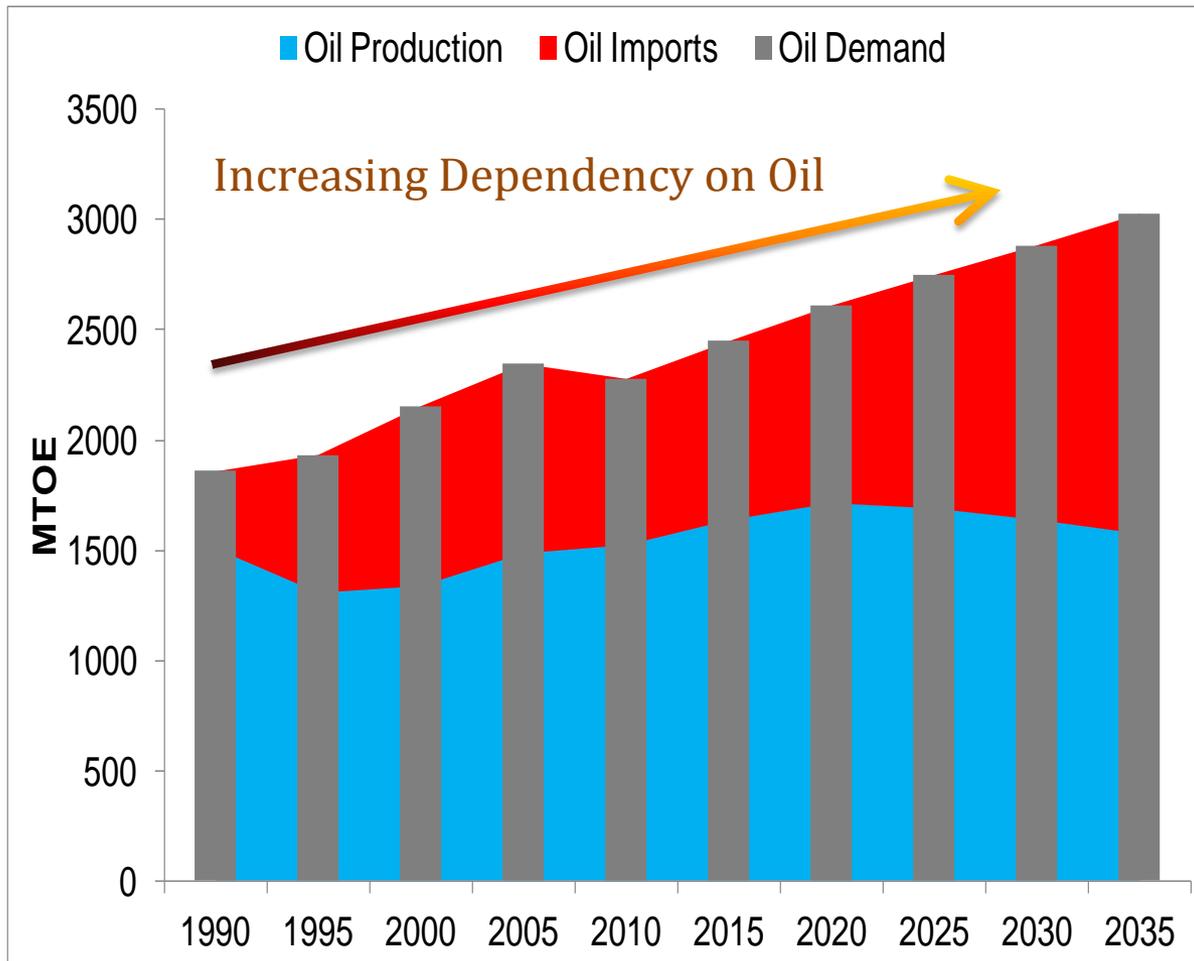


- Four transition cases were modeled, alternative vehicles adopted are:
 1. **Hyper-Cars**: An ultra-efficient conventional vehicle, achieved using ultra light composite materials, advanced power trains and state of the art aerodynamic design.
 2. **Electric Vehicles**: Uses electricity as its energy source
 3. **Hydrogen Fuel Cell Vehicle**: Uses hydrogen fuel cells as its energy source
 4. **Natural Gas Vehicle Transition**: Combusts natural gas instead of oil as its energy source

Key Findings



Key Findings #1: Oil security remains a major threat to the economies of the APEC region



