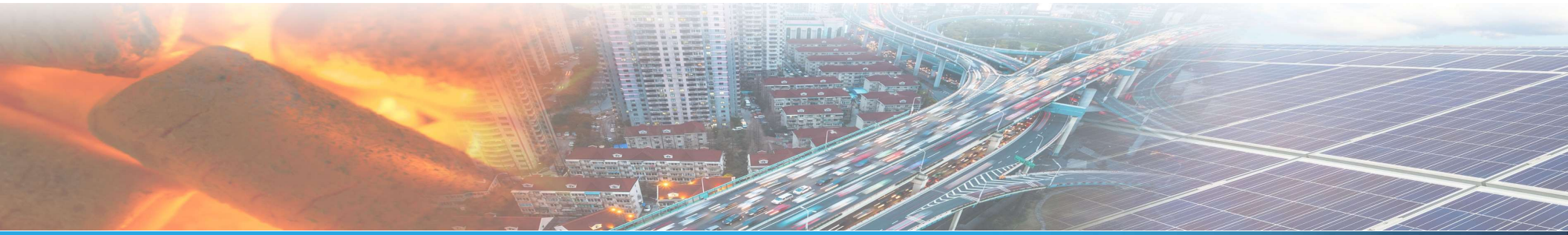

Energy Efficiency Policy Workshop 2019

Transport CO_2 emissions in APEC 2000-50

Alexey Kabalinskiy
APERC (Asia Pacific Energy Research Centre)
18 March 2019, Hong Kong

APERC
Asia Pacific Energy Research Centre

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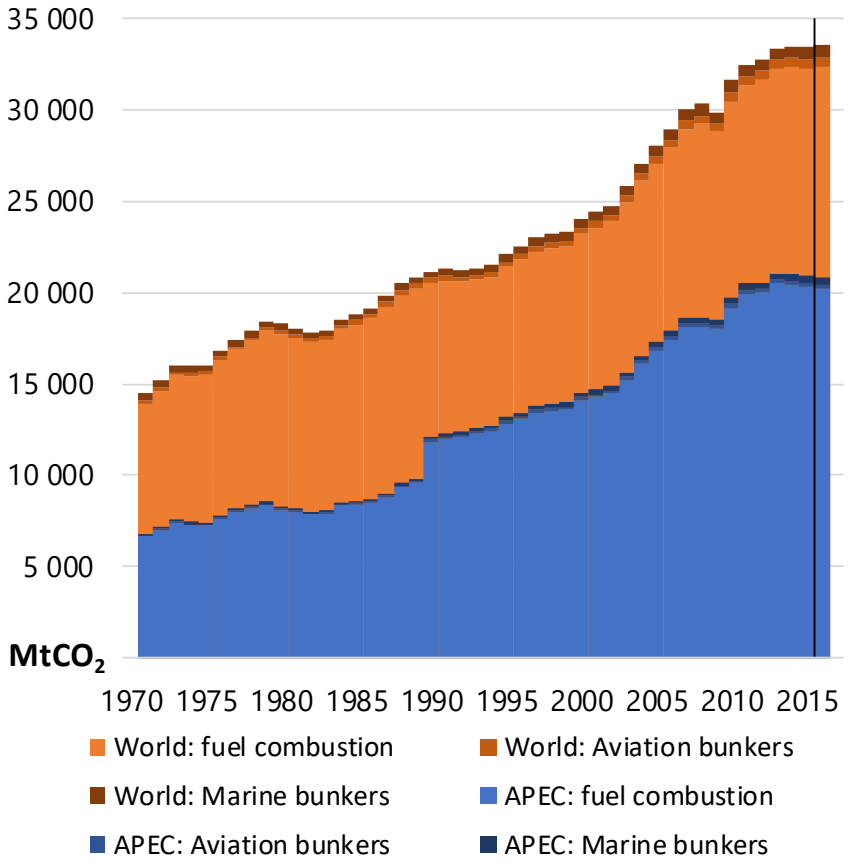
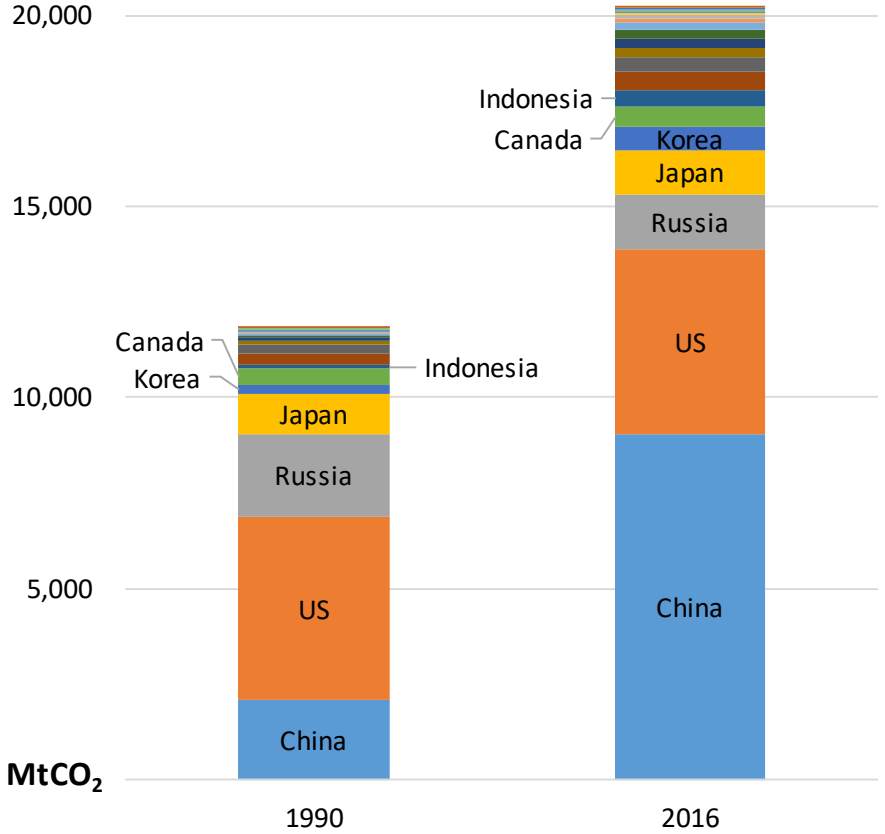
Asia-Pacific Economic Cooperation

