World Economic Dynamics (WED) Model: Oil consumption modeling and forecasting

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WED Content

▶ Economics modeling and forecasting

▶ Primary energy modeling and forecasting

▶ Electricity output modeling and forecasting

▶ Oil consumption modeling and forecasting

▶ Gas consumption modeling and forecasting
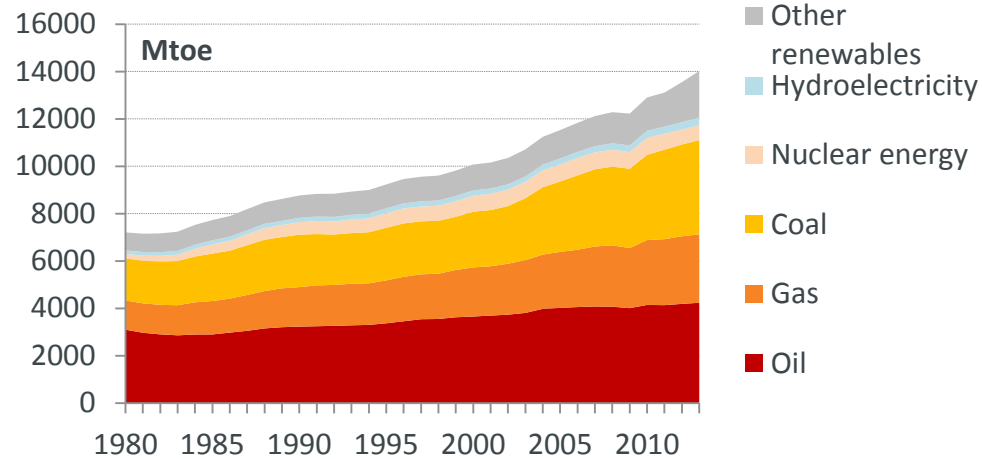
▶ Coal consumption modeling and forecasting

Presentation structure

➢ World primary energy consumption -> the role of oil
➢ Oil consumption structure
➢ Oil consumption forecasting model
➢ Another view on oil consumption forecasting
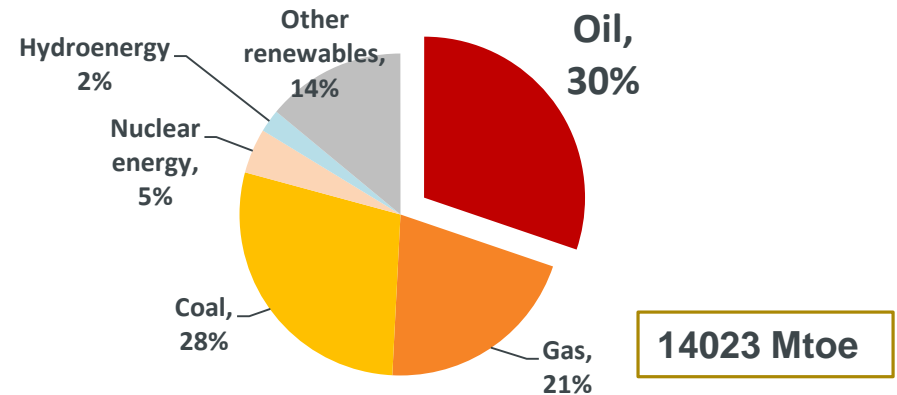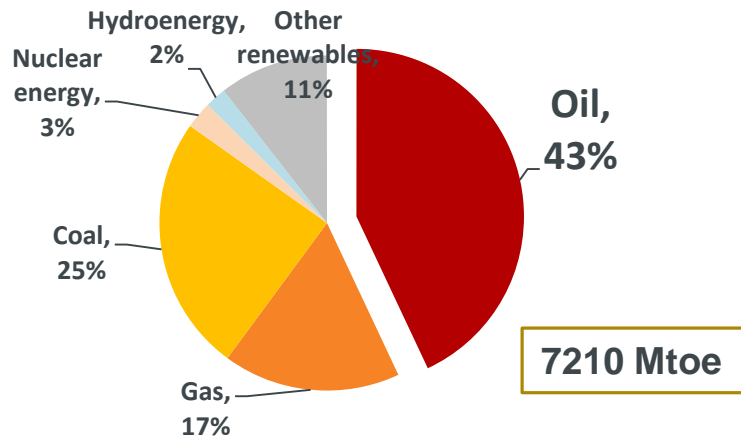➢ Calculation results

