

Powered by



Funded by the European Union's  
Horizon 2020 Research and  
Innovation Programme under  
Grant Agreement no. 846463



## *100% Renewable Energy Scenario in Tokyo metropolitan area with green recovery by 2050*

Sep. 21-22nd 2021

Hironao MATSUBARA

*Institute for Sustainable Energy Policies (ISEP)*

<http://www.isep.or.jp/en>

## *100% Renewable Energy Scenario in Tokyo metropolitan area with green recovery by 2050*

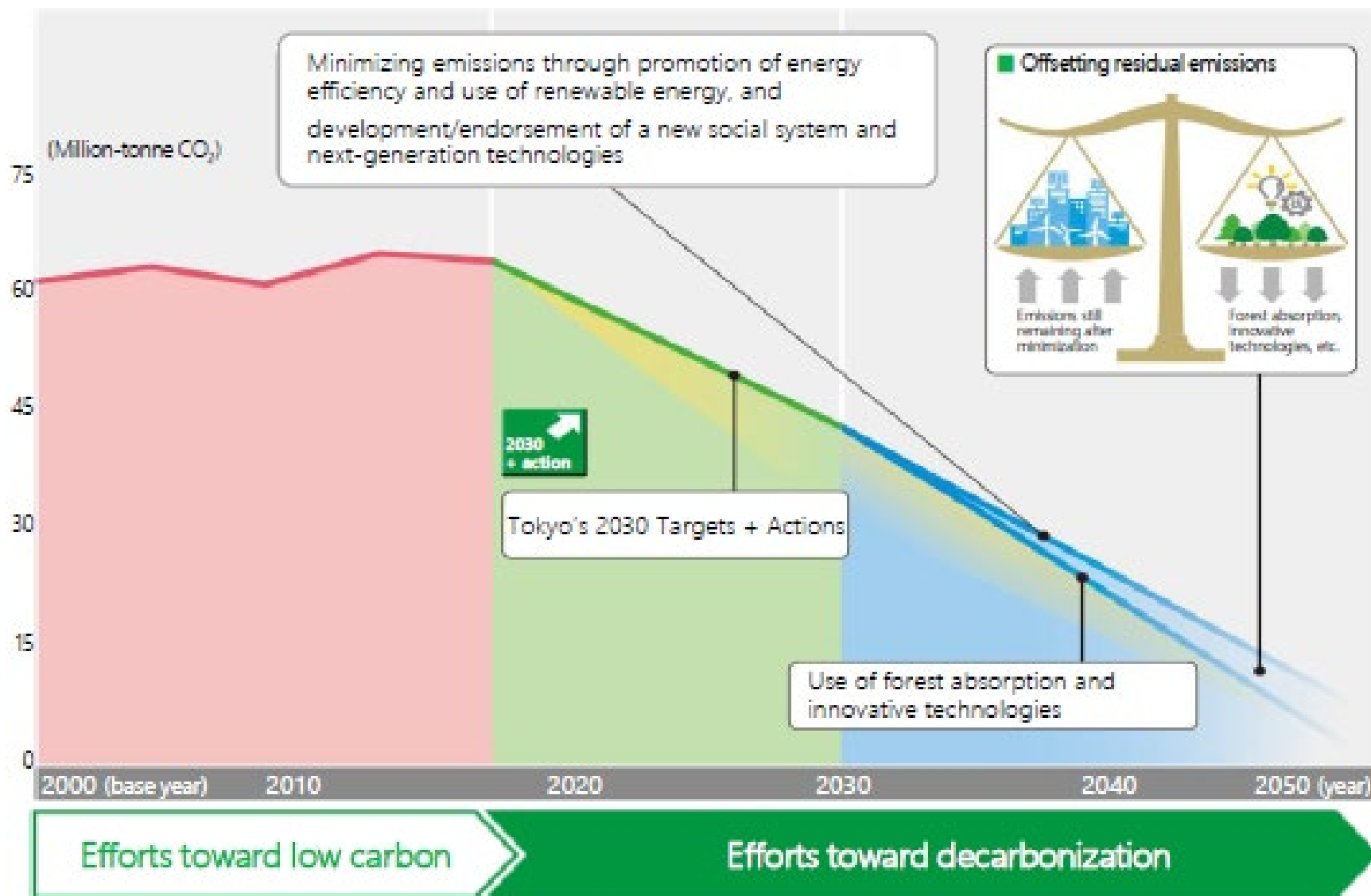
- This study presents investigation of the possibility of 100% Renewable Energy Scenario in Tokyo metropolitan area with green recovery process by 2050.
- To achieve this goal, a scenario for 100% renewable energy in Tokyo is examined, which corresponds to a sustainable economic recovery so called green recovery from the COVID-19, and the potential for energy conservation and the possibility of energy transition through sector coupling are shown.
- The amount of renewable energy introduced in Tokyo will be increased as much as possible in consideration of its potential in the Tokyo area, and mainly solar and wind power electricity will be procured from outside the area.

### Acknowledgement:

This study is conducted with Manabu Utagawa(AIST) as a joint research project between Greenpeace Japan, an international environmental NGO, and the Institute for Sustainable Energy Policies (ISEP), and I would like to thank both parties involved.

# Zero Emission Tokyo Strategy by Tokyo Metropolitan government

## Roadmap for CO2 emissions reductions by 2050



Source: Tokyo Metropolitan Government

[https://www.kankyo.metro.tokyo.lg.jp/en/about\\_us/zero\\_emission\\_tokyo/strategy.html](https://www.kankyo.metro.tokyo.lg.jp/en/about_us/zero_emission_tokyo/strategy.html)