APEC CO_2 emissions (fuel combustion) 1971-2016

APEC and global CO_2 emissions



APEC: Economy-specific emissions

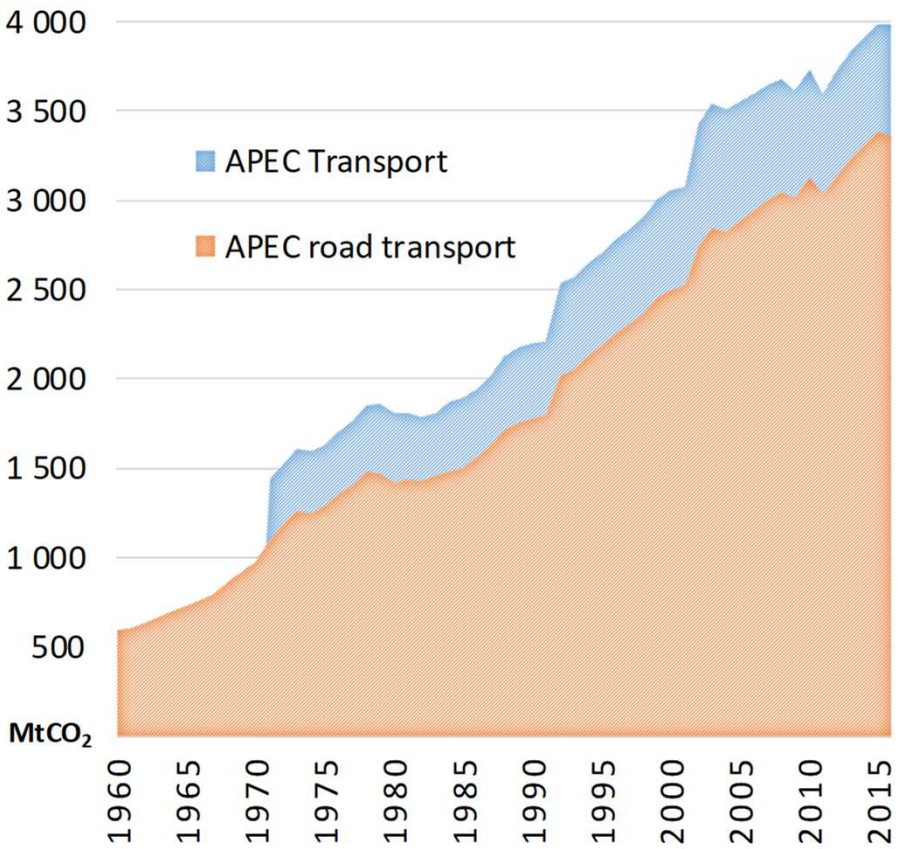


- APEC CO_2 emissions grew **x3** in 45 years, representing over 60% of the world,
- In 1990-2016: China's share grew from 18% to 45%, while US declined from 41% to 24%

