



Scenarios for the Control of Ozone Precursors in China

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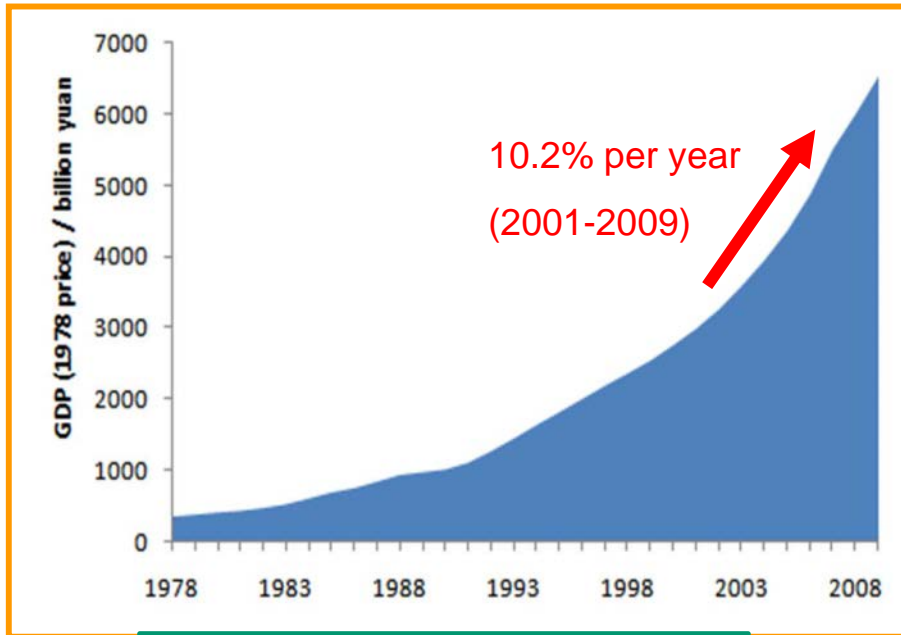
Content



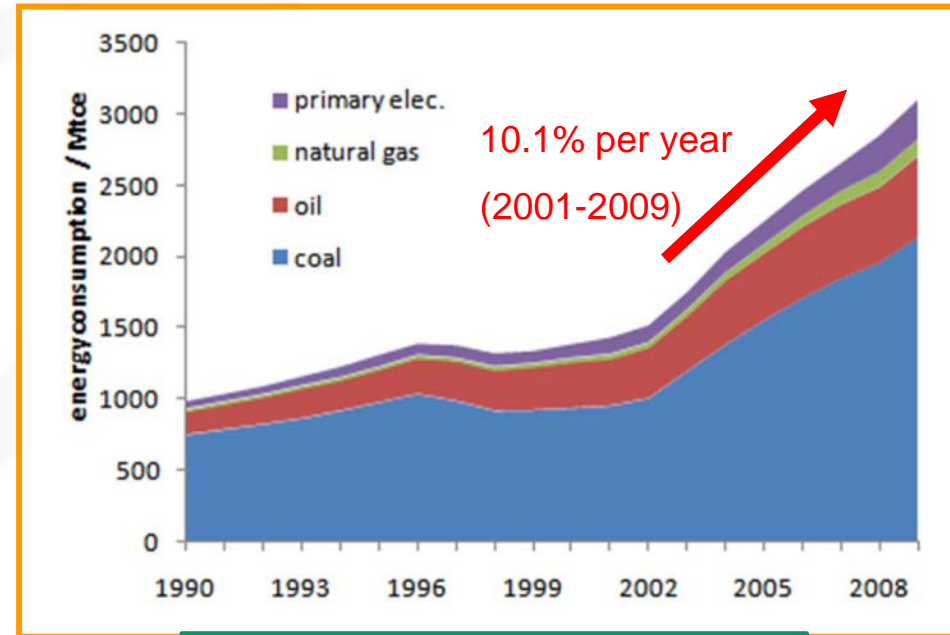
- **Background**
- **Methodology**
- **Driving Forces**
- **Energy Scenarios**
- **Pollution Control Scenarios**
- **Results and Discussion**
- **Future Work**



Background



GDP (1978 price)