- Oil dependency increases vulnerability to **volatile oil prices** and **oil supply disruptions**
- Transport sector accounts for most of the oil demand
- APERC's alternative cases suggest possible mitigation measures to improve oil security

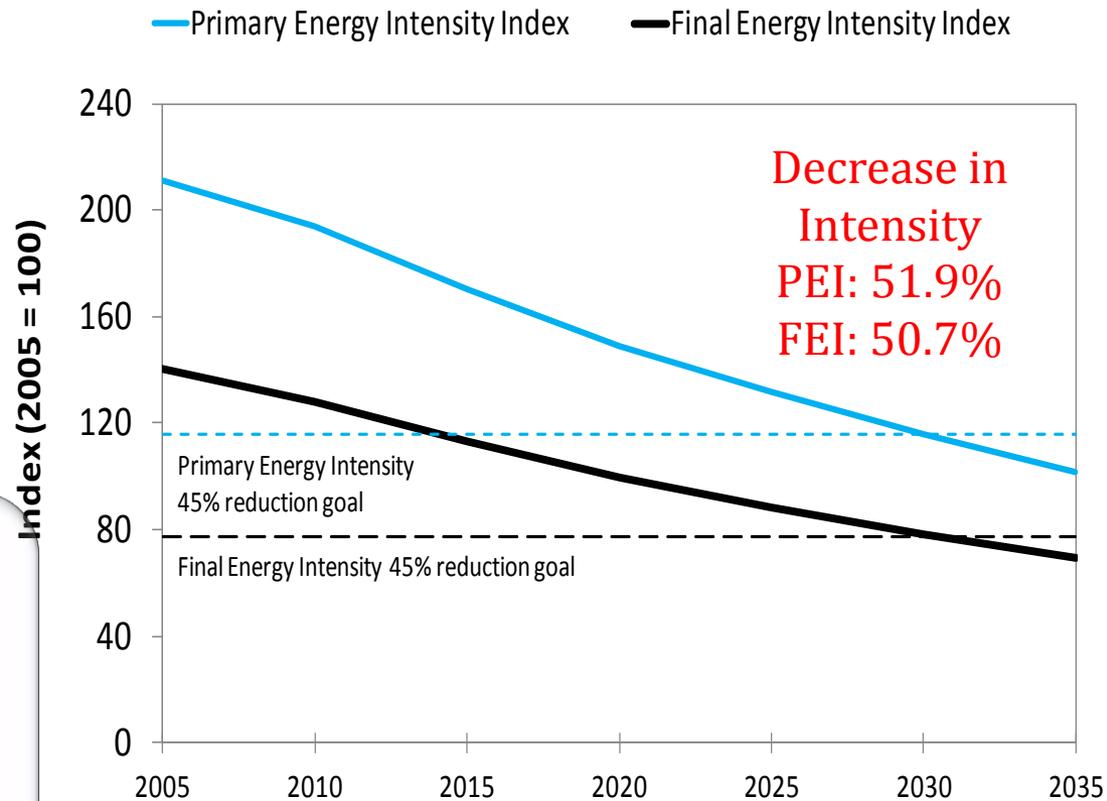
Key Finding #2: APEC's energy intensity goals will probably be met under BAU

We aspire to meet a new APEC-wide regional goal of reducing energy intensity of our economies by at least **45 percent by 2035**, using 2005 as a base year.