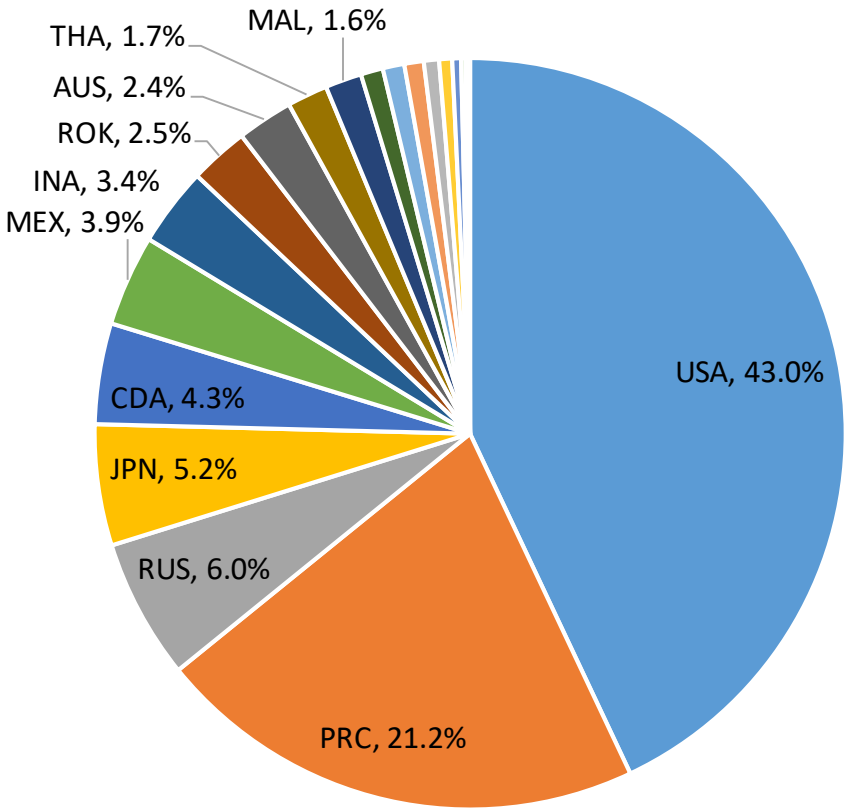
Source: *WorldBank, 2018; IEA, 2018*

APEC transport CO_2 emissions 1960-2016

APEC transport CO_2 emissions



APEC transport emissions in 2016



- Since 1971 road emissions grew **x3** in line with total emissions, road share grew from 78% to 85%,
- In 2016 China and the US were responsible for nearly 2/3 of APEC's transport emissions

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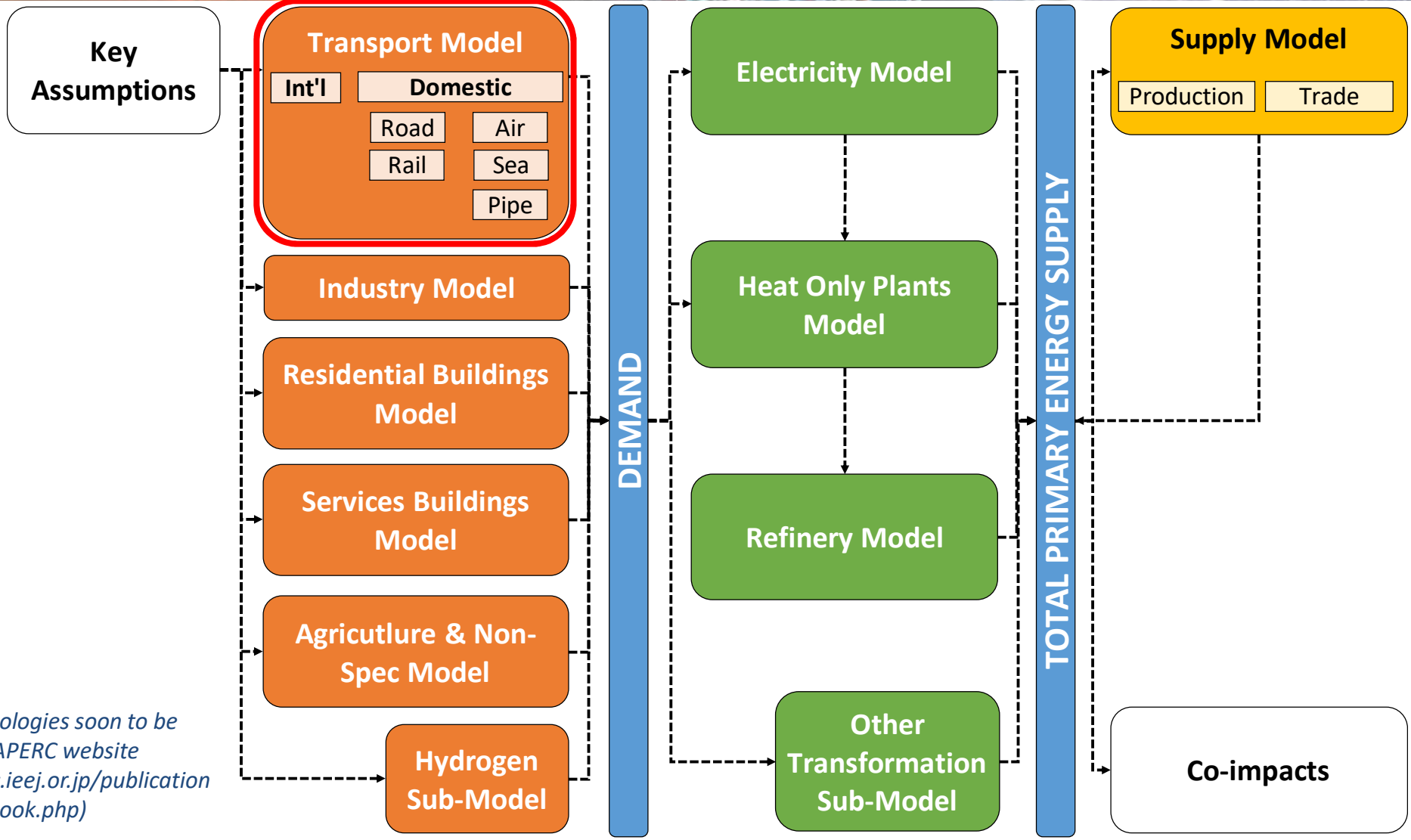
Source: *IEA, 2018; WorldBank, 2018*