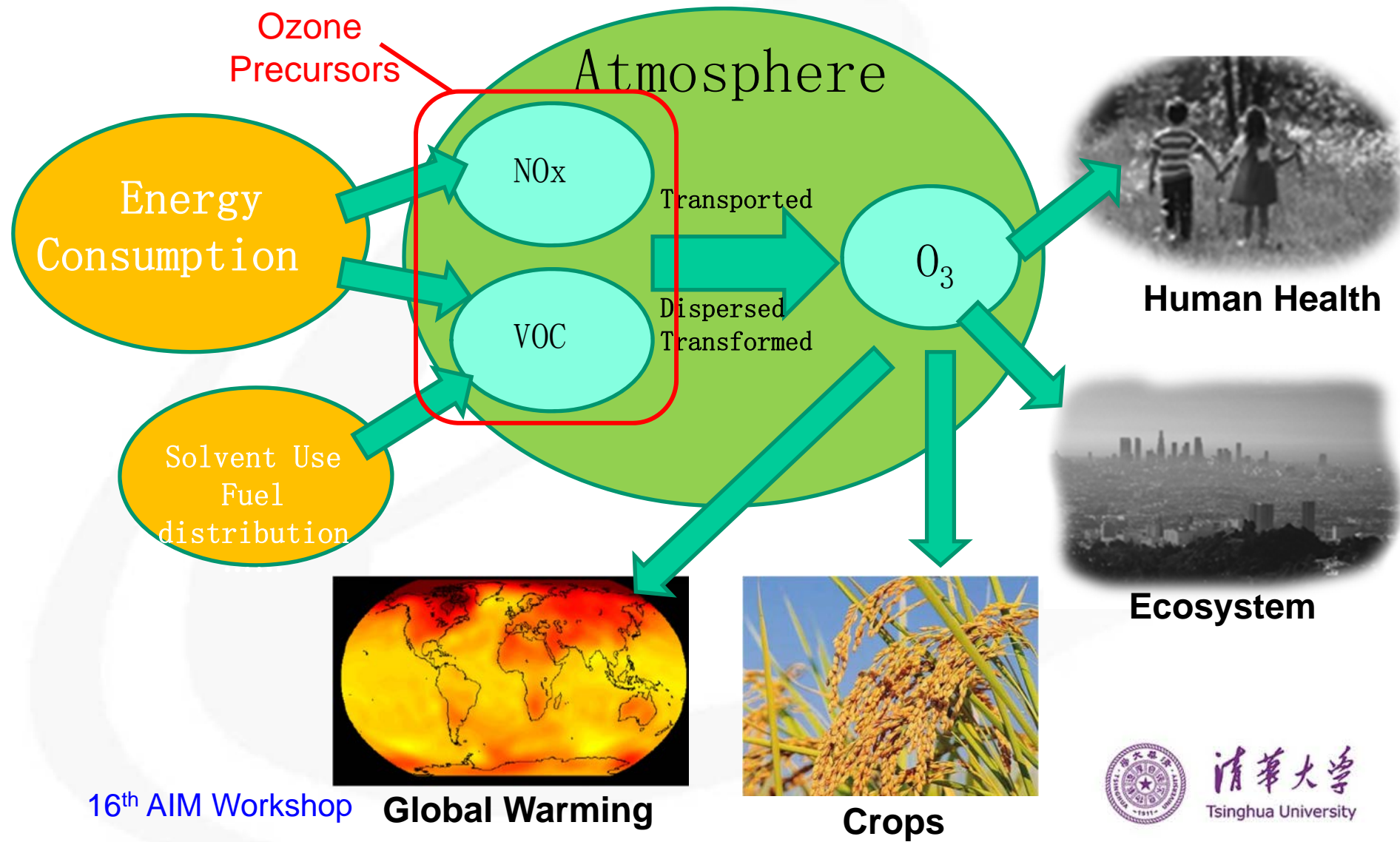
Total energy consumption by type

**Rapid
Economic growth**

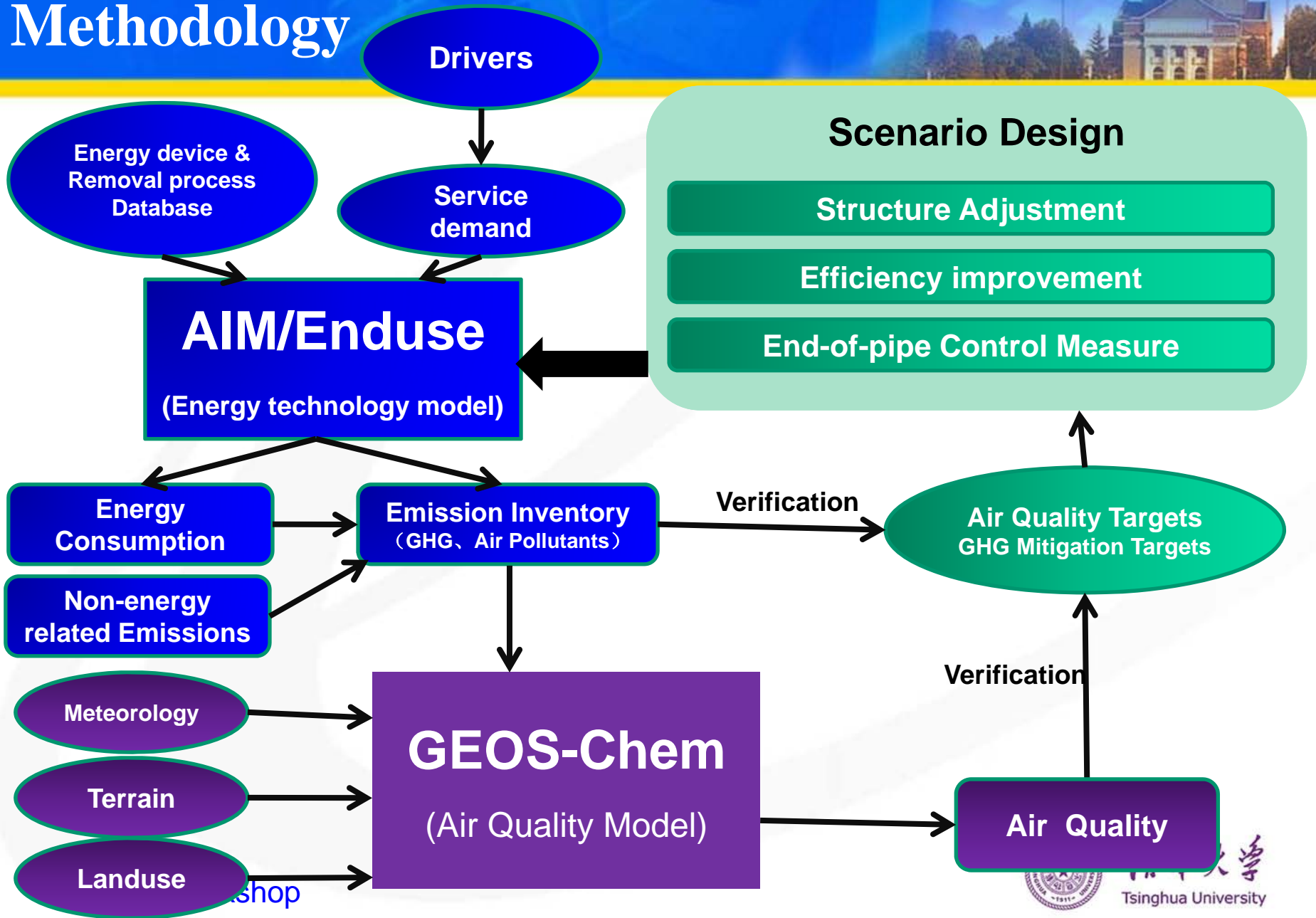


**Huge
Energy Consumption**

Background



Methodology



Scenarios



Energy Scenario	Energy Scenario Definition	Pollution Control Scenario	Pollution Control Scenario Definition
Business as Usual (BAU)	Current policies and compliance (till the first half of 2010)	Reference ([0])	Current policies and compliance (till the first half of 2010)
		New Policy ([1])	New policies and more strict compliance
Alternative Policy Scenario (PC)	New low carbon policies are released and are enforced more strictly, including life style changes, structural adjustment and efficiency improvement.	Reference ([0])	Current policies and compliance (till the first half of 2010)
		New Policy ([1])	New policies and more strict compliance



Driving Forces

■ National Plan:

- -To become a medium developed country by 2050
- -GDP per capita \geq 20000 USD

■ GDP growth rate:

2010	2011-2015	2016-2020	2021-2025	2026-2030
10 (2010)	8.0	7.5	6.5	5.5

■ Population and Urbanization

Items	2005	2010	2015	2020	2025	2030
Population(10^8)	13.08	13.41	13.90	14.40	14.68	14.74
Urbanization/%	43	47.5	53	58	61	63

Service Demand

- Service demand in BAU scenario reflects the current trend of economic development and existing policies in China.
- Service demand is generally lower in PC scenario because of a more conservative life style.

Energy-intensive products will continue to increase in the next 10 years, and will stabilize or even decline after 2020-2025.

Urban residential building area per capita will approach the level of Japan by 2030 in BAU scenario, while it's even larger in rural area.

Vehicle population per 1000 persons will increase to 368 and 315 in 2030 in BAU and PC scenarios, respectively, still much lower than most developed countries.