# Zero Emission Tokyo Strategy 2020 Update & Report (March 2021)

## Start Actions for “Carbon Half” by 2030

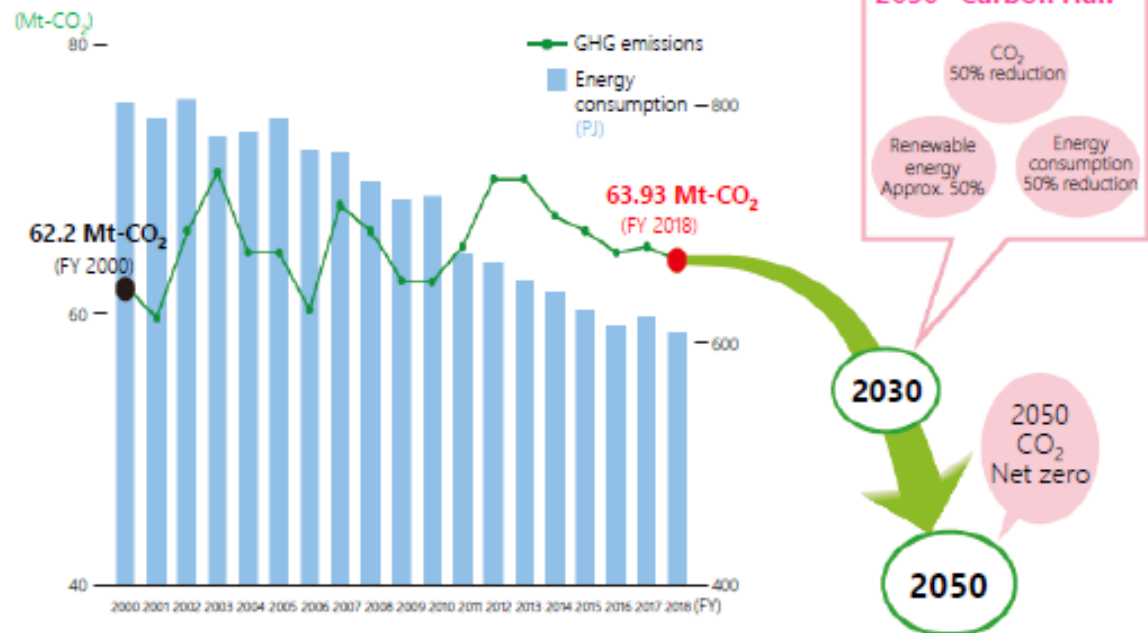


**Zero Emission Tokyo 15**  
Zero Emission Tokyo Strategy  
2020 Update & Report

|   |             | (Existing targets) |                |
|---|-------------|--------------------|----------------|
| ➢ Reduction of GHG emissions in Tokyo compared to 2000              | 30%         | ⇒                  | 50%*           |
| ➢ Reduction of energy consumption in Tokyo compared to 2000         | 38%         | ⇒                  | 50%*           |
| ➢ Percentage of power generated by renewable energy                 | Approx. 30% | ⇒                  | Approx. 50%*   |
| ➢ Phasing out the sale of new gasoline-only passenger cars in Tokyo |             | ⇒                  | 100%           |
| ➢ Phasing out the sale of new gasoline-only motorcycles in Tokyo    |             | ⇒                  | 100% (by 2035) |

\* TMG will discuss further these targets and initiatives for these aspects in the Tokyo Metropolitan Environmental Council

### Trend of GHG emissions etc.

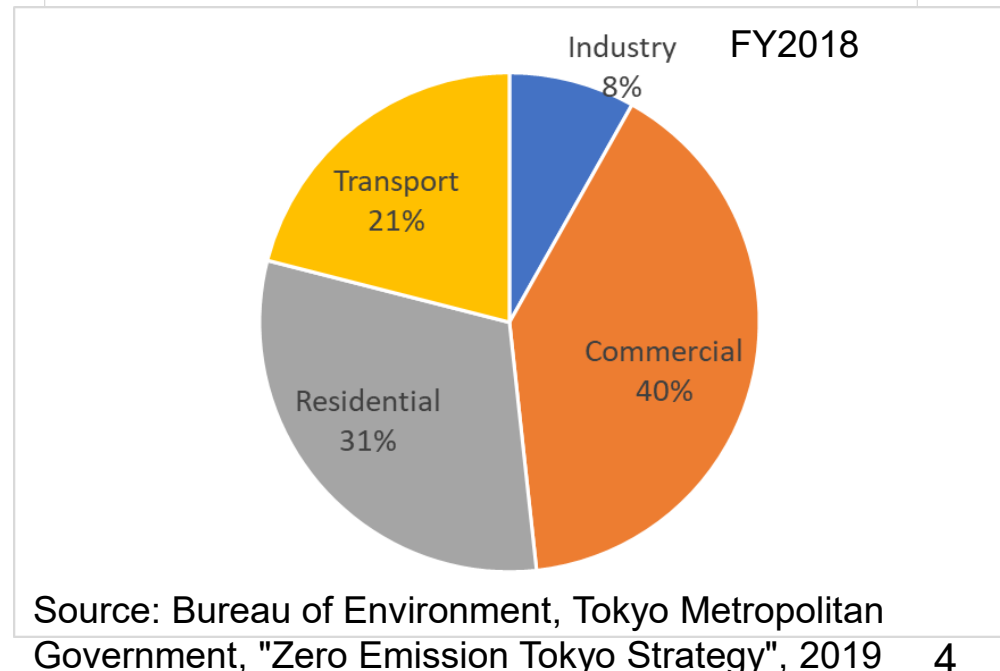
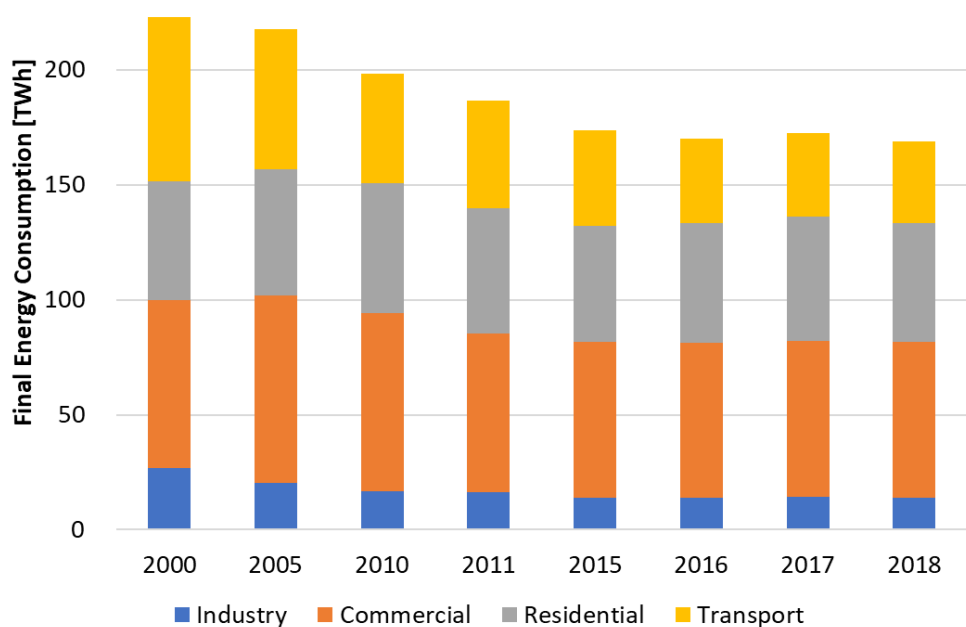
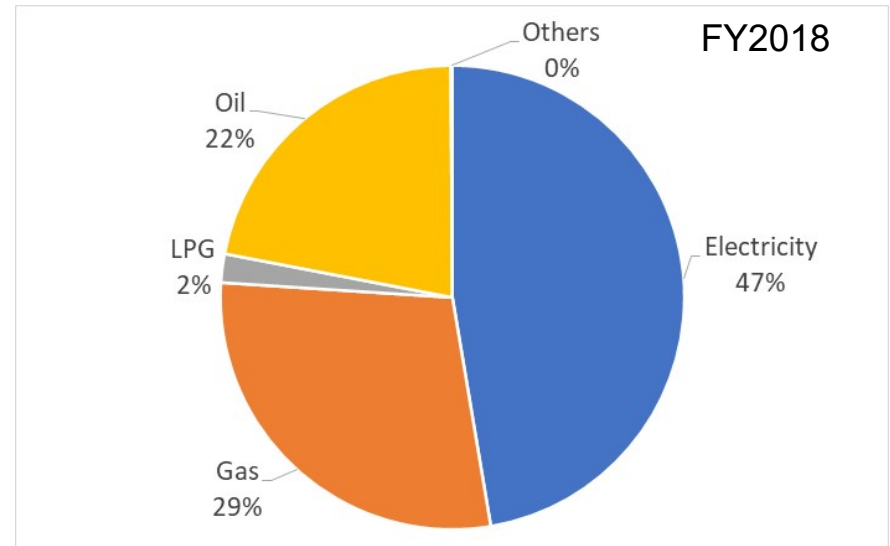
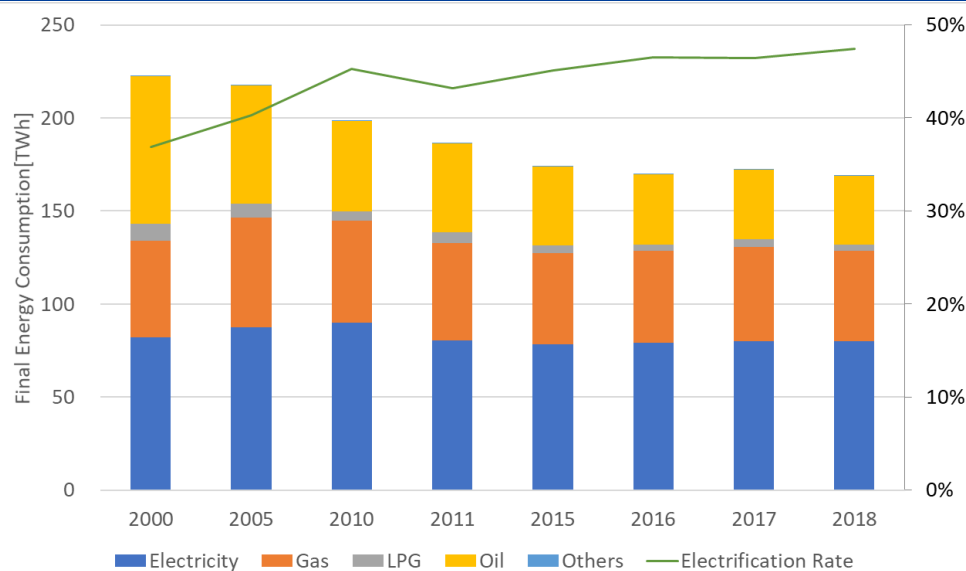