Oil in the world primary energy consumption

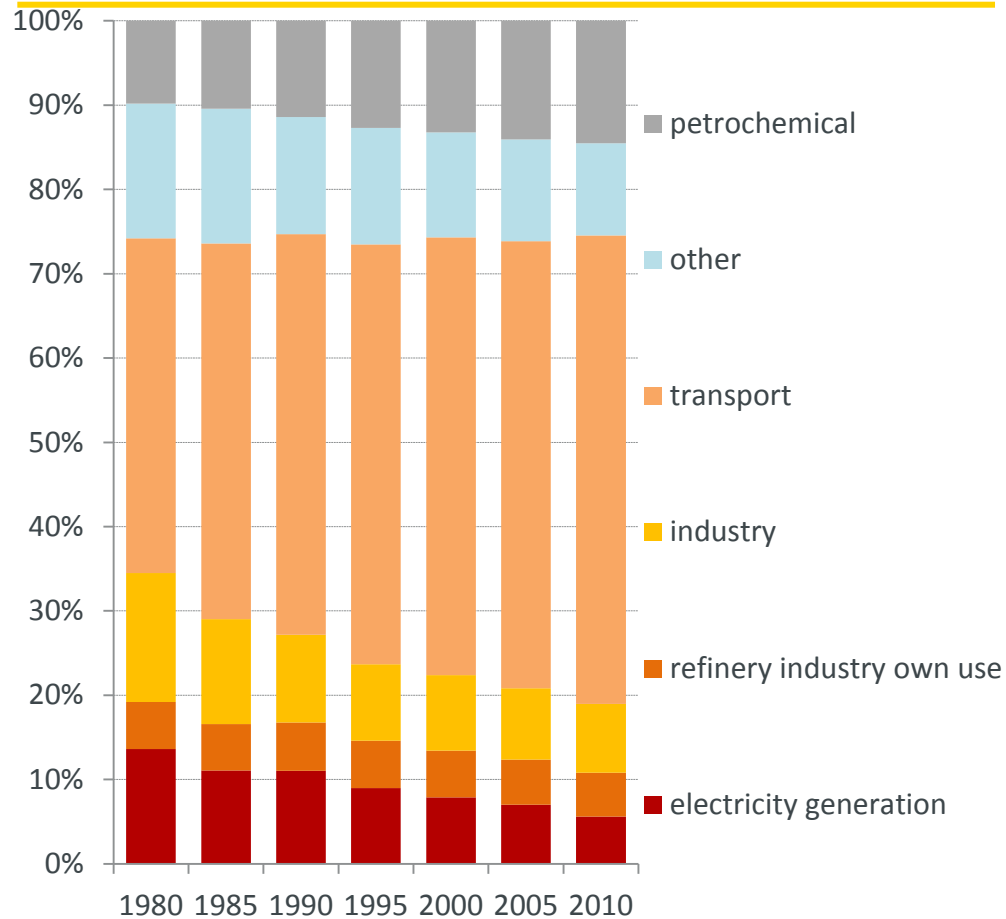## World primary energy consumption from 1980 to 2013 by fuel

Legend:
- Other renewables
- Hydroelectricity
- Nuclear energy
- Coal
- Gas
- Oil

1980 and 2013 fuel shares of world primary energy

1980:
- Oil, 43%
- Gas, 17%
- Coal, 25%
- Nuclear energy, 3%
- Hydroenergy, 2%
- Other renewables, 11%
- 7210 Mtoe

2013:
- Oil, 30%
- Gas, 21%
- Coal, 28%
- Nuclear energy, 5%
- Hydroenergy, 2%
- Other renewables, 14%
- 14023 Mtoe

Structure of the world oil consumption by sectors

Oil structure consumption from 1980 to 2010 by sectors

Legend:
- petrochemical
- other
- transport
- industry
- refinery industry own use
- electricity generation

Oil structure consumption in transport sector from 1980 to 2010

Legend:
- Other
- Marine
- Aviation
- Rail
- Road

4
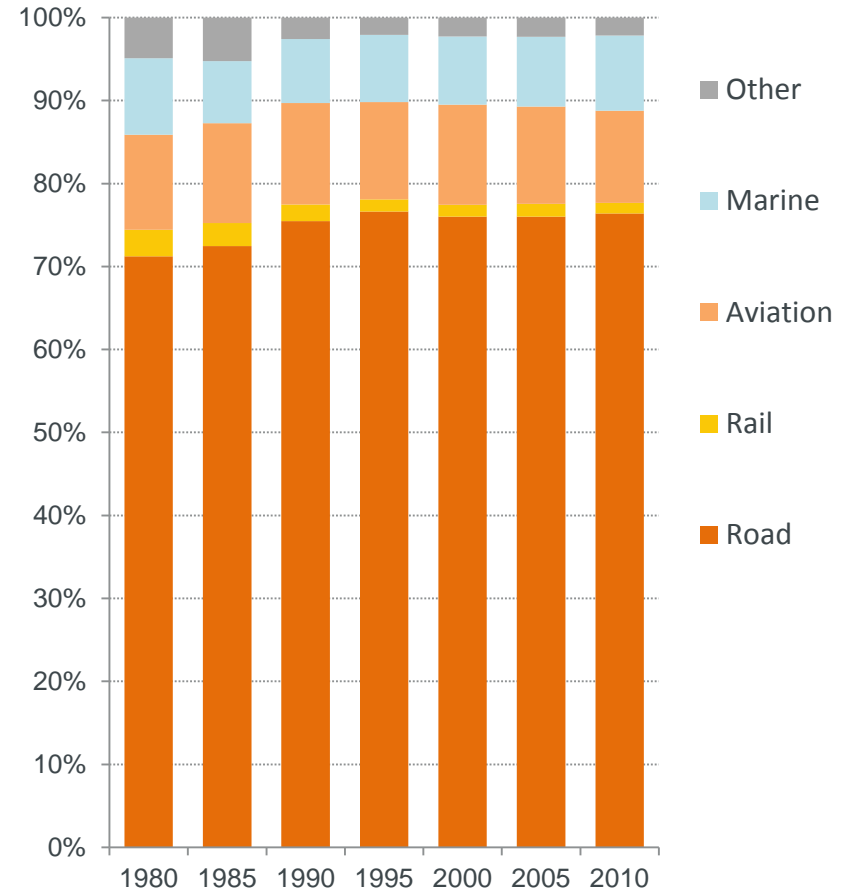
Modeling of oil consumption: methodology