APERC uses a suite of nine models for Outlook 7th Edition



Note: *methodologies soon to be published on APERC website (https://aperc.ieej.or.jp/publications/reports/outlook.php)*

Outlook 7th Edition: transport model

- Transport model projects APEC's transportation sector (following IEA's World Energy Balances) fuels demand,
- The model utilizes Excel and GAMS software packages,
- Passenger and freight activity are the key drivers

- International bunker fuels are modelled as f(GDP),
- Domestic non-road transport is split in passenger and freight and modelled top-down,
- Domestic road is modelled bottom-up with five vehicle types and ten powertrain technologies

Sub-sector	Passenger	Freight	Approach
International	-	-	Top-down
Aviation bunkers	-	-	Top-down
Marine bunkers	-	-	Top-down
Domestic	Y	Y	Mixed
Road	Y	Y	Bottom-up
2W	Y	Y	Bottom-up
LV	Y	-	Bottom-up
LT	-	Y	Bottom-up
BUS	Y	-	Bottom-up
HT	-	Y	Bottom-up
Rail	Y	Y	Top-down
Air	Y	Y	Top-down
Sea	Y	Y	Top-down
Pipe	-	Y	Top-down

***Notes**: vehicle types include 2W (*2-wheelers), LV (Light vehicles), LT (Light trucks), BUS (Buses), HT (Heavy trucks); road vehicle technologies include ICEG, ICED, HYBG, HYBD, LPGD, CNGD, FLEX, PHEV, BEVD and FCEV

Outlook 7th Edition includes three scenarios

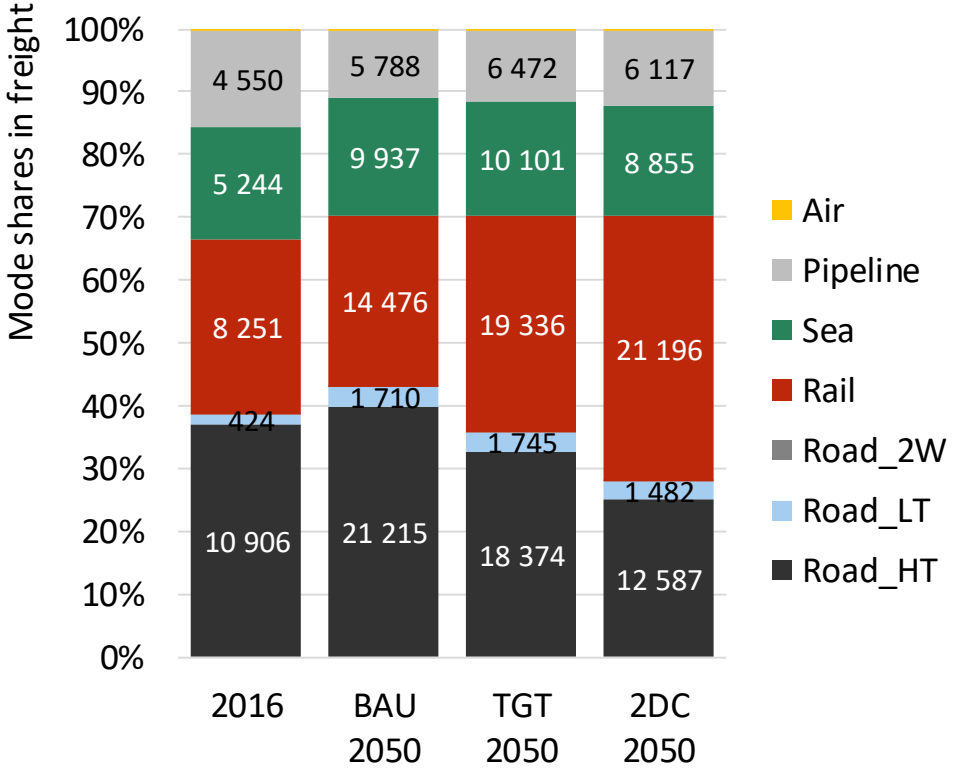
- **Business-as-usual (BAU) scenario:**
  The BAU scenario reflects current policies and trends within the APEC energy sector. In turn, it largely projects past trends into the future.
  - Road vehicle fuel efficiency assumptions reflect current policy,
  - Otherwise 'passive' improvement of new vehicles at 0.5-2.0%/yr until 2030

- **APEC Target (TGT) scenario:**
  The TGT scenario is driven by APEC's goals of reducing energy intensity while increasing the share of renewables.
  - Progressively improving Passenger and Freight transportation activity,
  - Accelerated fuel efficiency improvement: current policy and 0.5-1.0%/yr improvement in 2030-40, and
  - Increased share of biofuels