Source: Tokyo Metropolitan Government

[https://www.kankyo.metro.tokyo.lg.jp/en/about\\_us/zero\\_emission\\_tokyo/strategy\\_2020update.html](https://www.kankyo.metro.tokyo.lg.jp/en/about_us/zero_emission_tokyo/strategy_2020update.html)

# Final energy consumption and electrification rate in Tokyo

## Historical trends(FY2000 – 2018)



Source: Bureau of Environment, Tokyo Metropolitan Government, "Zero Emission Tokyo Strategy", 2019

# Concept of energy efficiency and conservation scenario

Assumed changes in activities by 2030 and 2050 (compared to FY2017)

| Sector              | 2030  | 2050  | notes  |
|---------------------|-------|-------|--|
| Industrial          | -6%.  | -19%. | future population decreasing in proportion.<br>(No overseas relocation is expected.)   |
| Commercial          | +2%.  | -1%.  | Office floor space to be reduced by 10% in 2030 compared to 2017 (otherwise proportional to Tokyo's population); after 2030, proportional to Tokyo's future population |
| Residential         | +5%.  | +1%.  | Proportional to the number of future households in Tokyo   |
| transport passenger | -10%. | -13%. | 10% decrease in 2030 compared to 2017; proportional to the future population of Tokyo after 2030   |
| freight             | -10%. | -23%. | 10% decrease in 2030 compared to 2017; proportional to the future population of the nation after 2030  |

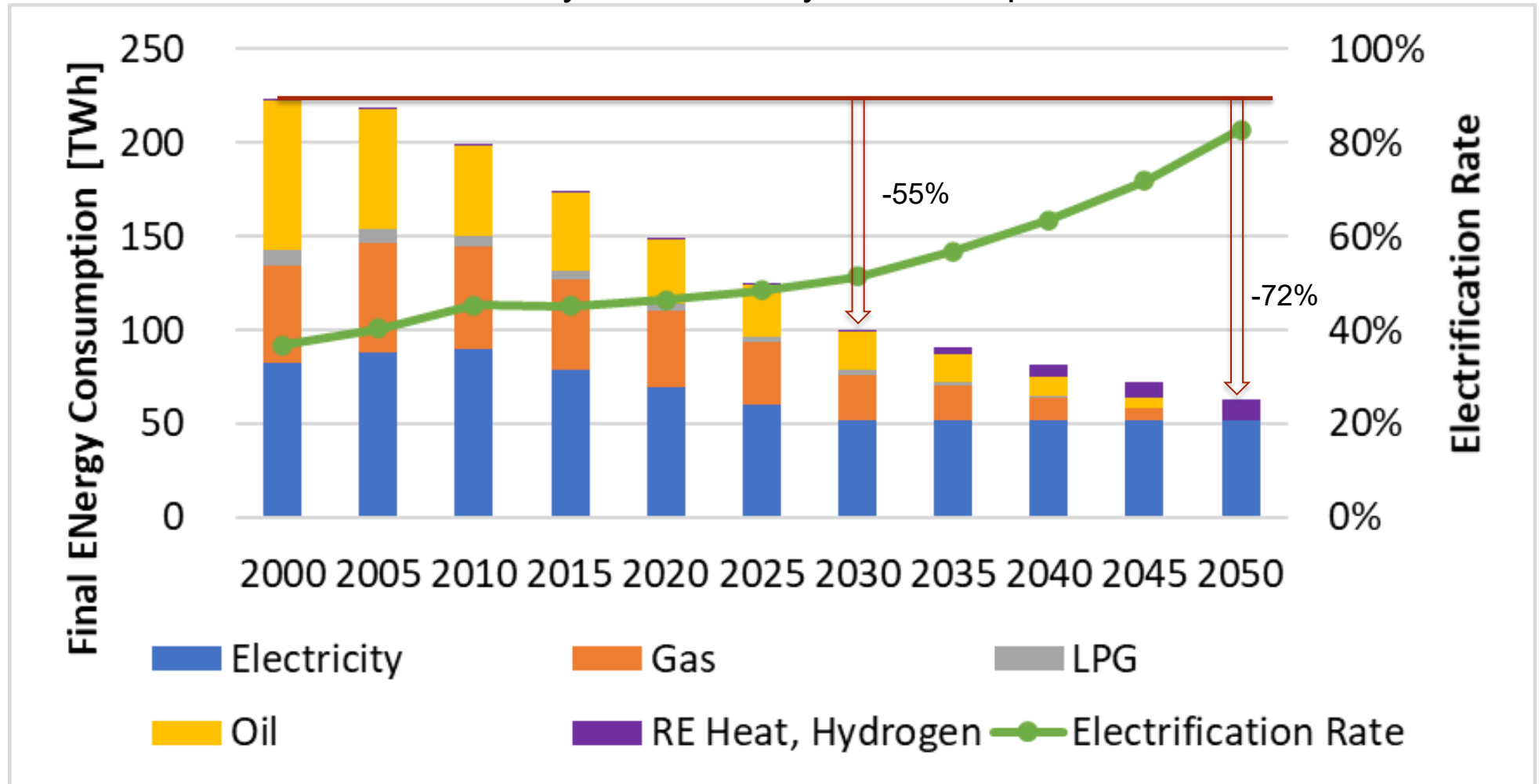
# Concept of energy efficiency and conservation scenario