Oil consumption, 1980 - 2013

Passenger vehicle and commercial vehicle in use per capita

Vehicle fuel consumption per km

Annual vehicle run, km

Share of vehicles with alternative fuel, %

Population, 1980-2045

Step 1

Step 2
Vehicle in use per capita (forecast)

Step 3
Vehicle in use (forecast)

Step 4
Annual vehicle fuel consumption (forecast)

Step 5
Estimation of "total fuel consumption"

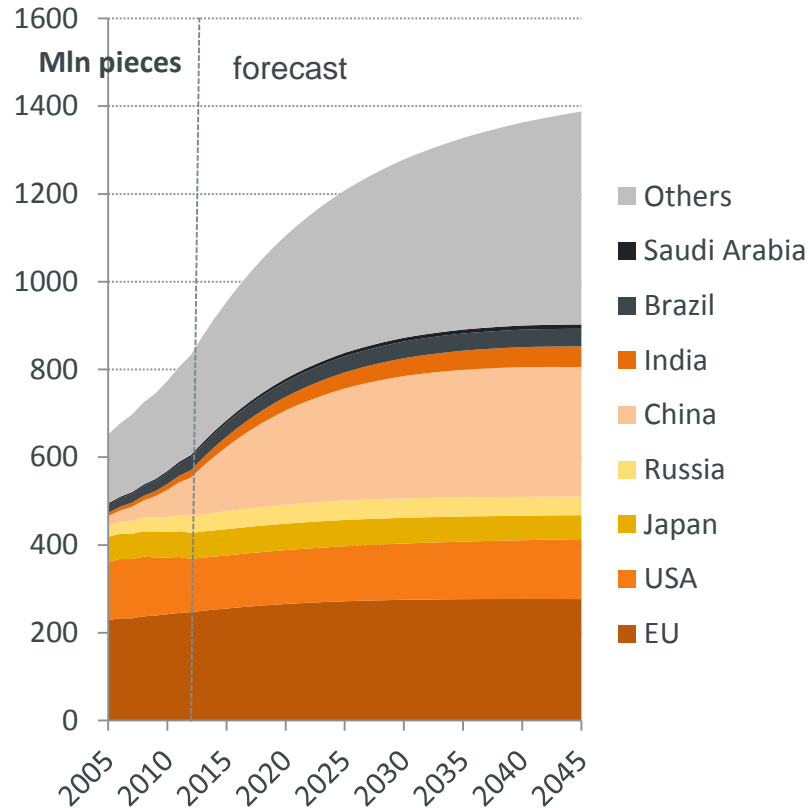Total oil consumption (forecast)

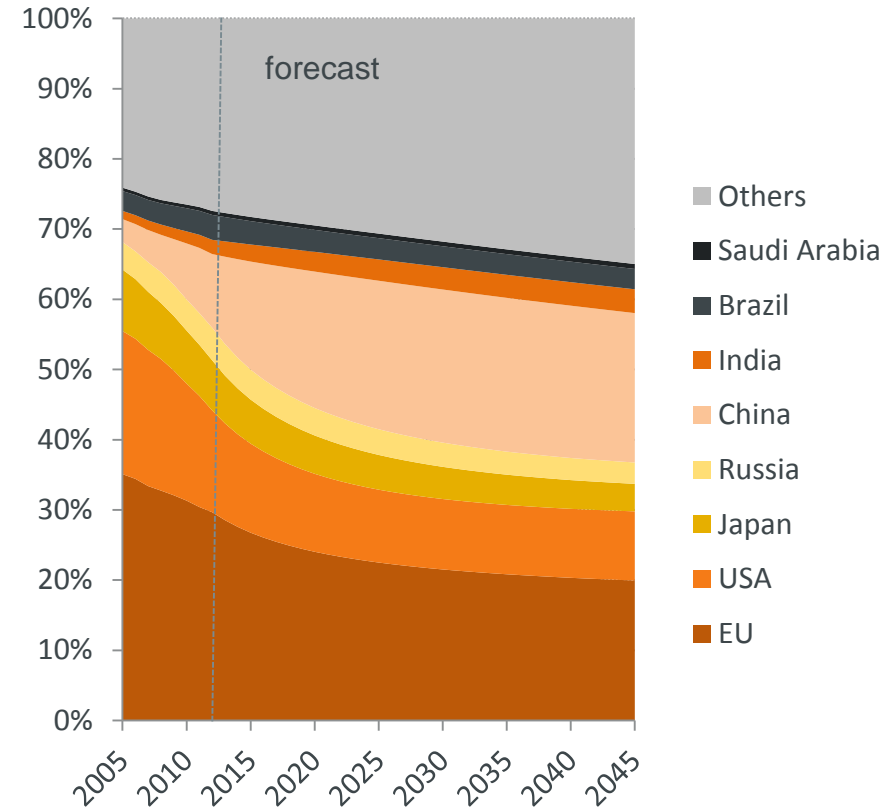**Step 6**
Oil consumption in motor transport