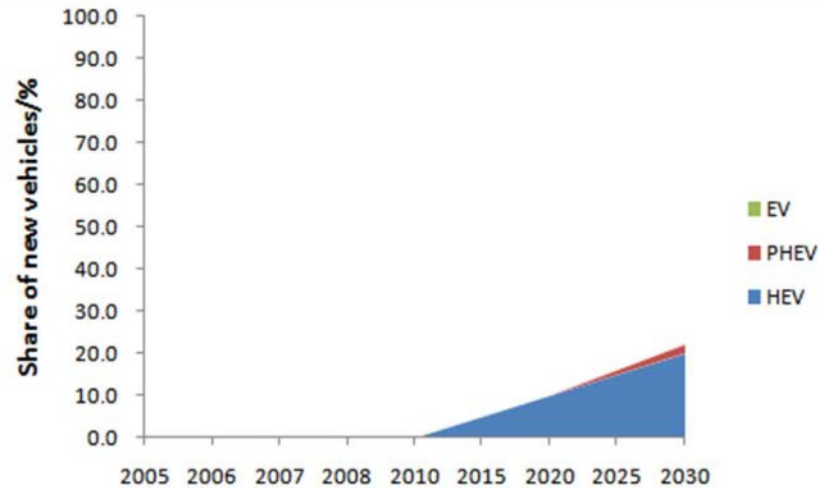
Structure and Efficiency



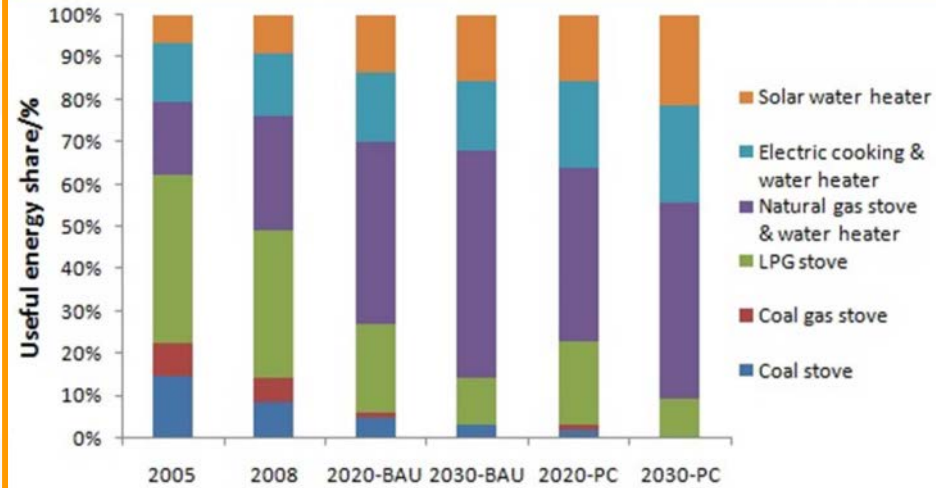
- **Industry:** According to China's policies, energy efficiencies of most energy-intensive products will become advanced in the world by 2030 in BAU scenario. In PC scenario, BATs (Best Available Technologies) will be widely adopted, and China's industrial energy efficiencies will be among the world's highest.
- **Transport:** In contrast with BAU scenario, new fuel efficiency standards will be released. Three stages designed for America by NAS (National Academy of Sciences in U.S.) will be implemented for light duty vehicles and Japanese standard for new vehicles will be implemented for heavy duty vehicles.