| Sector      | Target                    | By 2030   | After 2030 until 2050  |
|-------------|---------------------------|---|--|
| Commercial  | Buildings                 | Insulation standards for new construction and reconstruction until 2024<br>Introduction of ZEB for new construction and reconstruction from 2025          | Introduce ZEB at the time of new construction and reconstruction, and heat insulation retrofitting of existing buildings |
|             | Equipments                | Introduce top-class energy-saving equipment at the time of renewal.<br>Switch to electric units and renewable heat for heating and cooling heat use.      |  |
| Residential | Houshold                  | Insulation standards for new construction and reconstruction until 2024<br>Introduction of ZEH for new construction and reconstruction from 2025          | Introduce ZEH at the time of new construction and reconstruction, and heat insulation retrofitting of existing buildings |
|             | Equipment                 | Introduction of top-class energy-saving equipment at the time of renewal<br>Switch to electric units and renewable heat for heating and cooling heat use. |  |
| Transport   | Passenger car             | 20% conversion to electric vehicles<br>Energy efficiency improvement 80%  | All electric vehicles  |
|             | Bus                       | 5% for electric vehicles(stock percentage)<br>Energy efficiency improvement 70%.  | All electric vehicles  |
|             | Trucks                    | Truck 5% (stock percentage)<br>Energy efficiency improvement 70%.   | All electric vehicles  |
|             | Railroad, Ships, aviation | Energy efficiency improvements of 10% for rail, 10% for ship, 20% for air   |  |
| Industrial  |                           | Energy efficiency improvement equivalent to reduction obligation (set to -21% by 2030)  | Use of low and medium temperature heat throughout the plant: Partial conversion to electric heat pumps (-70%)            |



# Energy conservation scenario in Tokyo

- Reduction rate of energy consumption in 2030 will be about 55%, and 72% reduction by 2050
- By 2030, reduction of electricity consumption will be 37%, and same reduction by 2050
- Electrification rate will be 52% by 2030, 83% by 2050, compared with 37% in 2000





# Renewable Energy Installation Potential in Tokyo area

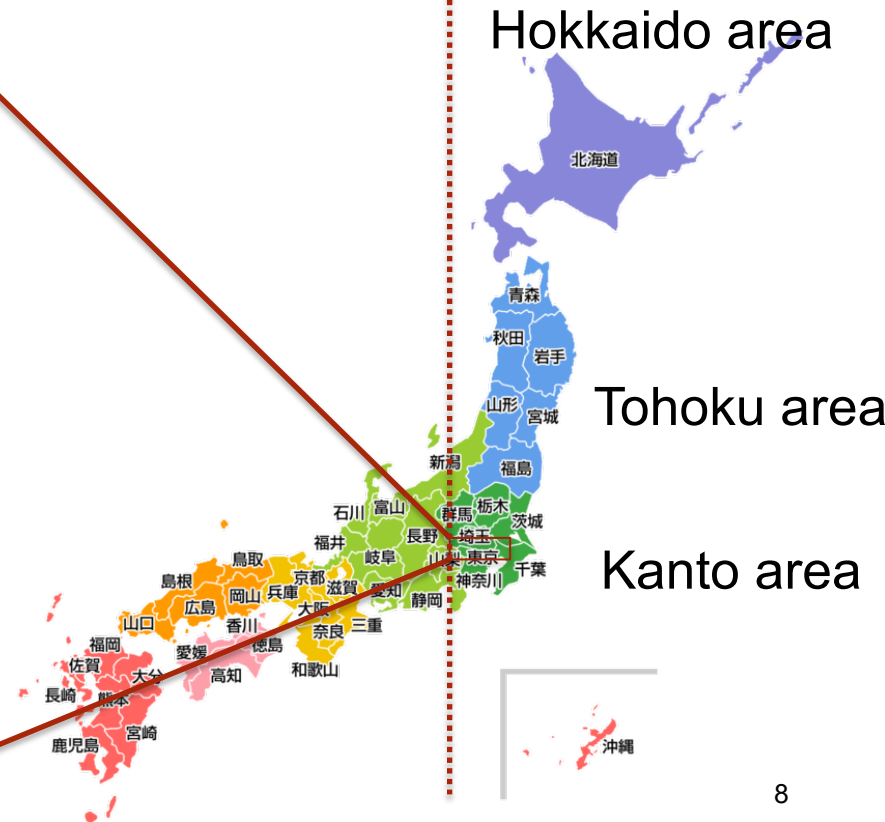
The potential of renewable energy in the region will be examined by referring to the Ministry of the Environment's database: REPOS.

The potential for renewable energy in the Tokyo metropolitan area is assessed by dividing it into two areas, inside and outside of the Tokyo area.