Transport. Passenger vehicle in use

Passenger vehicle in use from 2005 to 2045

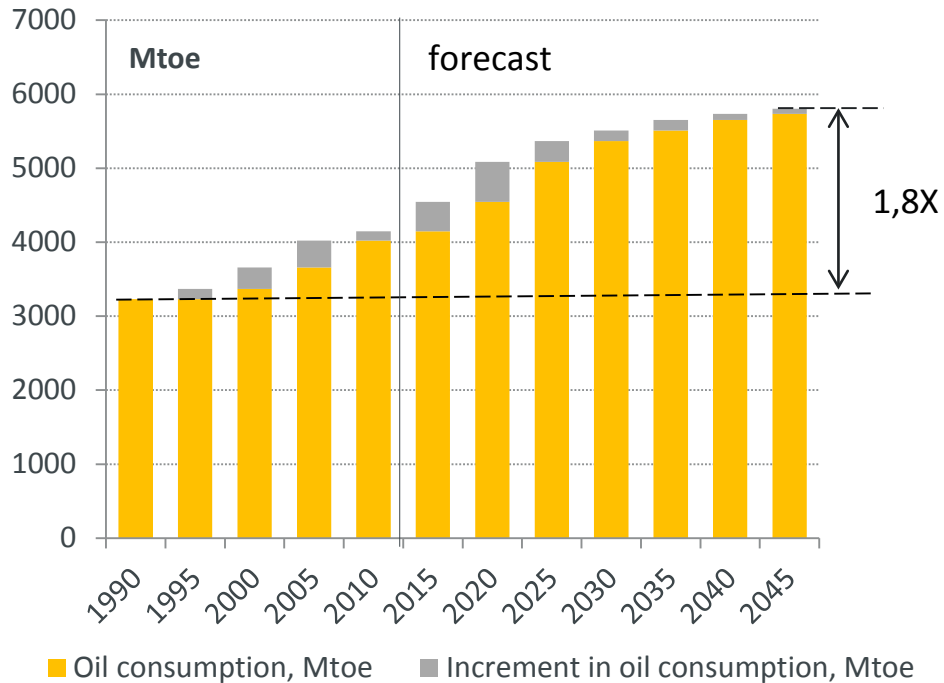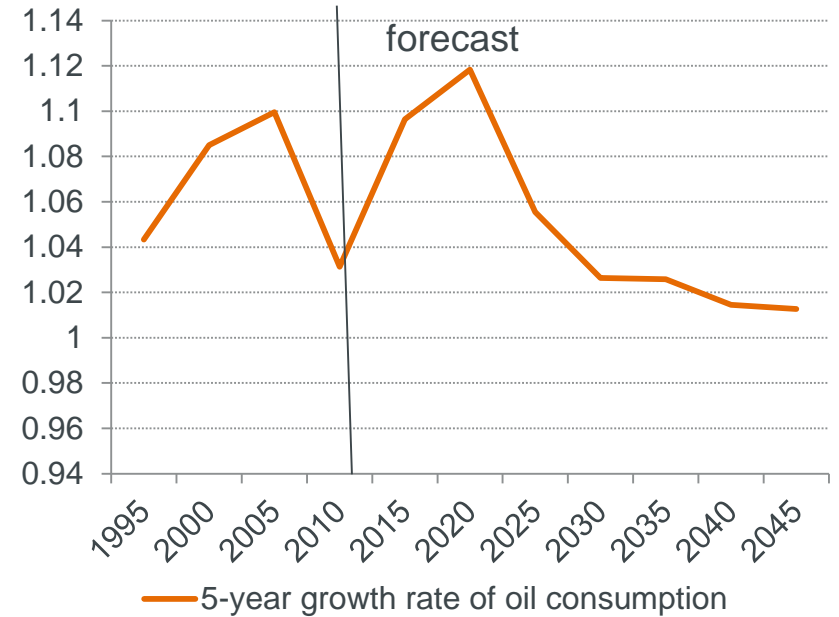## Structure of world passenger vehicle in use from 2005 to 2045