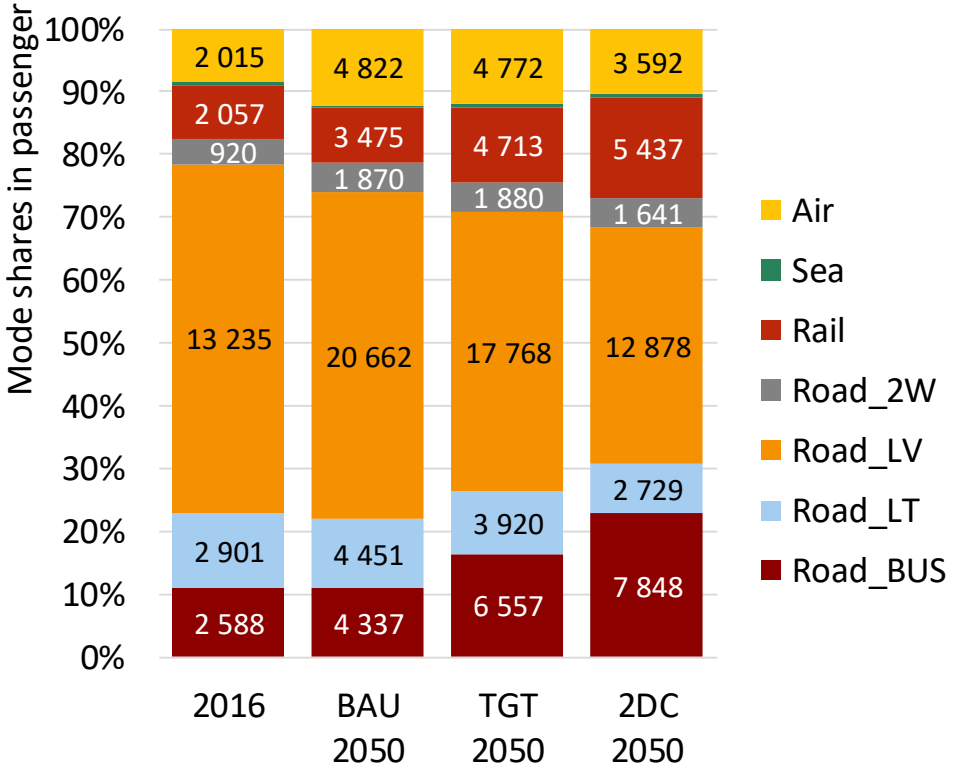
- **2 Degree Celsius (2DC) scenario:**
  2DC follows the carbon emissions reductions included in the Energy Technology Perspectives by IEA.
  - Decoupling the transportation activity and economic growth,
  - Reduced vehicle ownership and vehicle mileage compared to TGT,
  - Fuel efficiency and energy intensity consistent with TGT,
  - Support for advanced fuels and vehicles, mode/technology shifting.

Freight and passenger is dominated by road

APEC's Freight activity



APEC Passenger activity



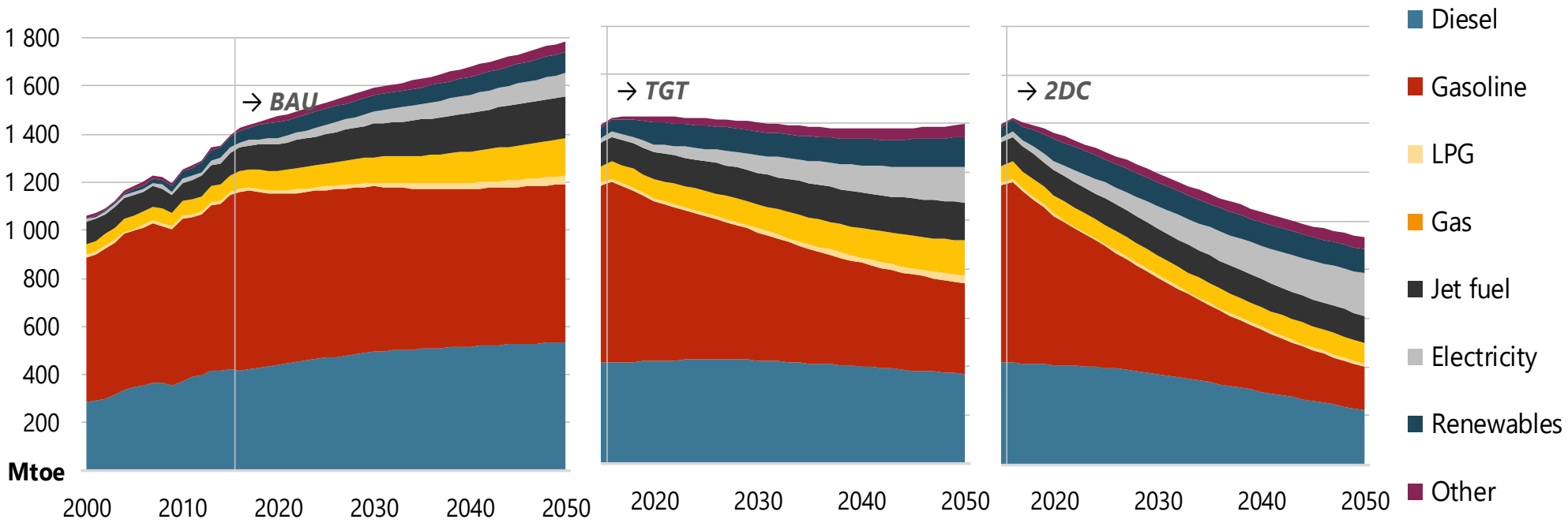
Source: APERC analysis;

Note: units are billion tonne-kilometres (Gtkm) for freight, and billion passenger-kilometres (Gpkm).