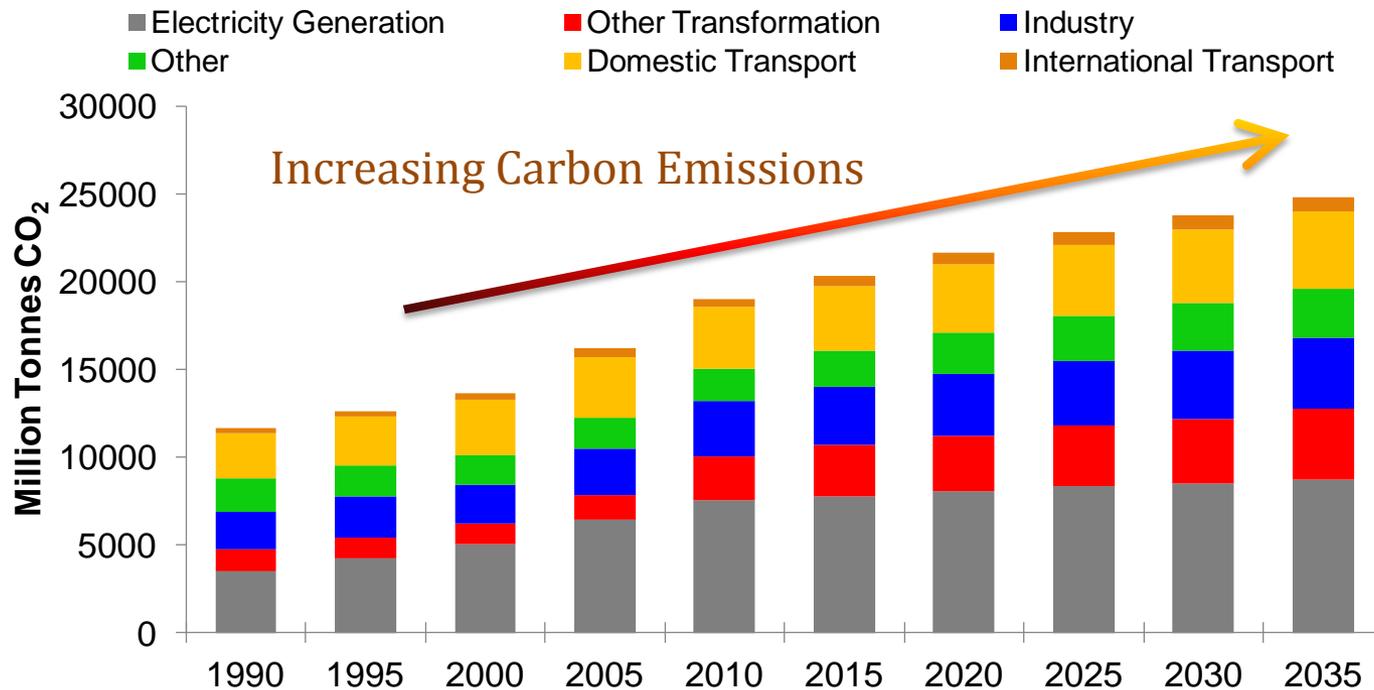
APEC Leaders
2011 APEC Ministerial Meeting



Reduction in energy intensity primarily reflects **improvements in technology**, driven by **rising energy prices** and the effectiveness of **energy efficiency policies**



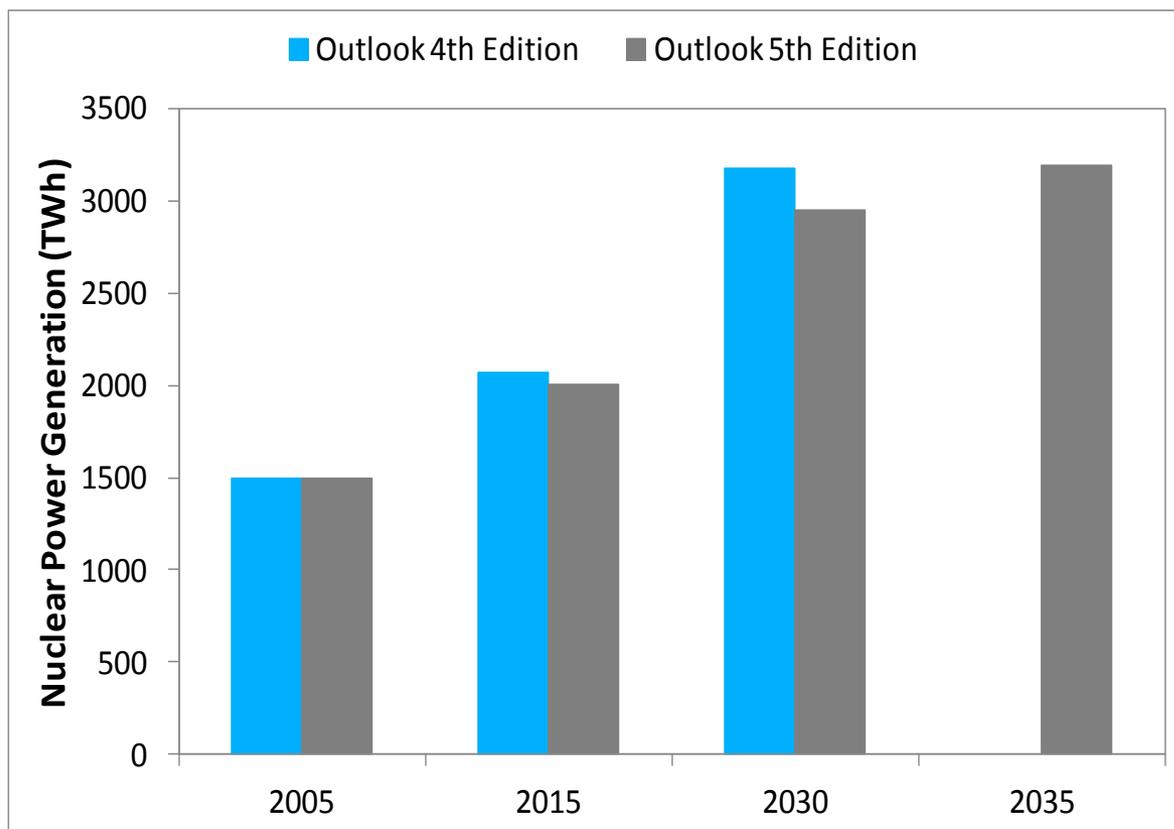
Key Finding #3: BAU is still environmentally unsustainable