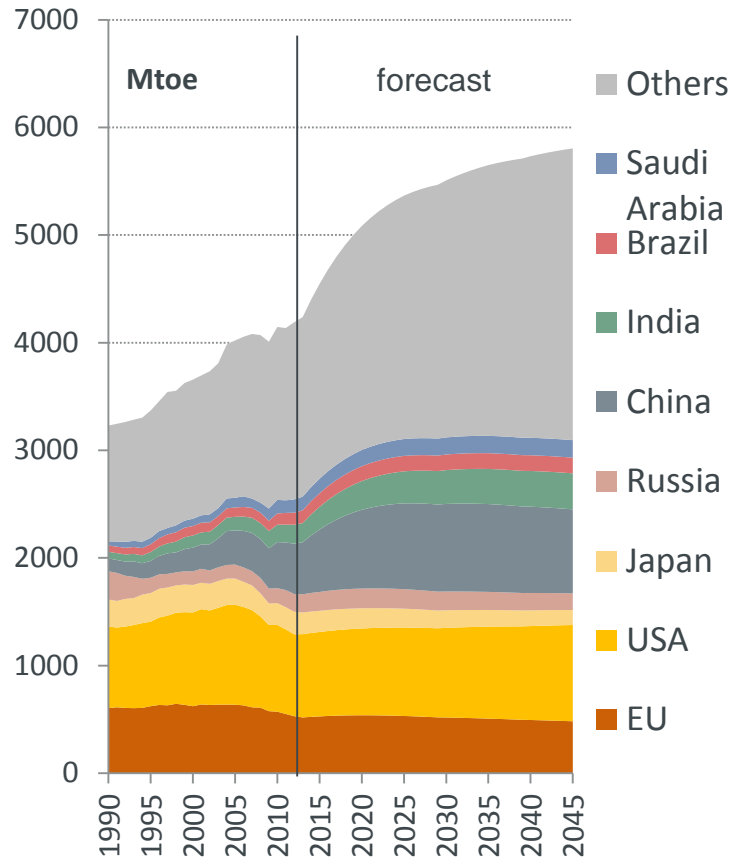# Model results: world

World oil consumption from 1990 to 2045

Mtoe forecast

1,8X

- Oil consumption, Mtoe
- Increment in oil consumption, Mtoe

World oil consumption from 1990 to 2045

forecast

5-year growth rate of oil consumption

Model results: countries

Oil consumption from 1990 to 2045

Mtoe | forecast

Legend: Others, Saudi Arabia, Brazil, India, China, Russia, Japan, USA, EU

Oil consumption structure from 1990 to 2045 by countries

forecast

Legend: Others, Saudi Arabia, Brazil, India, China, Russia, Japan, USA, EU
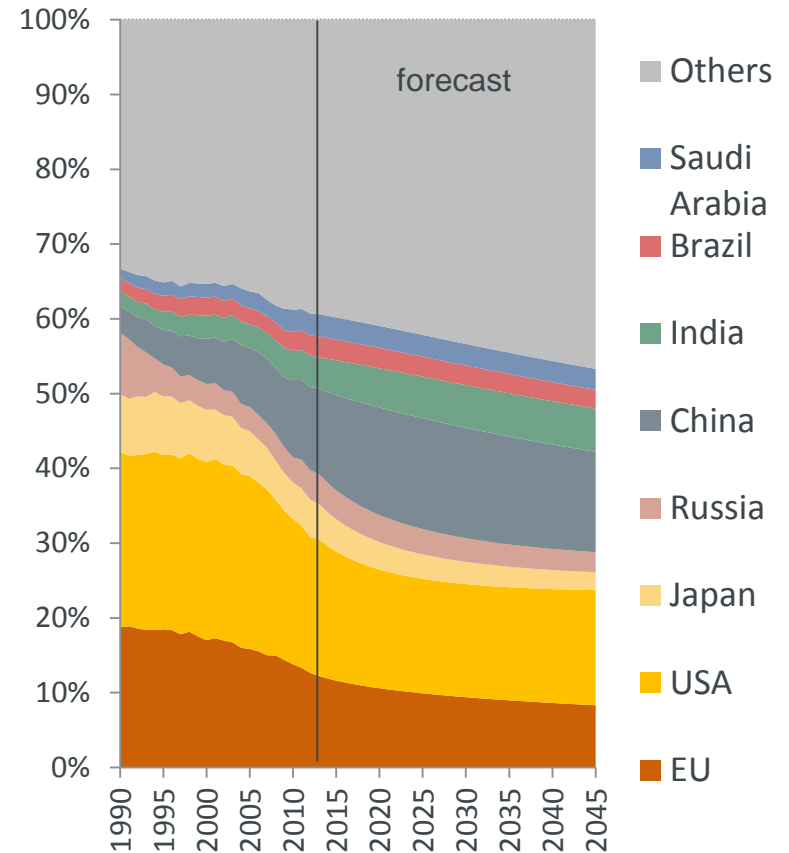
World. Relationship between oil consumption and economic growth