60Hz(West Japan) 50Hz(East Japan)

## Tokyo Metropolitan area

Population: 14 M



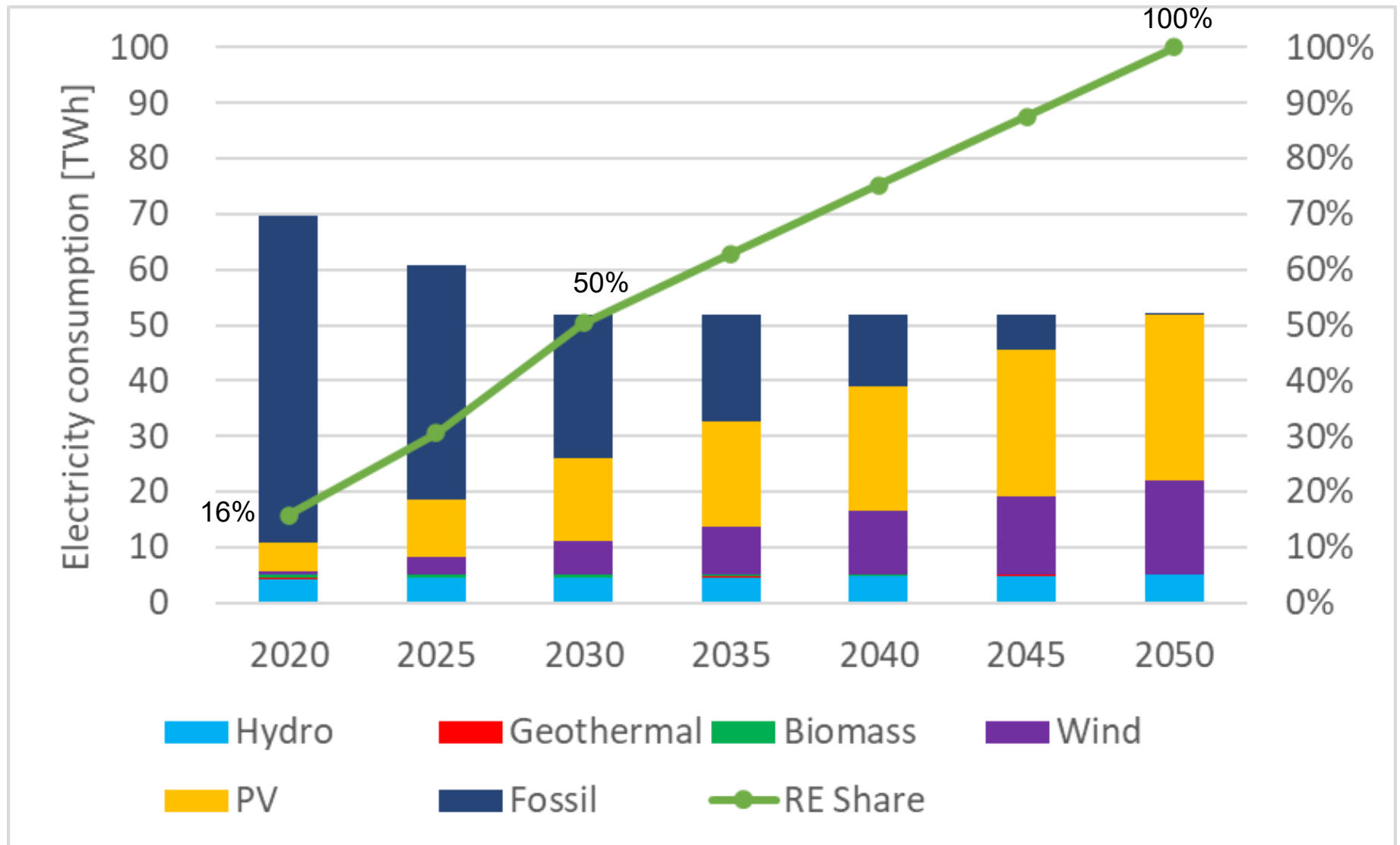
# Renewable Energy Installation Potential in Tokyo area

Based on the Ministry of the Environment's REPOS (Renewable Energy Potential System)

| Renewable Energy        | Installation Potential   |
|-------------------------|--|
| <b>PV</b>               | 15.9 TWh (8.3 GW for residential, 4.7 GW for public space) mainly on roof tops and un-used land                                  |
| <b>Wind</b>             | 227.8 TWh (2.0 TWh onshore, 95.6 TWh offshore on fixed type, 130.2 TWh offshore on floating) including TEPCO (mainly Kanto) area |
| <b>Geothermal power</b> | 0.05TWh (7.4MW) Flash, Binary  |
| <b>Small hydro</b>      | 0.10TWh(15.5MW) excluding existing installation  |
| <b>Solar thermal</b>    | 6.5TWh(Mainly roofs of buildings)  |
| <b>Geothermal heat</b>  | 79.2TWh(Including sewage heat, etc.)   |

# “Renewable Energy 100% scenario in Tokyo by 2050”

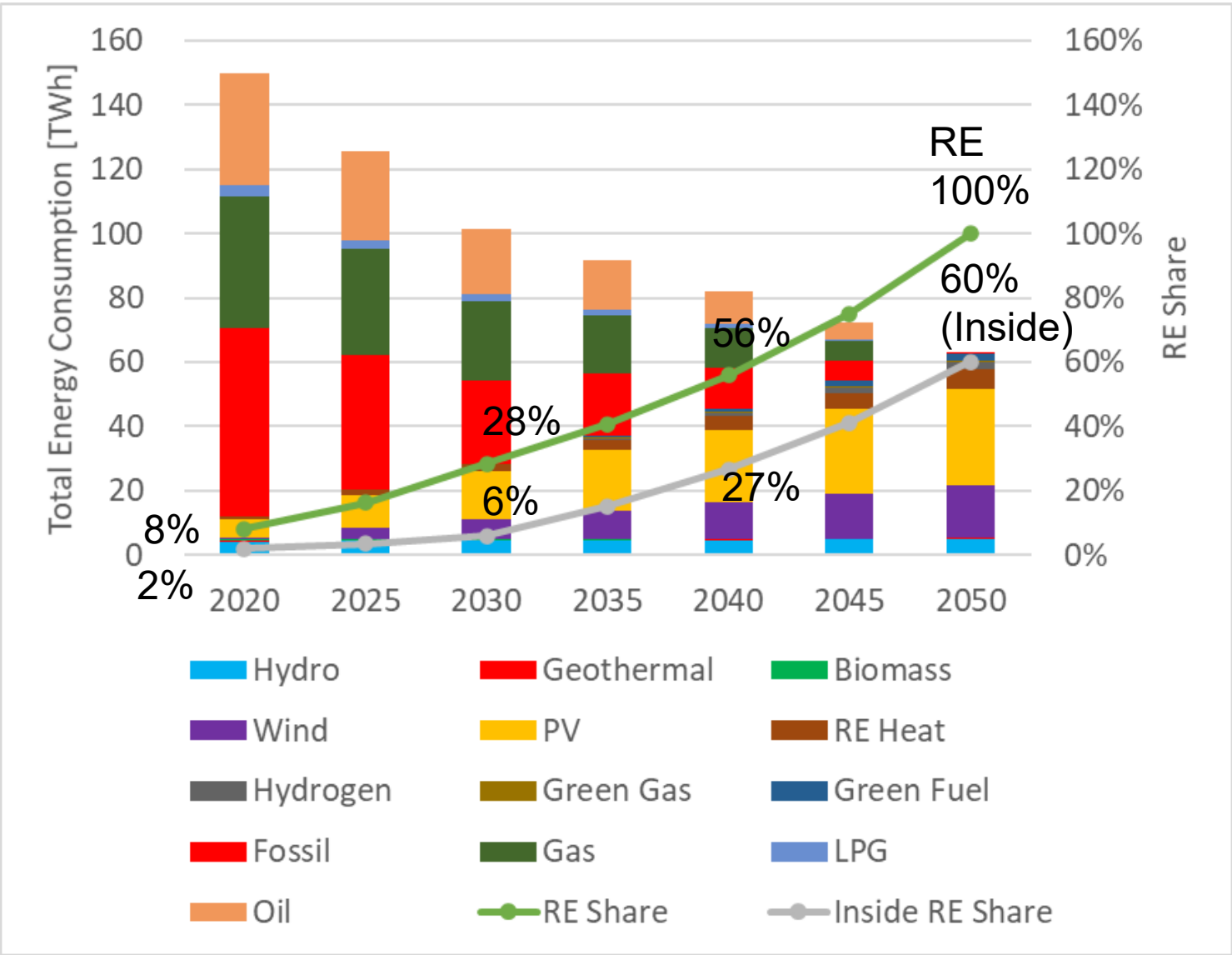
## Estimated annual electricity consumption for 100% renewable energy