- CO₂ emissions rise by **33 percent** between 2010 -2035.
- Emissions pose a threat to humanity, to the environment, and to the economies of the APEC region and the world
- Further efforts still required for a more secure and sustainable future

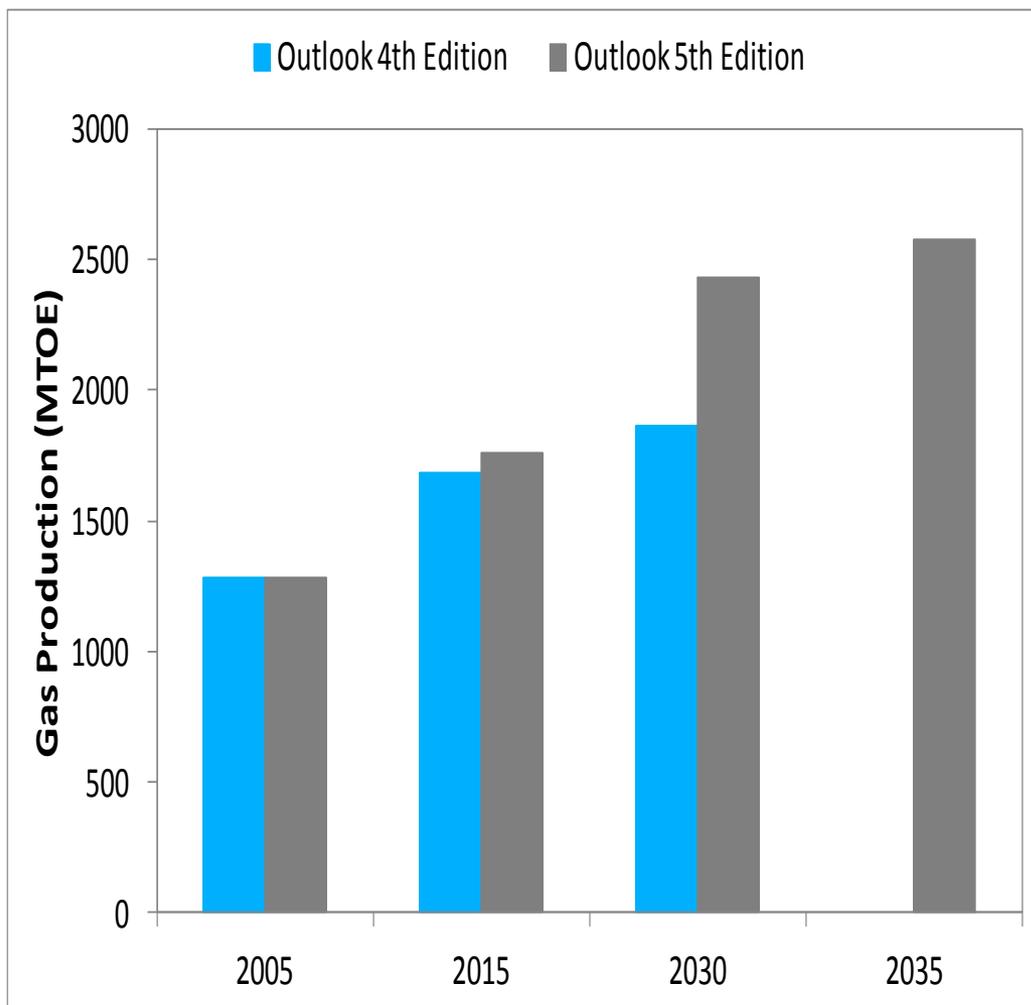
Key Finding #4: Nuclear development slows down, but not by much