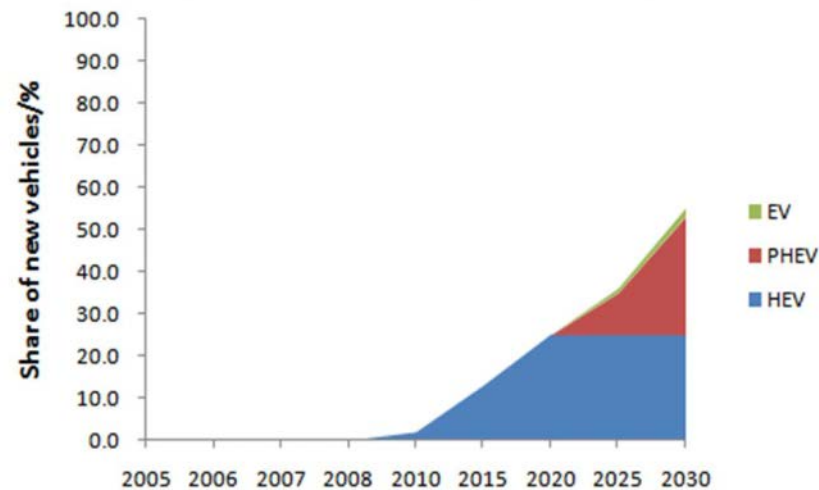
Structure and Efficiency



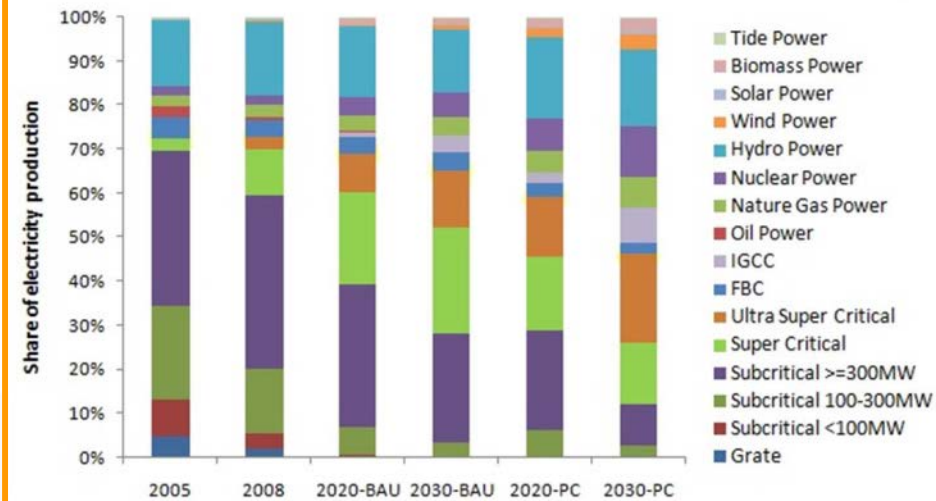
Electric vehicles development -BAU



Urban Cooking & Hot water

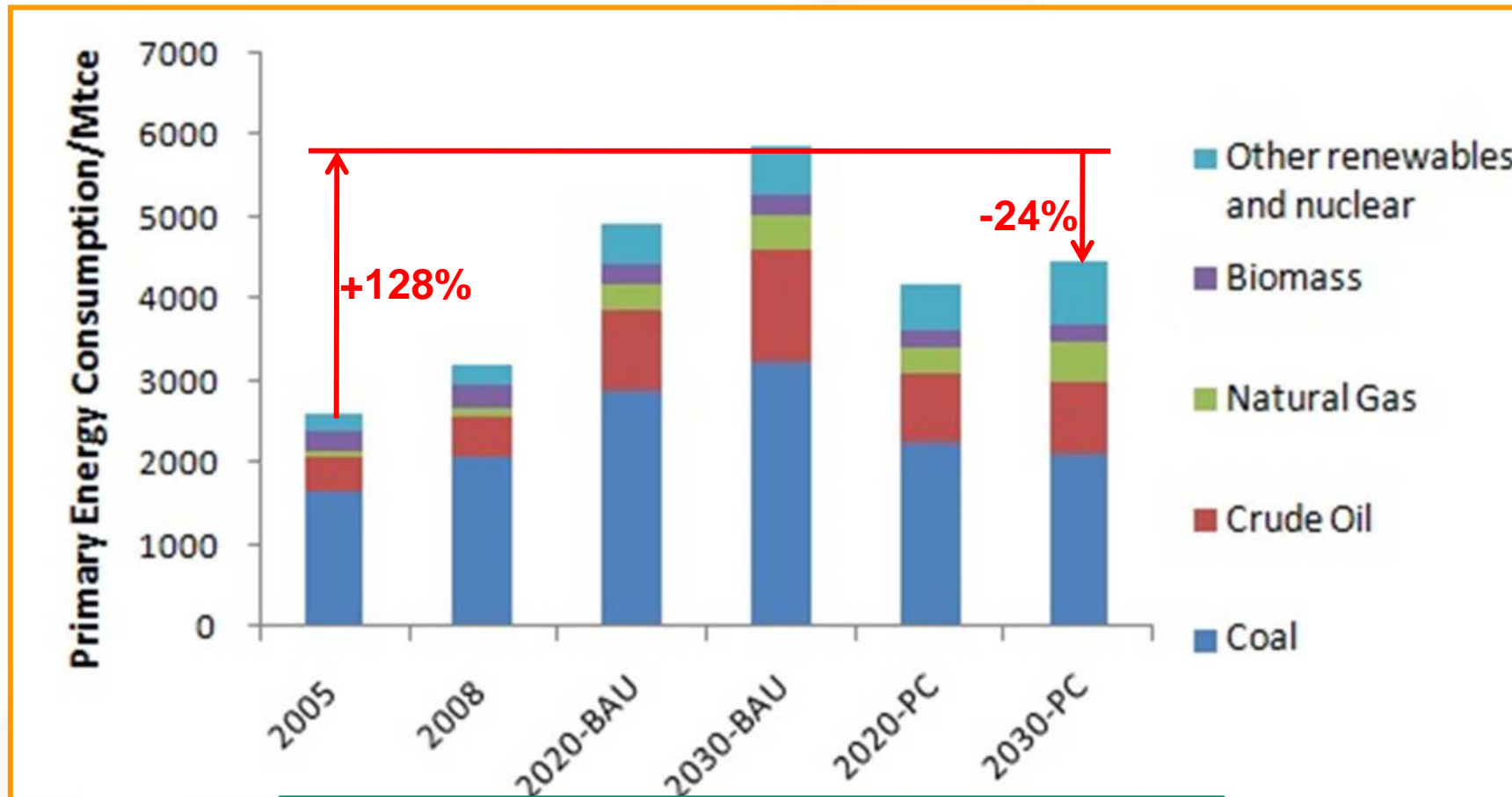


Electric vehicles development -PC



Share of electricity production technologies

Total Energy Consumptions – by Fuel



Total primary energy consumption by type

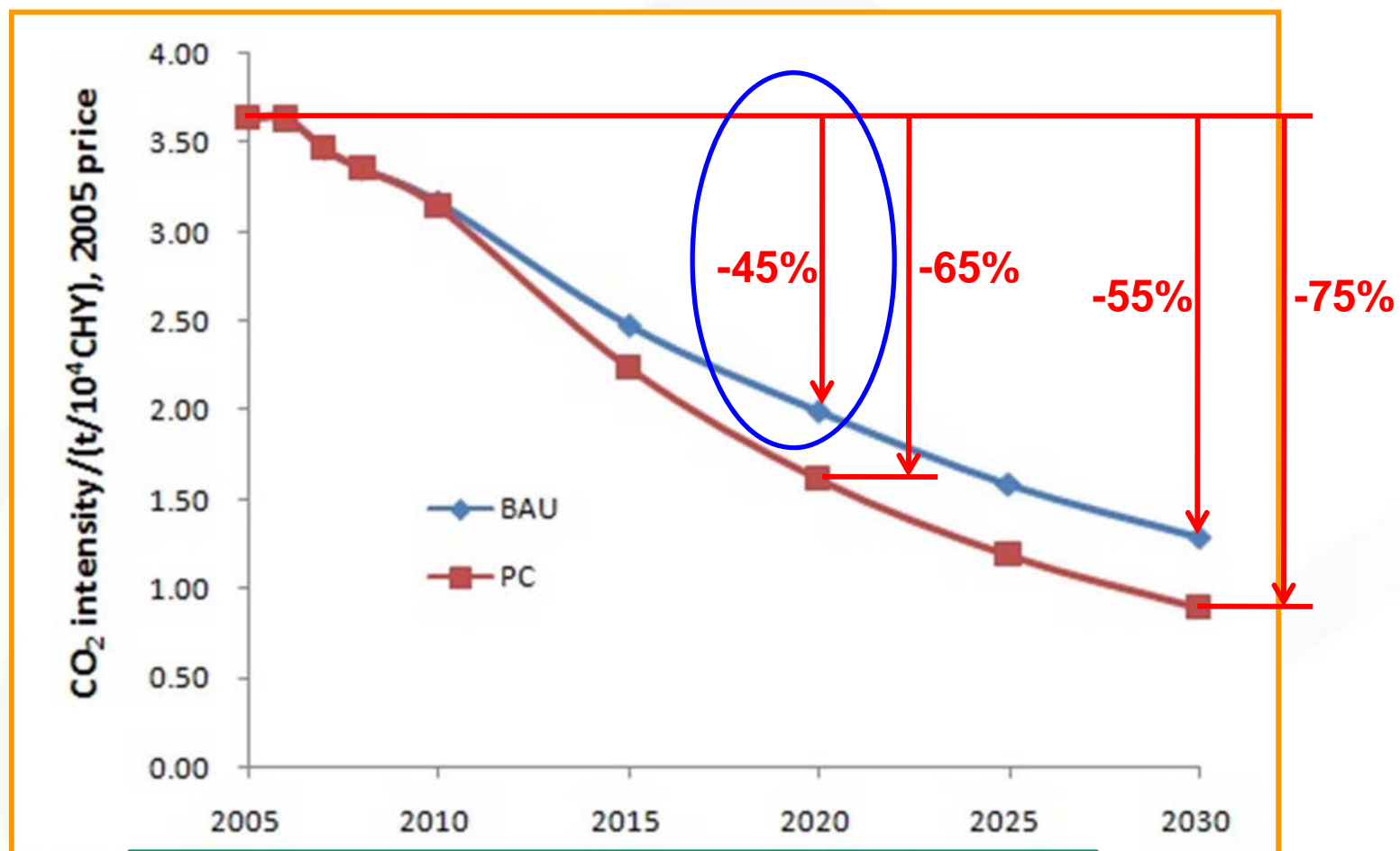
Note: 1 Biomass includes traditional combustion, biogas, bio-fuel and biomass power