\* 50% renewable energy electricity case in 2030

# “Renewable Energy 100% scenario in Tokyo by 2050”

## Total energy composition in the 100% renewable energy scenario

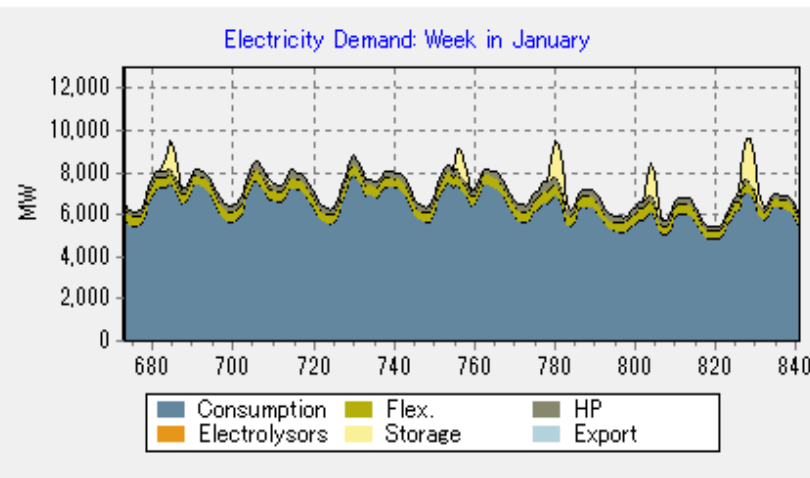


\* 50% renewable energy electricity case in 2030

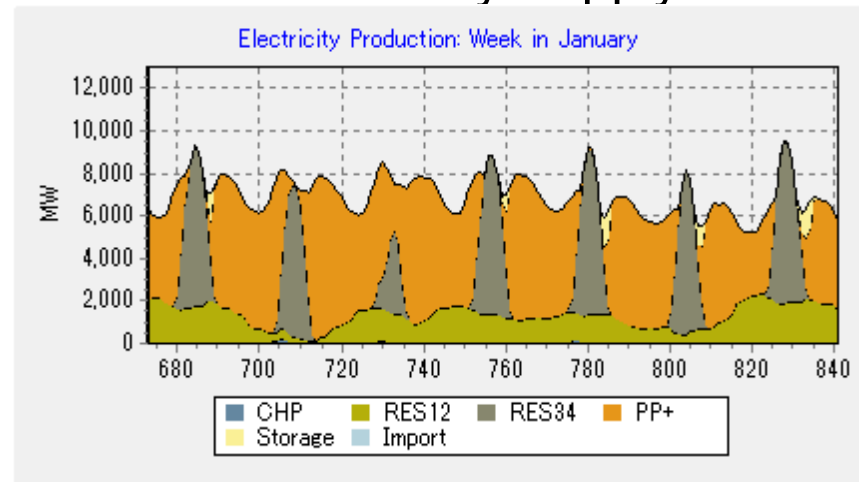
# Electricity supply and demand for one week in January