- After the Fukushima Nuclear Accident in March 2011, several APEC economies have re-evaluated their nuclear policies



- Over the long-run, APEC economies (except for Japan and Taiwan) will **most likely continue** with their existing nuclear policies but under more **stringent safety regulations** and **extended deployment periods**.

Key Finding #5: Gas production growth speeds up, and could challenge coal



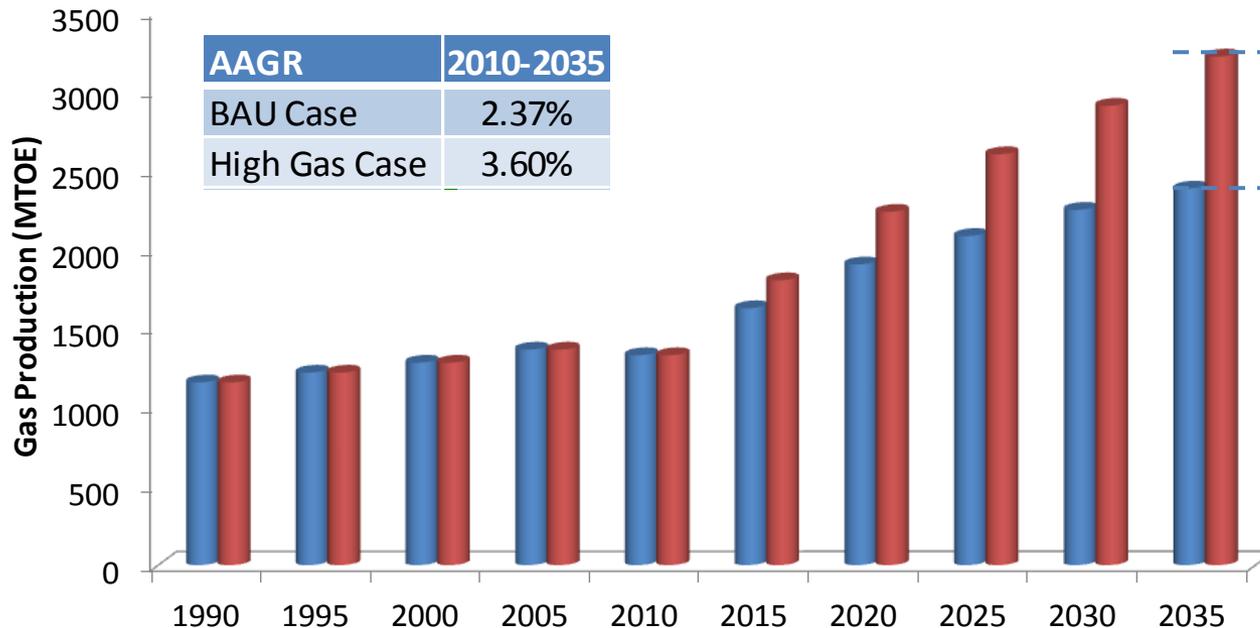
- Gas production in APEC economies accelerates, driven by:
 - **Shale gas revolution** in US and Canada
 - **Improving technologies** for producing conventional and unconventional gas
- Note that these production estimates are still on the conservative side, taking into account only proven reserves and existing natural gas policies

APERC High Gas Case (HGC) Scenario Results— Increased Gas Production

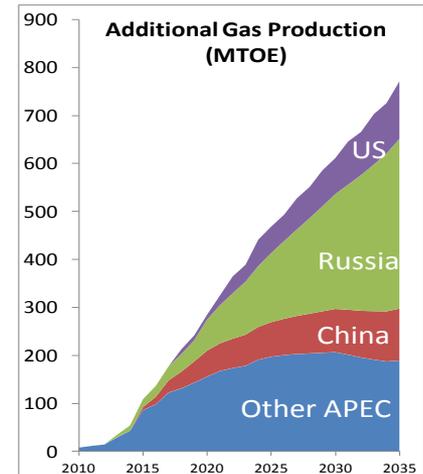
Background

- The High Gas Case assumes that constraints on natural gas production and trade are relaxed