2 Other renewables include hydro power, solar energy, wind energy and ocean energy.



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CO₂ Intensity



Total primary energy consumption by type

NO_x Control Scenarios

Power



[0]: Current standards, only LNBs are requested.

[1]: New standards are released, and SCR/SNCRs are promoted gradually, spreading from coastal provinces to the whole countries.

Industry



[0]: Nearly no specific control measures.

[1]: New standards for various industries are released, and effective industry-specific anti-pollution devices are installed gradually.

Transport



[0]: Current standards only.

[1]: Existing standards in EU are implemented in China gradually.

VOC Control Scenarios

Industry



[0]: Nearly no specific control measures.
[1]: Primary measures (process modification etc.) and secondary measures (adsorption, incineration etc.) are taken in coke, refinery, pharmacy and edible oil extraction industries.

Transport



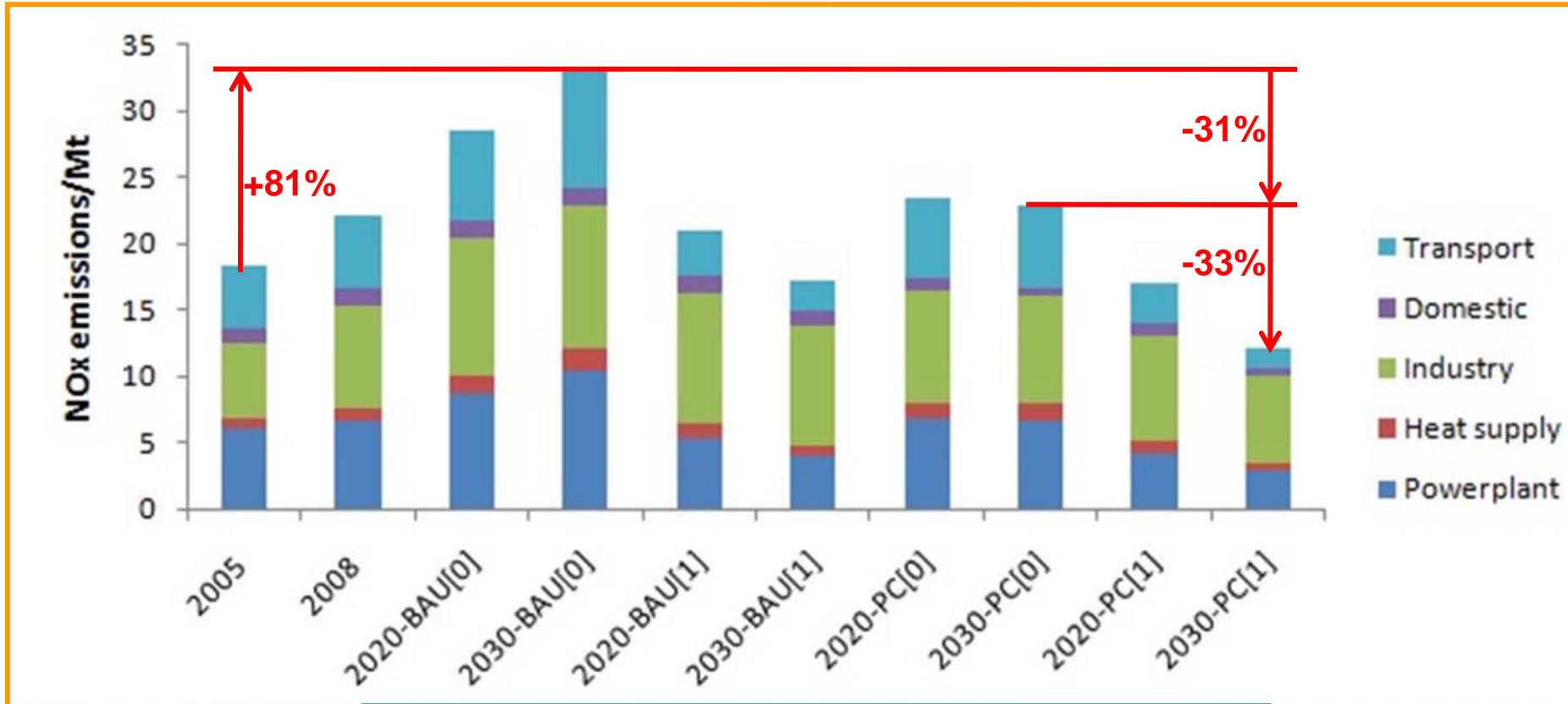
[0]: Current standards only.
[1]: Existing standards in EU are implemented in China gradually.