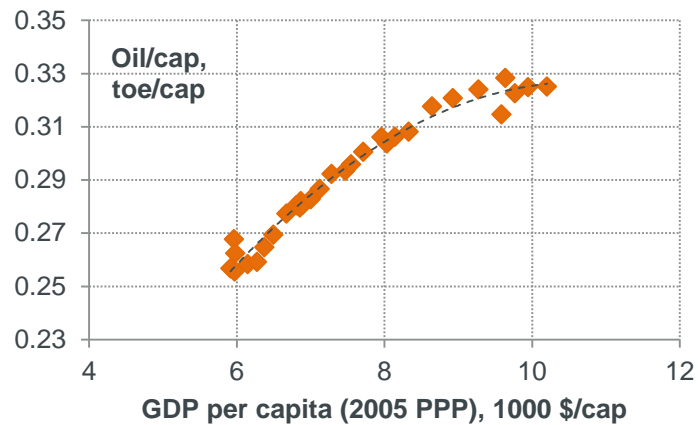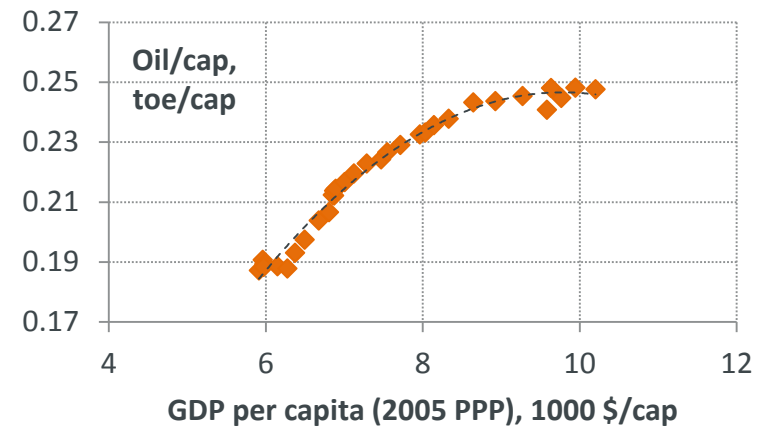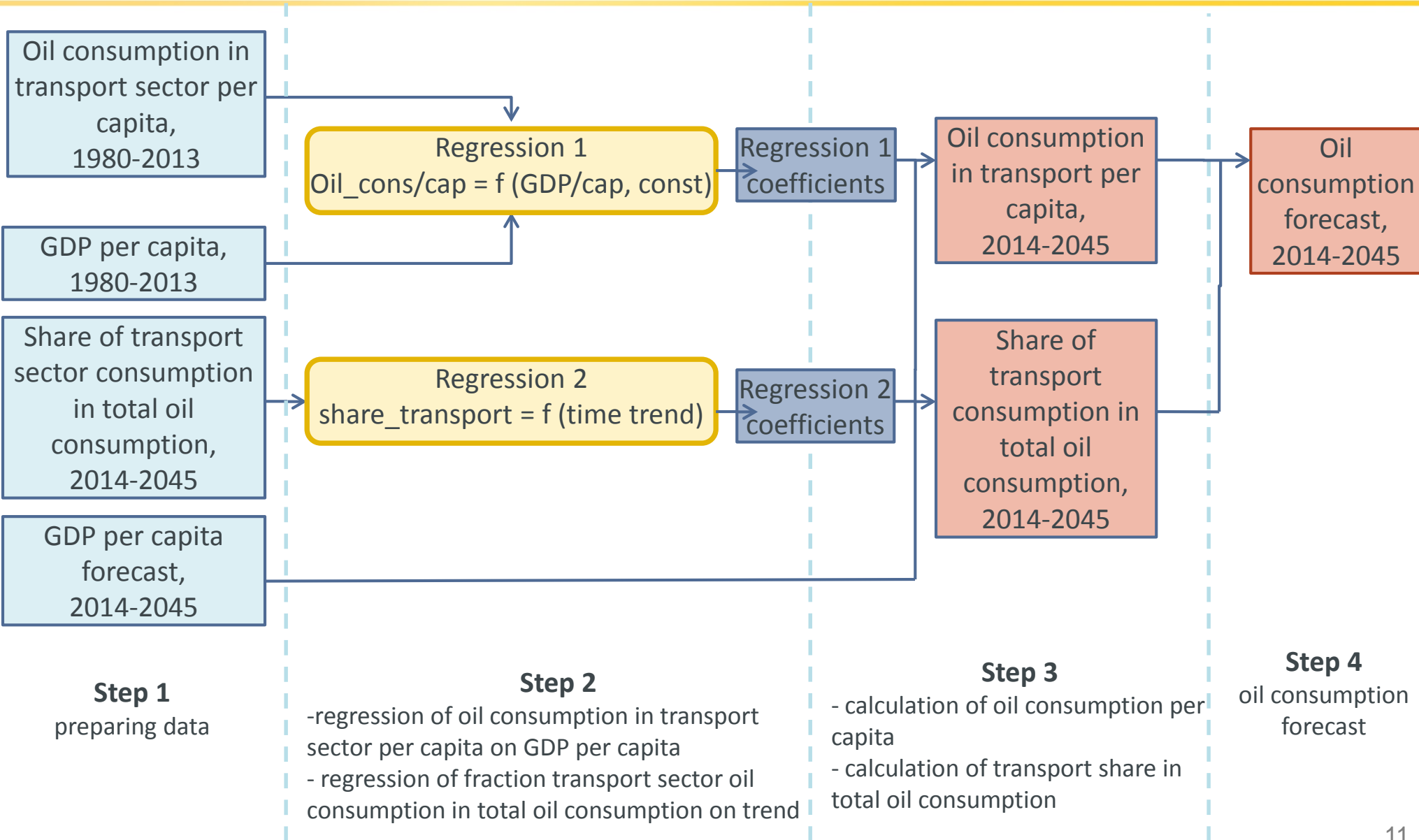## Total oil consumption from 1980 to 2011
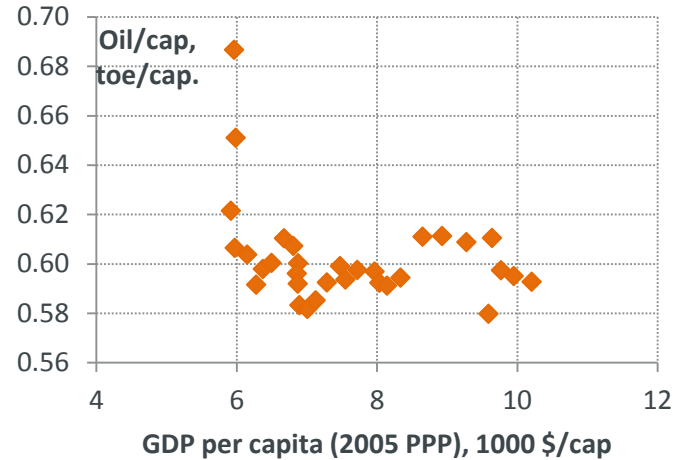
Transport oil consumption from 1980 to 2011