■ BAU Case Gas Production ■ High Gas Case Production



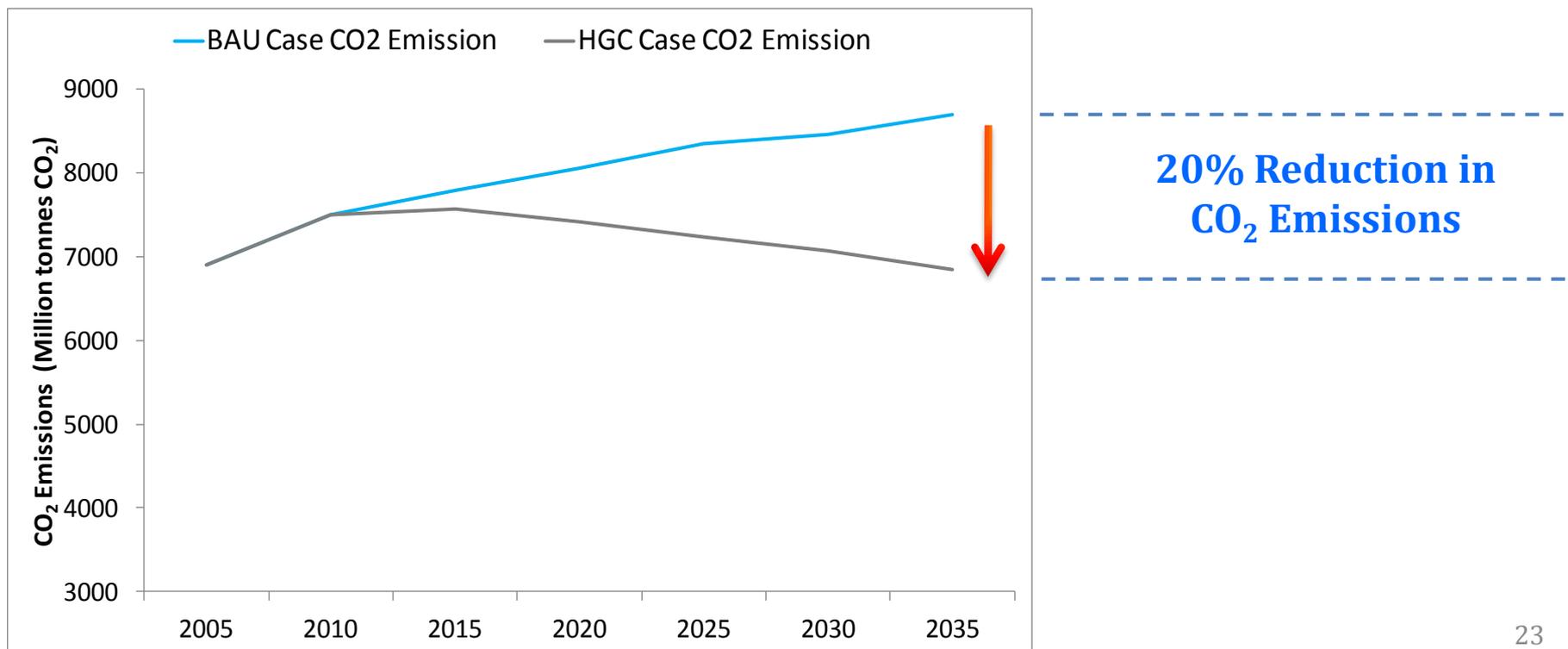
↑ 35% Increase in Gas Production



APERC High Gas Case (HGC) Scenario Results— Impact on Electricity Sector CO₂ Emissions

