

22nd AIM International Workshop 9 – 11 December, 2016 NIES, Tsukuba, JAPAN

SLCP emission from Residential sector and its impact in Asia

Gakuji KURATA Kyoto University

Diversity of residential sector energy consumption

Developed Country & A part of Urban Area of Developing Country.

Target of Residential Sector Model



How to minimize the energy consumption. (Mainly electricity) How to reduce the environmental loading. (Municipal waste and wastewater) How to introduce the low carbon lifestyle.

Wood Fireplace

BC, OC, PM2.5, NMVOC

Energy Poverty

- Indoor Air Pollution ← largest health Risk
- Direct emission of GHG and SLCP

How to reduce the **Solid fuel use**. (Biomass, Coal) How to introduce the **high efficiency equipment** How to accelerate **the electrification.**

Developing Country and Rural Area

Direct emission of SLCP from Residential sector

Combustion of Solid Fuel (Coal, Biomass) in Residential sector causes



Issue on the Emission from Residential sector



* low- and middle-income countries

Death Attributable to Household air pollution (per 100 000 capita) [WHO 2012]



Premature death due to indoor air pollution in the World is <u>4.3 million people</u> (WHO ,2012)

China: 1.46 million India: 1.25 million

Indoor air pollution is the largest factor in the environmental risk.



Household Solid Fuel Use



In rural of China and India, more than 50% of energy sources used in the household is solid fuels such as coal and biomass (firewood, crop residue and animal dung).



year 🖓

Importance of Residential Sector

year 🖓







Lack of attention to Residential Sector



SSP2 Reference CO2 emission by Technology for Residential sector 2010-2050 China



There are no difference between Countermeasure cases for Climate Change

Because, the Climate Policy mainly focus on the <u>Power generation</u>, <u>industrial sector</u> and <u>Transportation sector</u>.

7



Improvement of Residential sector model

Lack of Future Service demand estimation

 Because there are large differences in lifestyle between regions, it is difficult to estimate the service demand in the future residential sector.

Lack of Technology Information

 Bottom-up model carries out technology selection according to economic rationality. However, in addition to the lack of information on the initial cost and running cost of the household equipment, it differs greatly from country by country.

Lack of Emission Factor for air pollutants.

 The emission factors of air pollutants from household equipment are extremely limited.



Future Emission Estimate from Residential Sector



Future estimation of Energy Consumption of Residential Sector (case study for China)



Estimated Trend of Share of technology



11

SLCP (and Air Pollutants) emission from Residential Sector in Rural and Urban area China.

Target Pollutants

BC , CO, NO_X, OC, PM2.5, PM10, SO₂, VOC

Estimation of Emission from Urban and Rural area :

$$M_{ur,f,N} = E_{ur,f,N} \times EF_{f,N}$$

M: Emission of SLCP
ur: Urban / Rural
f: type of Fuel
N: type of SLCP
EF: Emission Factor
E: Household energy consumption

Future Emission of Air Pollutant from Residential Sector







2030

Energy consumption by Fuel and Purpose.



Heating(ADV)





This year plan after we get the emission scenarios.

Future Emission Scenarios of Residential Sector



Regional Air Pollution

Contribution of Residential Sector



Indoor Air Pollution



15

Average Indoor exposure of PM2.5 multiplied by population.

Summary of current situation and future plan

- 1. It is extremely important to improve the accuracy of future estimates of the emissions from the residential sector, as SLCP emissions are large and the impact of indoor air pollution is serious.
- 2. In this year, we are conducting research focusing on the estimation of the service demand of the residential sector and the estimation of the reduction potential by AIM/Enduse model.
- 3. After that, we will estimate the contribution of pollutants from the residential sector to local and regional air pollution and estimate the impact to the indoor air pollution.

Thank you for your attention