Road oil consumption from 1980 to 2011

Forecasting of oil consumption: model improvements

Oil consumption in transport sector per capita, 1980-2013

GDP per capita, 1980-2013

Share of transport sector consumption in total oil consumption, 2014-2045

GDP per capita forecast, 2014-2045

Regression 1
Oil_cons/cap = f (GDP/cap, const)

Regression 2
share_transport = f (time trend)

Regression 1 coefficients

Regression 2 coefficients

Oil consumption in transport per capita, 2014-2045

Share of transport consumption in total oil consumption, 2014-2045

Oil consumption forecast, 2014-2045

Step 1
preparing data

Step 2
-regression of oil consumption in transport sector per capita on GDP per capita
- regression of fraction transport sector oil consumption in total oil consumption on trend

Step 3
- calculation of oil consumption per capita
- calculation of transport share in total oil consumption

Step 4
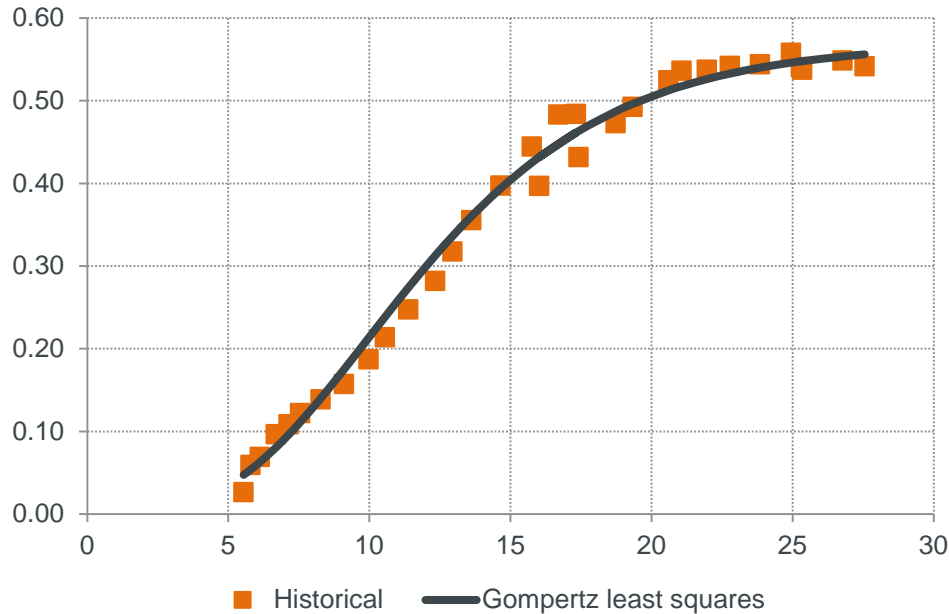oil consumption forecast