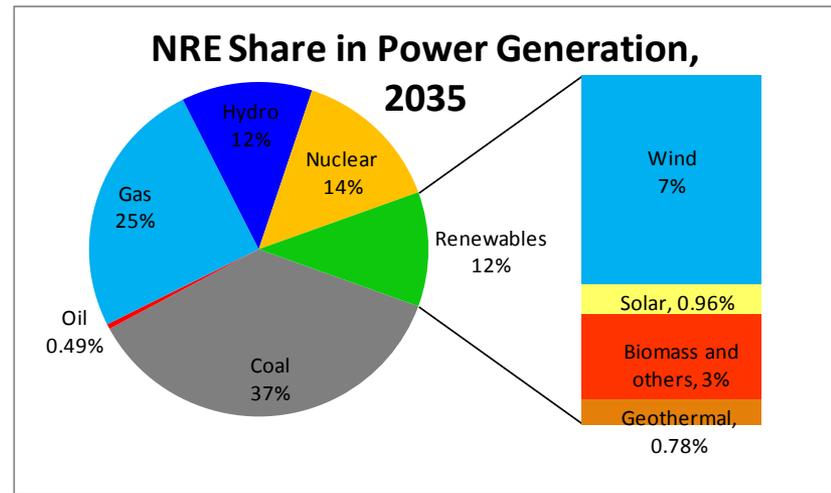
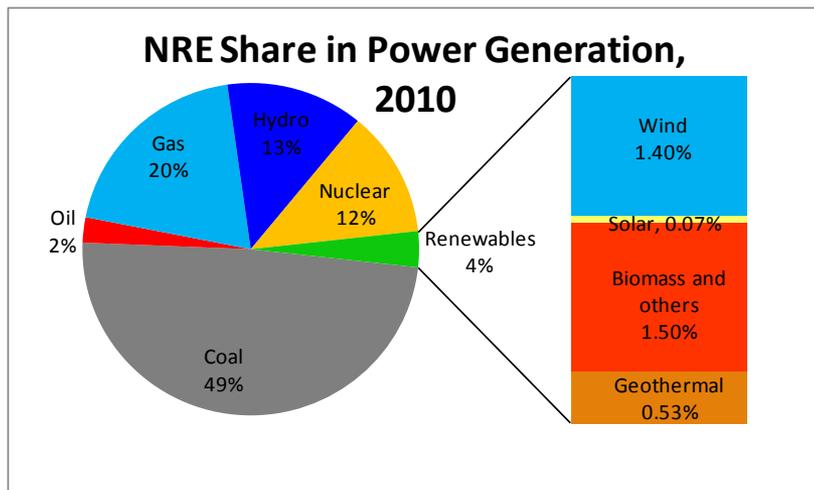
Key Assumption

- All additional gas production is either exported or used to **replace coal** in electricity generation
- Burning less coal would **reduce local air pollution and CO₂ emissions**



Key Finding #6: New Renewable Energy (NRE) Goes Mainstream

- NRE penetration will be driven by two factors:
 - Policies to promote renewable energy in power generation and transportation sector
 - Continuing technological improvements that further reduces cost and improves the performance of renewable energy



Key Finding #7: Big Opportunities to Improve Efficiency, Especially in Transportation

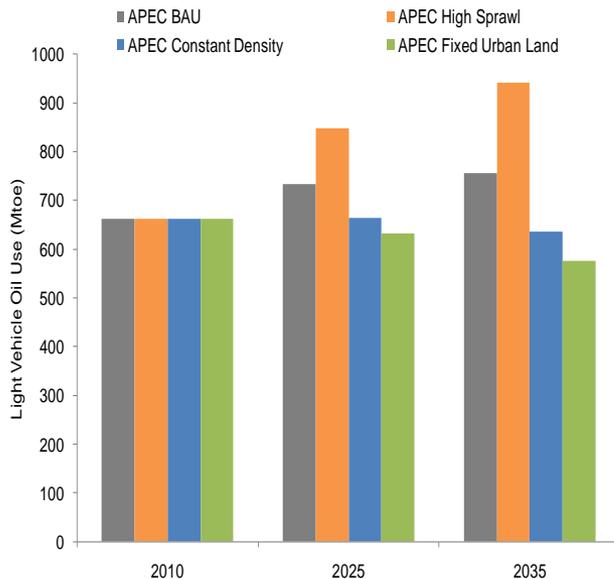
- Two alternative scenarios for improving energy efficiency in the transportation sector were developed for each APEC economy
 - **Alternative Urban Development Scenarios**
 - High Sprawl
 - Constant Density
 - Fixed Urban Land
 - **Virtual Clean Car Race**
 - Hyper-car Transition
 - Electric Vehicle Transition
 - Hydrogen Vehicle Transition
 - Natural Gas Vehicle Transition
- For each sensitivity case, the impact on oil consumption and emissions reduction is assessed.