- Road freight expands under BAU, share of Rail grows in TGT and 2DC
- Road passenger is over 70% of , public transport grows in TGT and 2DC

Gasoline and diesel are key in BAU, electricity grows fastest in all scenarios

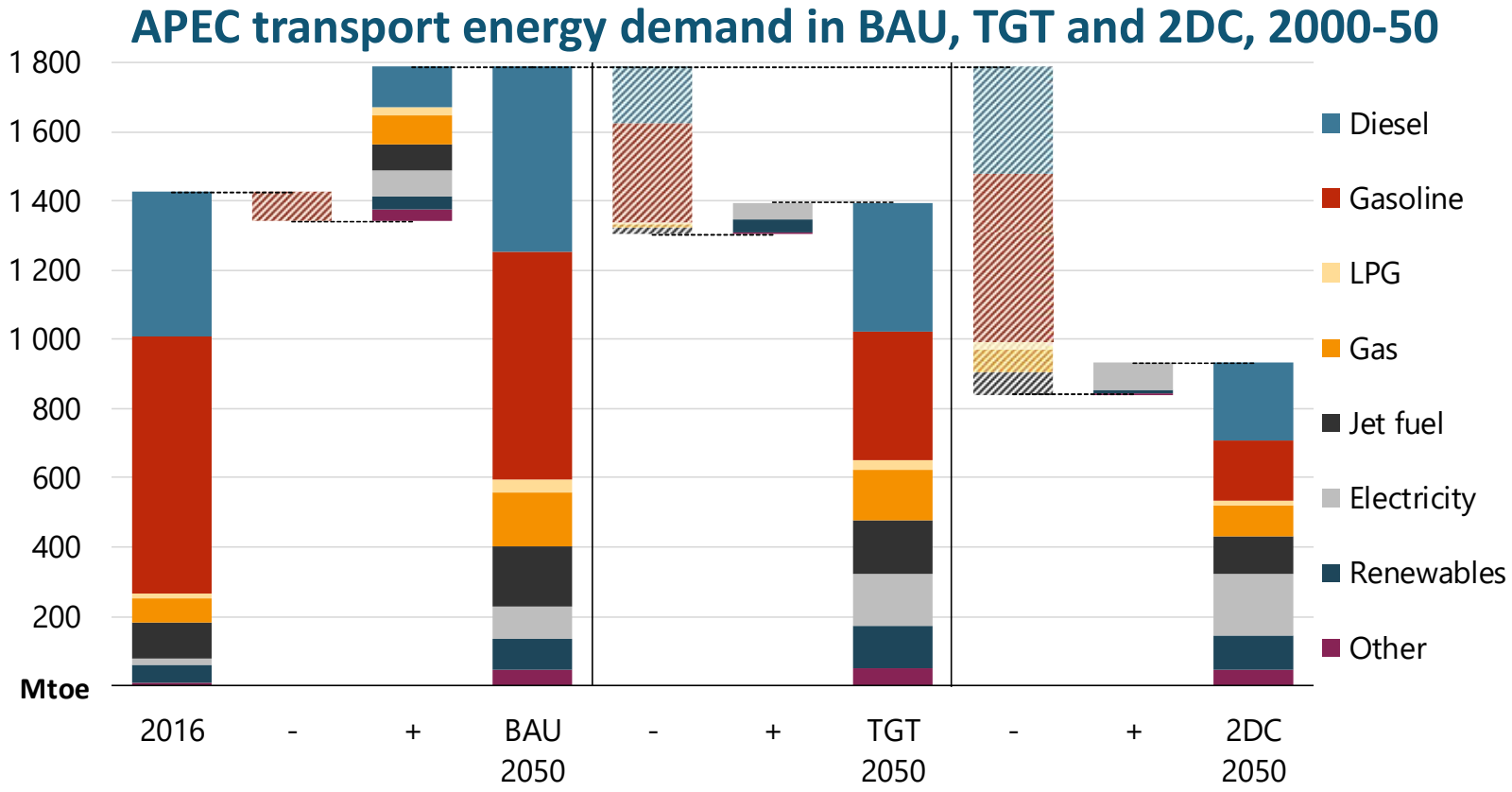
APEC transport energy demand in BAU, TGT and 2DC, 2000-50



- Conventional fuels dominate under BAU,
- Gasoline for passenger transport declines in TGT and 2DC,
- Diesel remains strong in all scenarios for Road freight;
- Demand grows 25% in BAU, remains flat (-2.1%) in TGT and drops 35% in 2DC

