# Environmental Policy and its Impact on Industries in Japan

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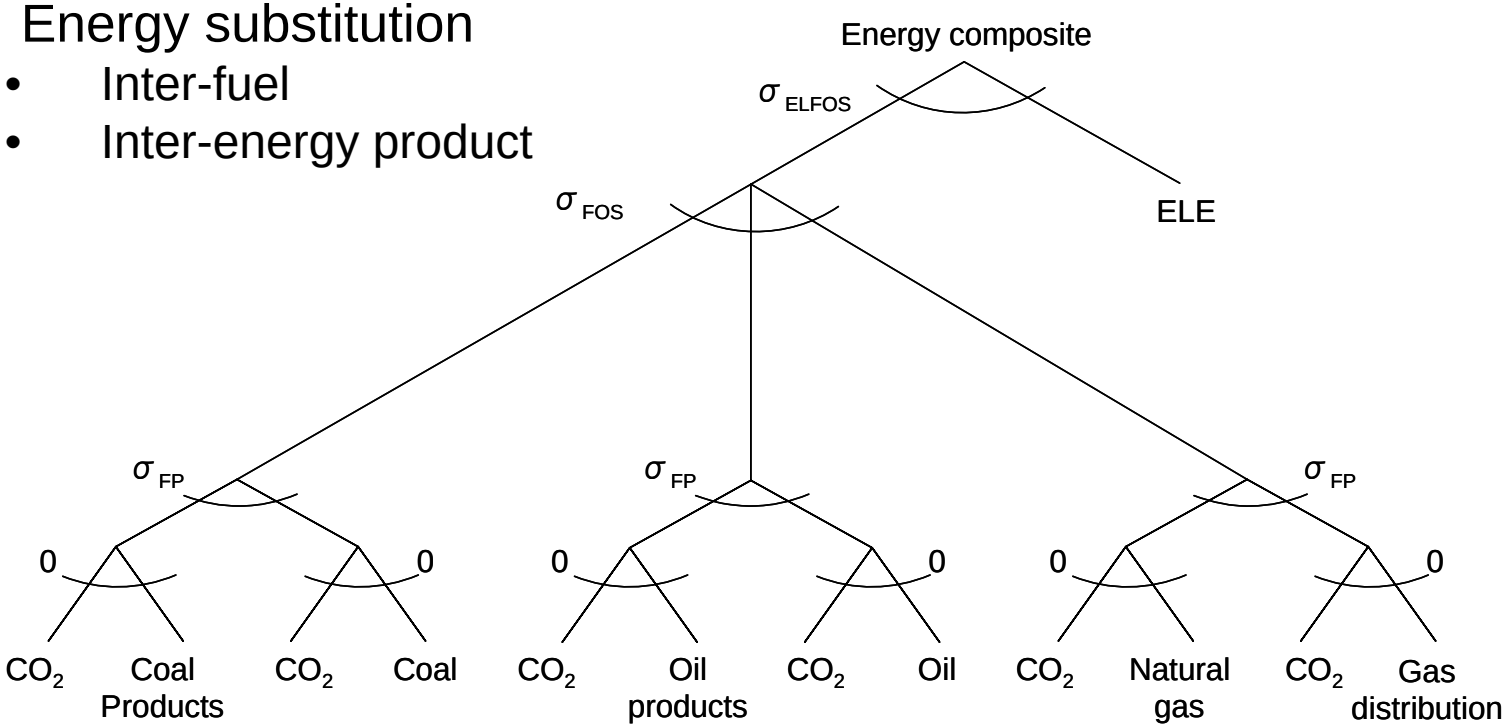
# Background

- Environmental policies will increase production costs, especially for energy intensive industries.
  - Strong opposition from Nippon Keidanren (Japan Business Federation) to environmental tax
  - Acceptability of policies
  - Mitigating negative impacts on energy intensive industries
- Which assistance program is more acceptable for the business to reduce $CO_2$ emissions?
  1. Tax exemption
  2. Free allocation of emission permits
- How much are welfare losses and $CO_2$ abatement costs of these assistance programs?

# CGE Model of Japan

- CGE model of Japan
  - Static and multi-sectoral model
  - IO table of 2000
  - Software: GAMS/MPSGE
- Overview
  - Our model is mostly like conventional CGE models.
  - Energy substitution
    - Inter-fuel
    - Inter-energy product