Alternative Urban Development Scenario – Overall Results for Oil Demand and CO₂ Emissions

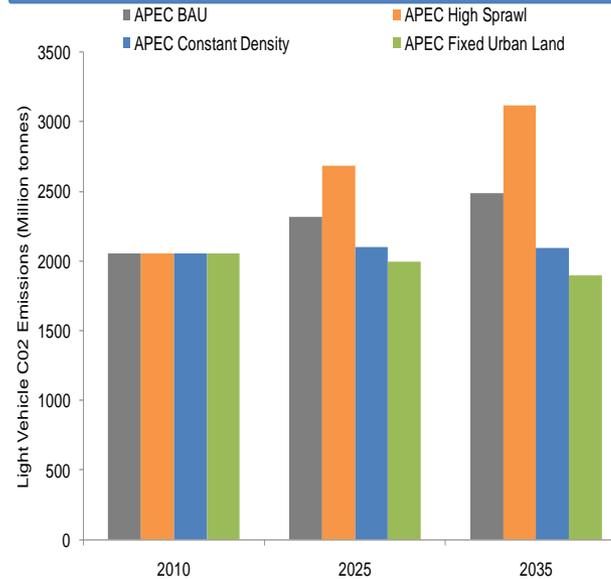
Introduction

- The rapid growth of APEC's economies presents a unique opportunity to build cities in an energy efficient manner.

Light Vehicle Oil Consumption



Light Vehicle CO₂ Emissions



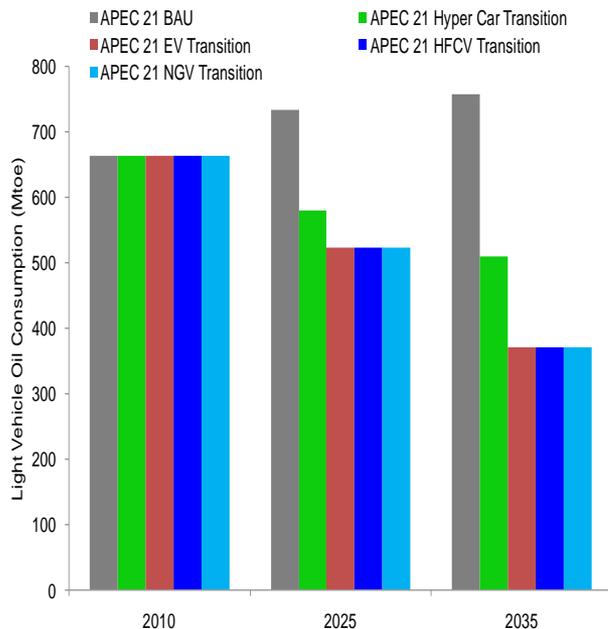
- Compact cities *tend* to favor transport energy-saving features in greater abundance
- Results consistently show that cities with lower population densities has higher energy demand

Virtual Clean Car— Overall Results for Oil Demand and CO₂ Emissions

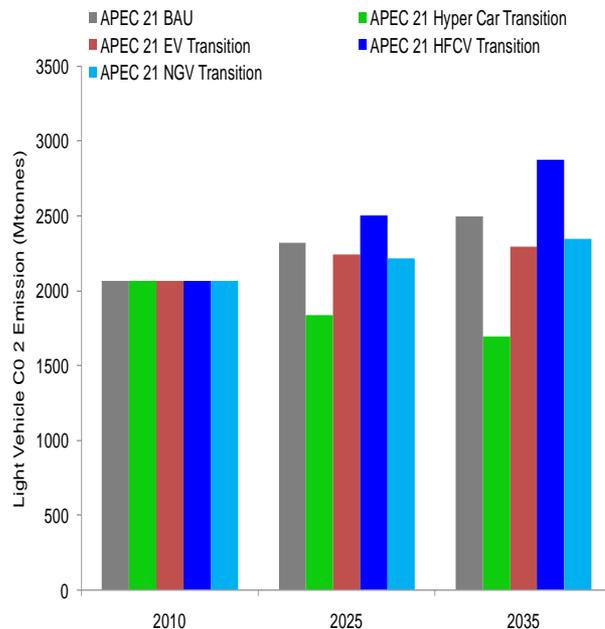
Introduction

- How will the adoption of light vehicle alternative technologies impact the energy sector if we take into account fuel production?

Light Vehicle Oil Consumption



Light Vehicle CO₂ Emissions



- The results can vary dramatically by economy depending on the marginal source for electricity generation
- APEC-wide, hyper-cars has the best emissions reduction benefits.

Thank you for your kind attention

<http://www.ieej.or.jp/aperc>