Fossil fuel distribution



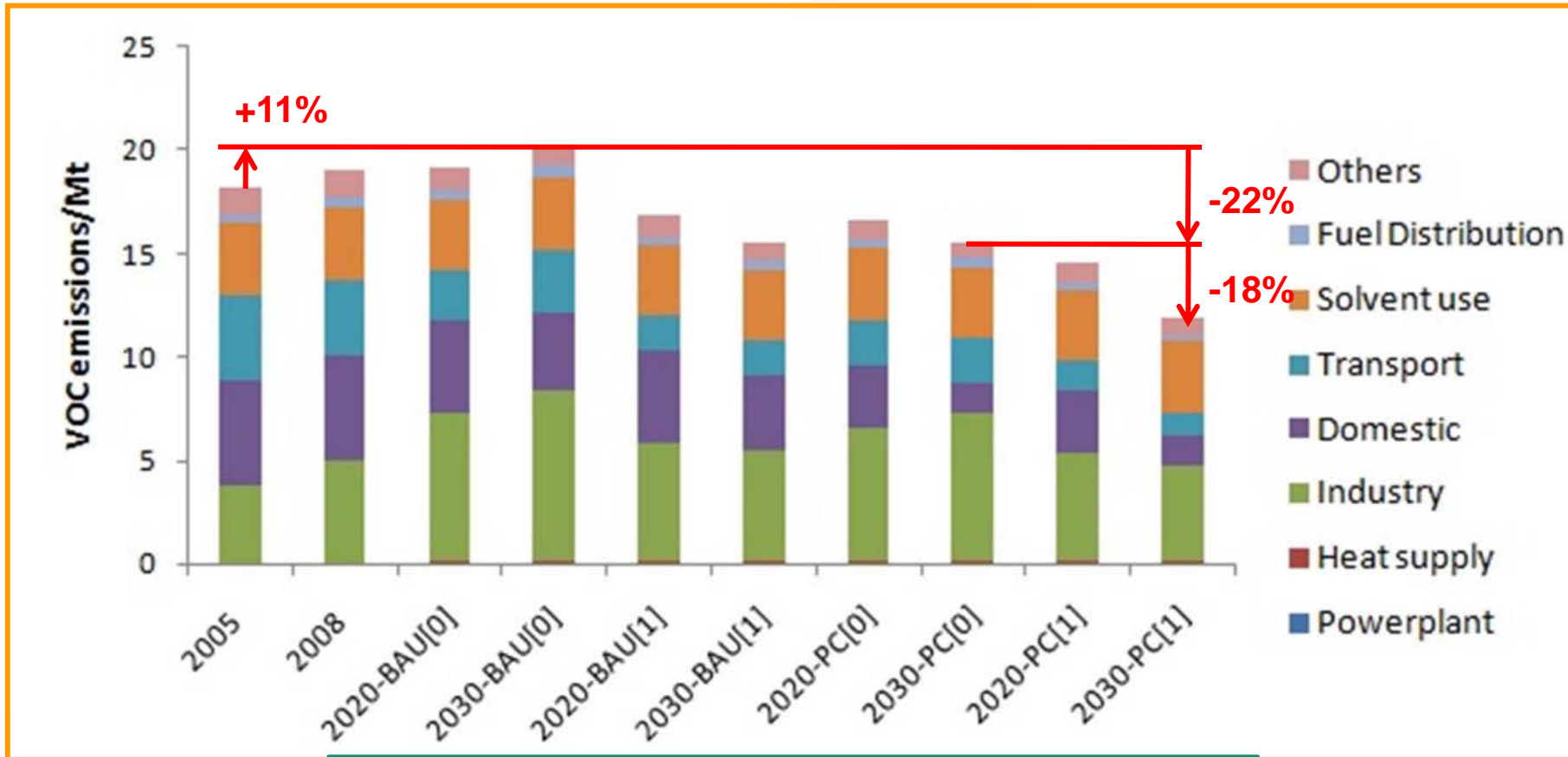
[0]: Current standards, vapor recovery techs for gasoline distribution are installed gradually.
[1]: New standards are released. Vapor recovery techs are installed for crude oil distribution and secondary seals are promoted.