## Example of energy balance analysis in EnergyPLAN

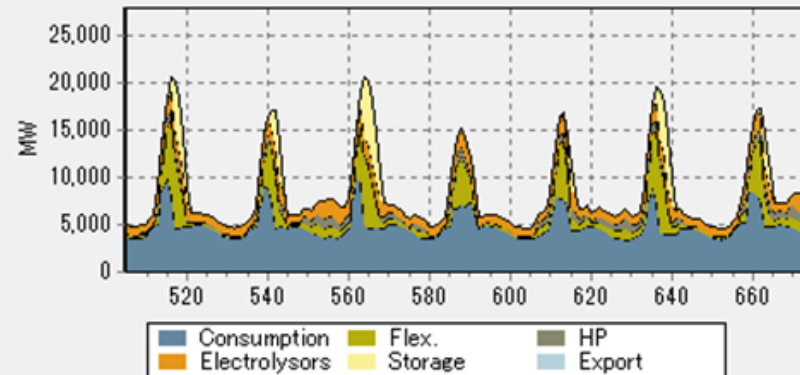
### Electricity Demand



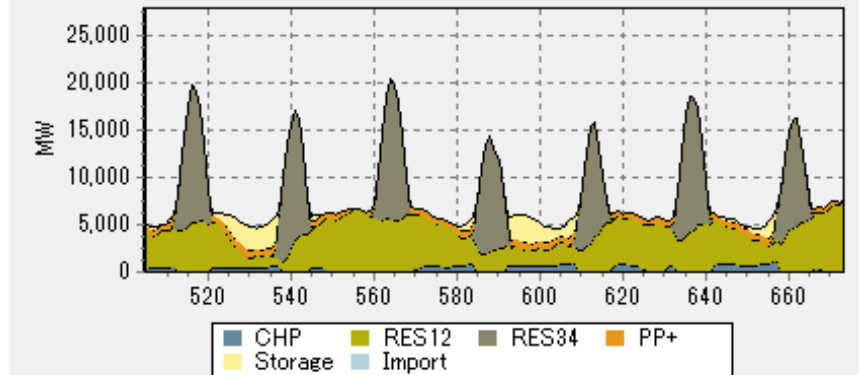
### Electricity Supply



### Electricity Demand: Week in January



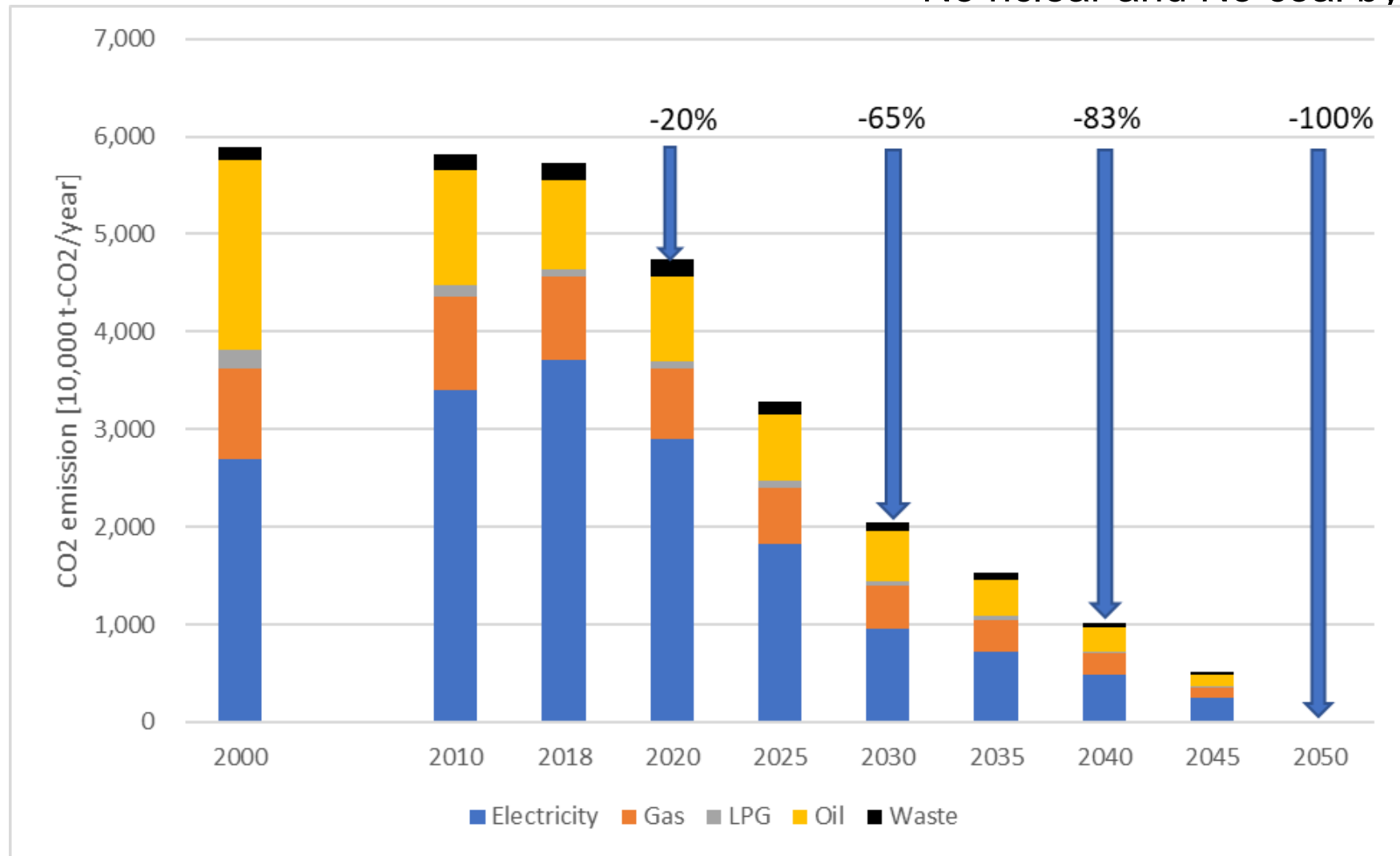
### Electricity Production: Week in January