Source: IEA, 2018; APERC analysis

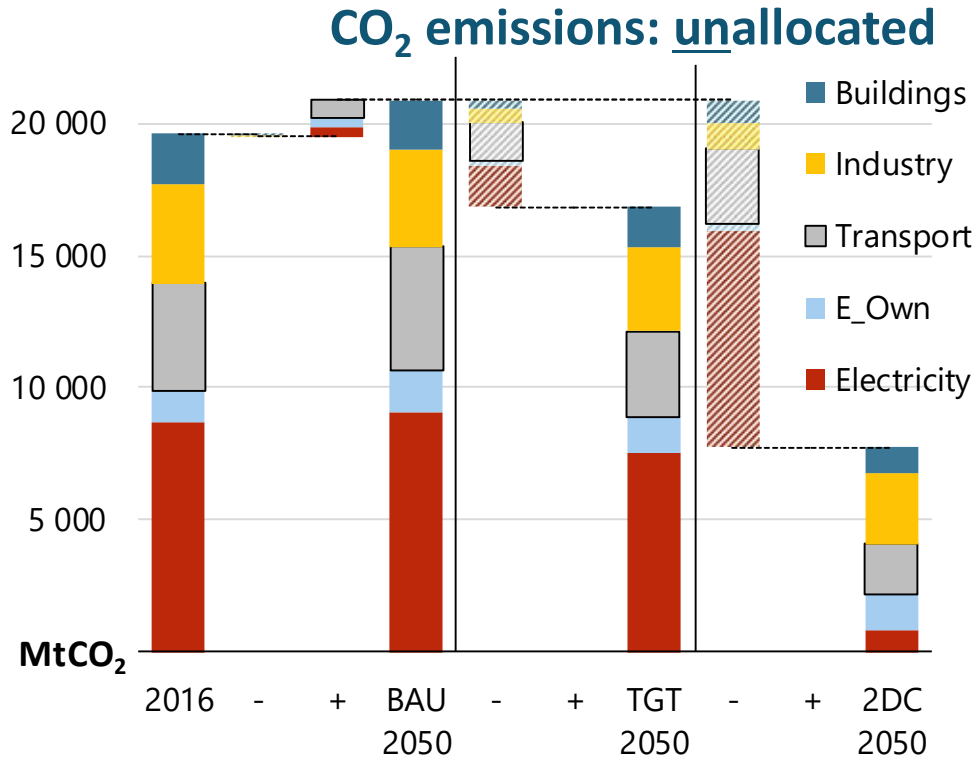
Gasoline and Diesel are key in BAU, Electricity and biofuels grow in all scenarios

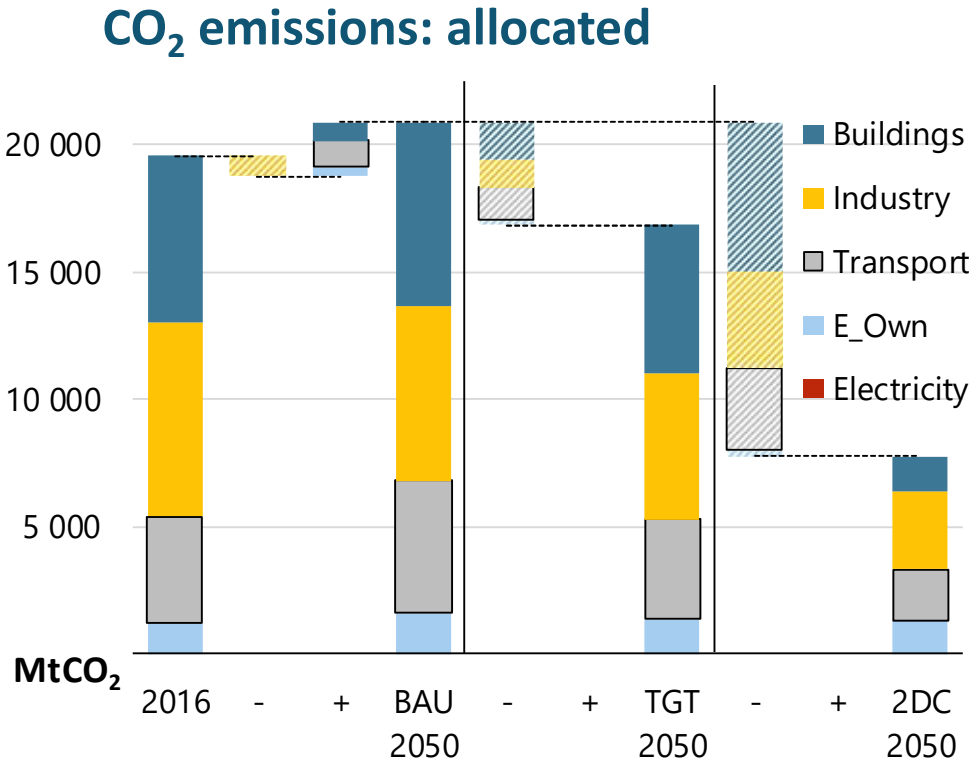


- BAU: growth in diesel, natural gas, jet fuel and electricity is offset by decline in gasoline (-12%),
- TGT compared to BAU: electricity (+52%) and biofuels (+42%); gasoline (-43%) and diesel (-31%),
- 2DC compared to BAU: growth only in electricity (+82%) and biofuels (+13%); declines in other fuels, especially gasoline (-74%) and diesel (-58%)

Source: IEA, 2018, APERC analysis

Although important, domestic transport is not the main source of direct and indirect CO2 emissions