South Korea. Forecasting of oil consumption

Relationship between road oil consumption and GDP per capita from 1980 to 2011

Historical ■ — Gompertz least squares

$R^2=97\%$

Share of road oil consumption in total oil consumption from 1975 to 2011

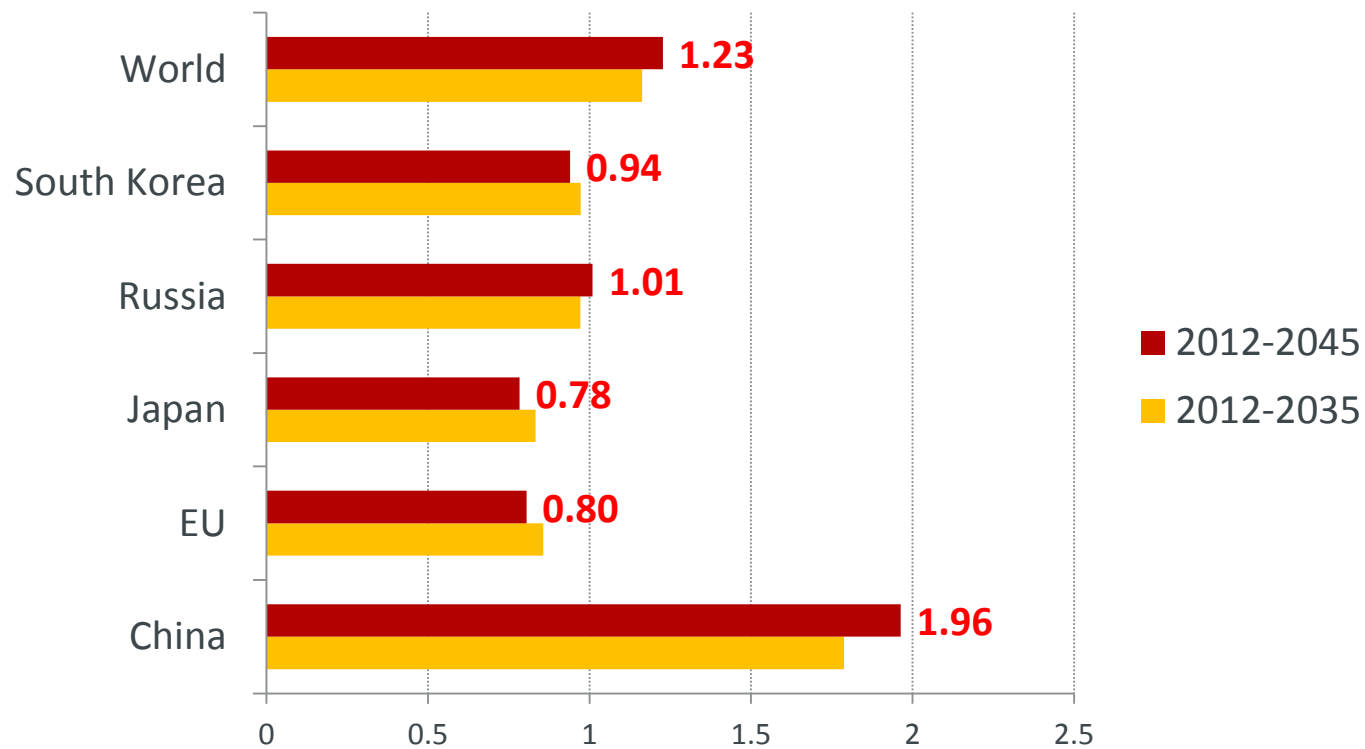
Historical ◆ — Gompertz least squares
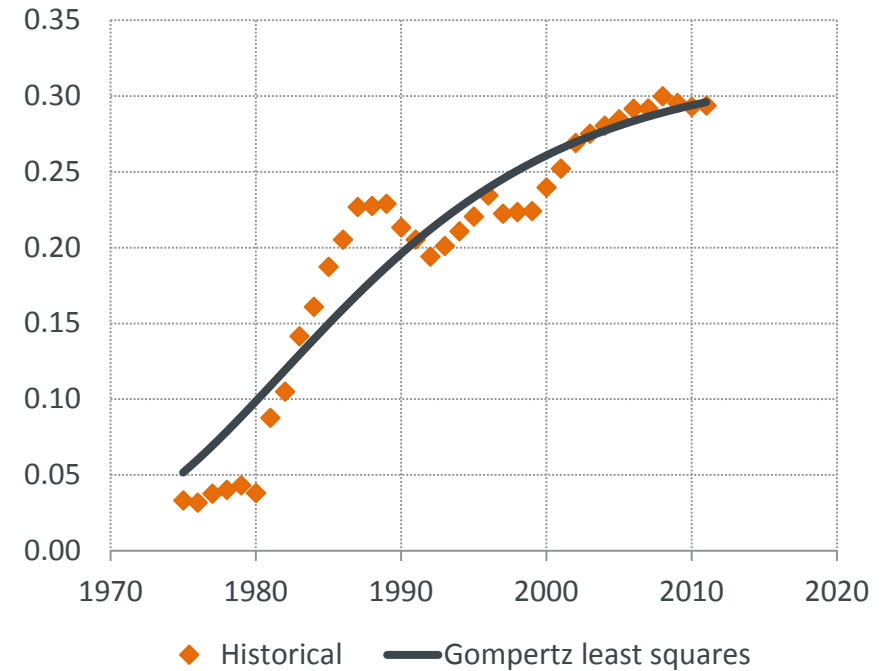
$R^2=92\%$

$$Y=k*a^{(b^X)} \text{ - Gompertz function}$$

Forecasting of oil consumption. Results

Forecast oil consumption from 2012 to 2035 and 2045

Legend:
- 2012-2045
- 2012-2035

Region	2012-2045
World	1.23
South Korea	0.94
Russia	1.01
Japan	0.78
EU	0.80
China	1.96

Thank you for your attention!

РОСНЕФТЬ

Top 15 world oil consumers in 1990 and 2013

Mtoe

Legend: 2013, 1990

Countries (top to bottom): Venezuela, Australia, Thailand, Indonesia, Canada, Iran, South Korea, Mexico, Brazil, Saudi Arabia, Russia, India, Japan, China, EU, USA