Results – NOx Emissions



NOx emissions by sector

Results – VOC Emissions



VOC emissions by sector

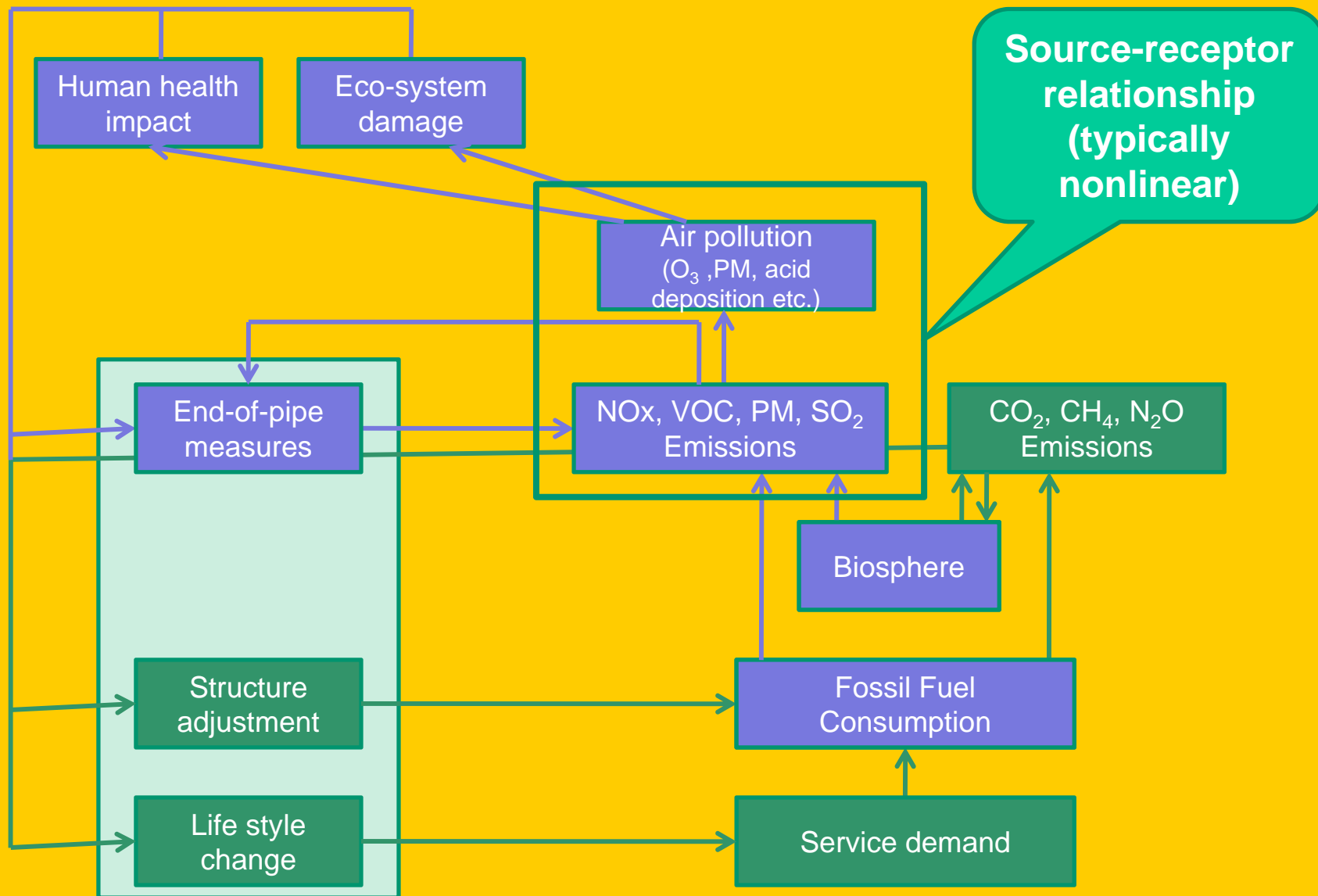
Note: Emission of solvent use is taken directly from Wei, 2009, and are assumed to stay the same in the future.

Future Work

- Improvement of the scenarios;
- Run East Asia nested GEOS-Chem air quality model with emissions of different scenarios;
- **Effect-based** optimization model for the **joint control** of air pollution and GHG emissions.



Effect-based optimization model for the joint control of air pollution and GHG emissions





Thank you !