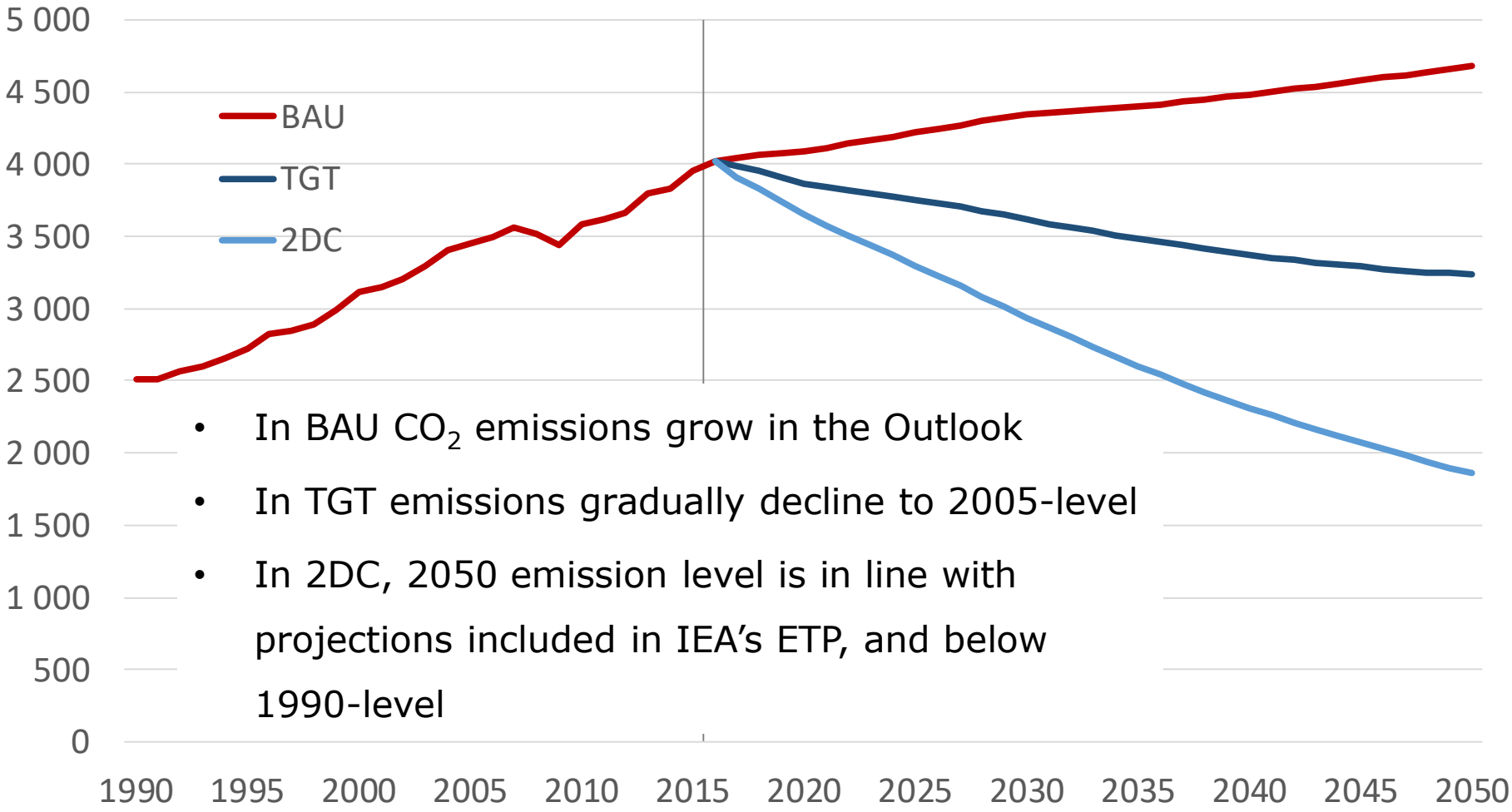




- If CO_2 unallocated: transport share is about 19-22%, second after electricity (43-45%); except in 2DC: electricity drops to 11%, and transport (24%) is second to industry (35%),
- If CO_2 allocated: transport share is about 21-25% in all scenarios; significant share of buildings (33-35%), except 18% in 2DC; industry is the hardest to decarbonise with 33-39% share

Source: IEA 2018, APERC analysis

In BAU, economic growth drives the demand, in TGT and 2DC: historical trend is reversed



- In BAU CO_2 emissions grow in the Outlook
- In TGT emissions gradually decline to 2005-level
- In 2DC, 2050 emission level is in line with projections included in IEA's ETP, and below 1990-level

Source: IEA 2018, APERC analysis

Conclusions

- **Strong demand for freight and passenger transport until 2050,**
- **Under BAU: increasing fuel demand and CO_2 emissions,**
- **In TGT: fuel demand plateaus, but emissions decline:**
  - **Through mode switching,**
  - **Longer-term and wider adoption of fuel efficiency policy,**
  - **Efficient public transport,**
  - **Hybrids as transition technology and natural gas as transition fuel,**
- **In 2DC: opportunities for deep decarbonization:**
  - **Alternative fuels and techs: hybrids, EVs and biofuels (although limited),**
  - **Fast and comfortable public transport for cities (80% of APEC residents),**
  - **Maximise alternative fuels and modes for freight**

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