# “Renewable Energy 100% scenario in Tokyo by 2050”

## CO2 emissions reduction in a 100% renewable energy scenario

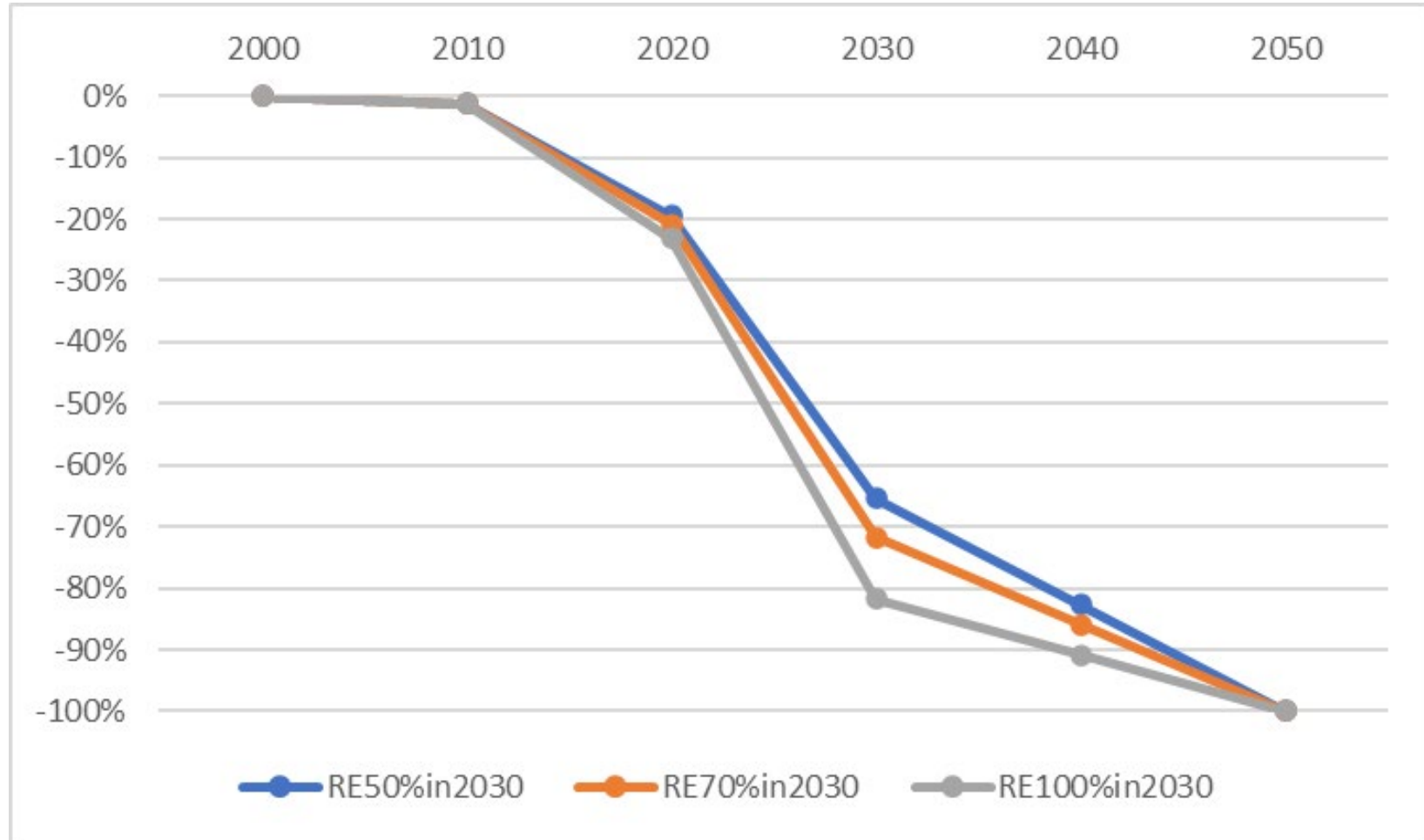
\* No nuclear and No coal by 2030



\* 50% renewable energy electricity case in 2030

# “Renewable Energy 100% scenario in Tokyo by 2050”

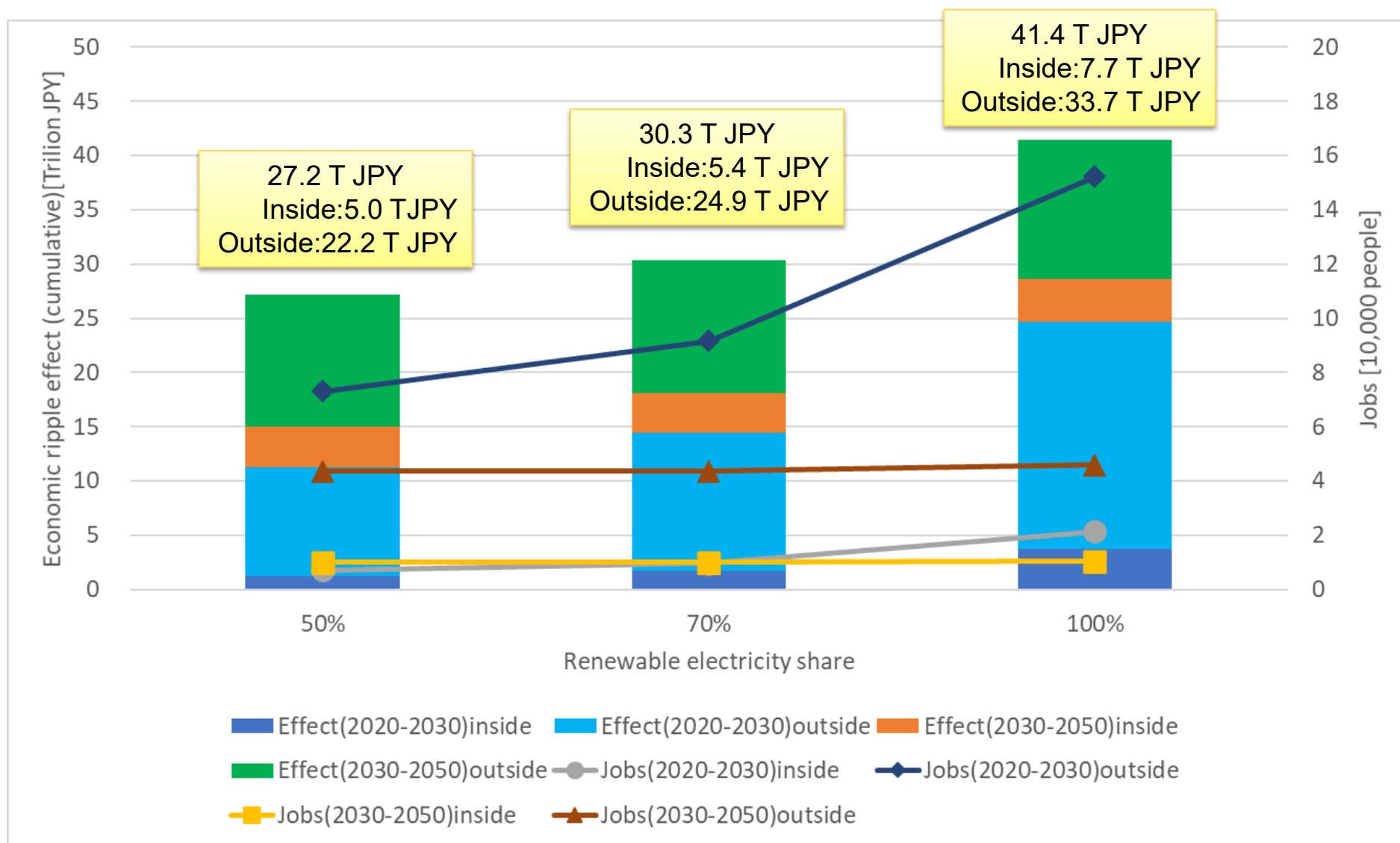
## CO2 emissions reduction in 100% renewable energy scenarios





# “Renewable Energy 100% scenario in Tokyo by 2050”

## Comparison of economic ripple effects and employment in renewable energy scenarios



# Concluding Remarks

- This study developed a 100% renewable energy scenario that is compatible with green recovery in response to the Tokyo Metropolitan Government's "Zero Emission Tokyo Strategy,"
- Based on the energy conservation scenario, we examined a scenario in which 100% renewable energy is used for final energy consumption in all sectors, and conducted an energy model analysis using EnergyPLAN.
- In order to realize this 100% renewable energy scenario, it is important to set a clear goal and develop a roadmap, so that various stakeholders in Tokyo can promote the introduction of renewable energy in this region, including the surrounding areas. Local energy projects should be promoted on a public and private basis, and for each sector to procure sustainable renewable energy electricity from outside the region.

# **100% Renewable Energy Scenario in Tokyo metropolitan area with green recovery by 2050**

**Thank you !**

Hironao MATSUBARA

Institute for Sustainable Energy Policies(ISEP),  
Tokyo, Japan

<http://www.isep.or.jp/en>