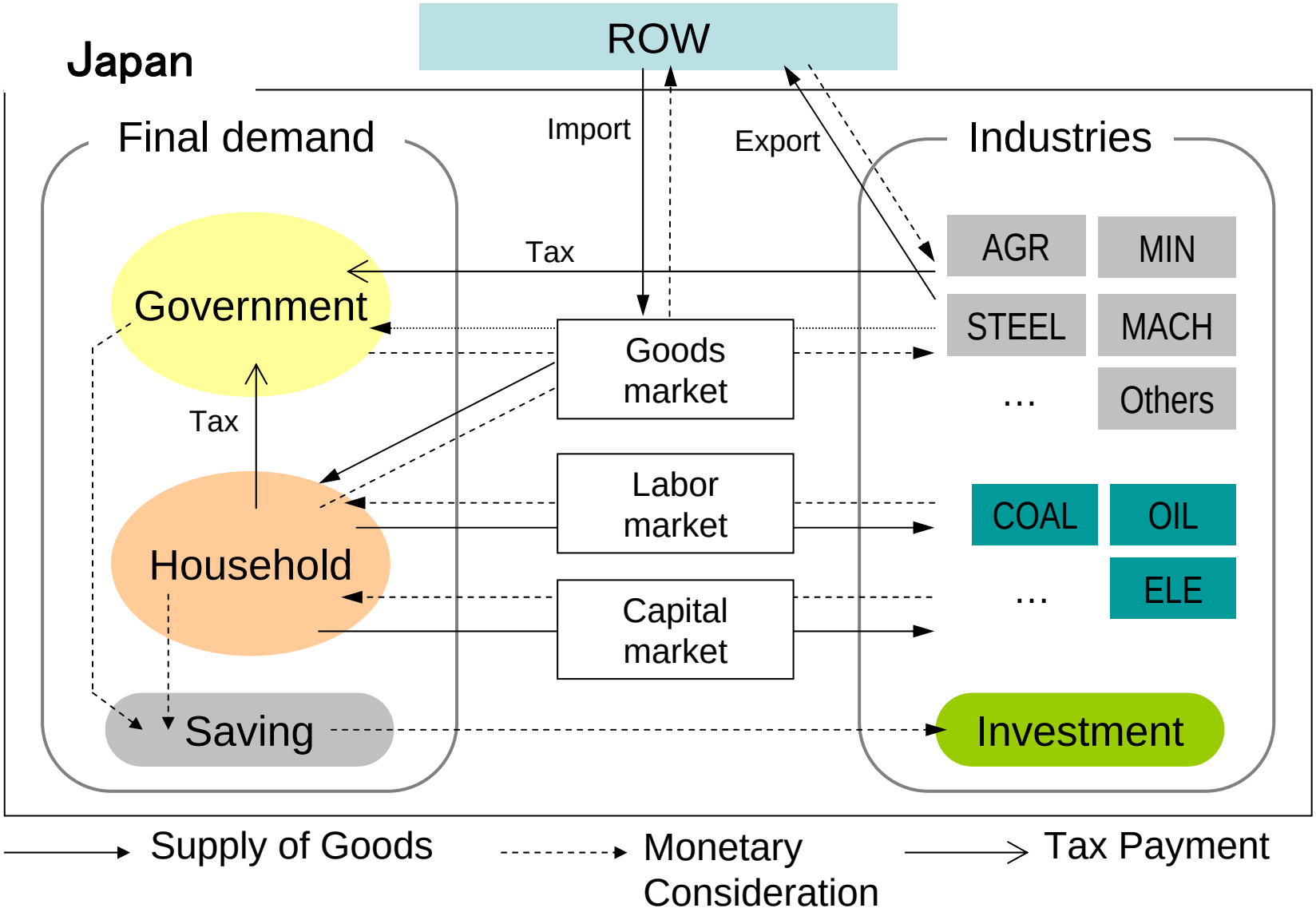


# 33 Industries

| Energy | Manufacturing | | Service | |
|---|---|---|---|---|
| Coal | Agriculture | *Iron & Steel* | Construction | Financial Services |
| Oil | Mining | Metal Products | Water | Public Services |
| Gas | Food | Machine | *Waste* | Private Services |
| *Coal Products* | Textile | Electric Machinery | Commerce | Business Services |
| Oil Products | Pulp | Transport Machinery | Real Estate | Others |
| *Gas Distribution* | *Chemical* | *Recycle* | *Transport* | |
| *Electric Power* | *Clay* | Other Manufacturing | Telecom | |

***9 industries indicated in red*** **are energy intensive.**

# Model Structure



# 3 Simulation Scenarios

The Goal of All Simulations:

$CO_2$ reduction by 16% (94% of 1990 level)

| Environmental Tax Policies: | | |
|---|---|---|
| | 1. Uniform Tax | 2. 50% Exemption |
| Environmental Tax Rate (US$/t-C) | All Industries: T | 9 Energy Intensive Industries: $T_E$<br>Other Industries: $T_O$<br>$T_E = T_O * 0.5$ |

**T, $T_E$ and $T_O$ are endogenously determined to meet the target of 16% reduction.**

# 3 Simulation Scenarios

| Emission Trading System: | |
|---|---|
| | 3. Partial Free Allocation |
| Price of Emission Permit (US$/t-C) | All Industries: P |
| Allocation of Permits | 9 Energy Intensive Industries: Freely allocated<br>Other Industries: Auctioned |

**The Japanese Government introduce ETS to meet the target of 16% reduction. P is endogenously determined.**

# Economy-Wide Impact

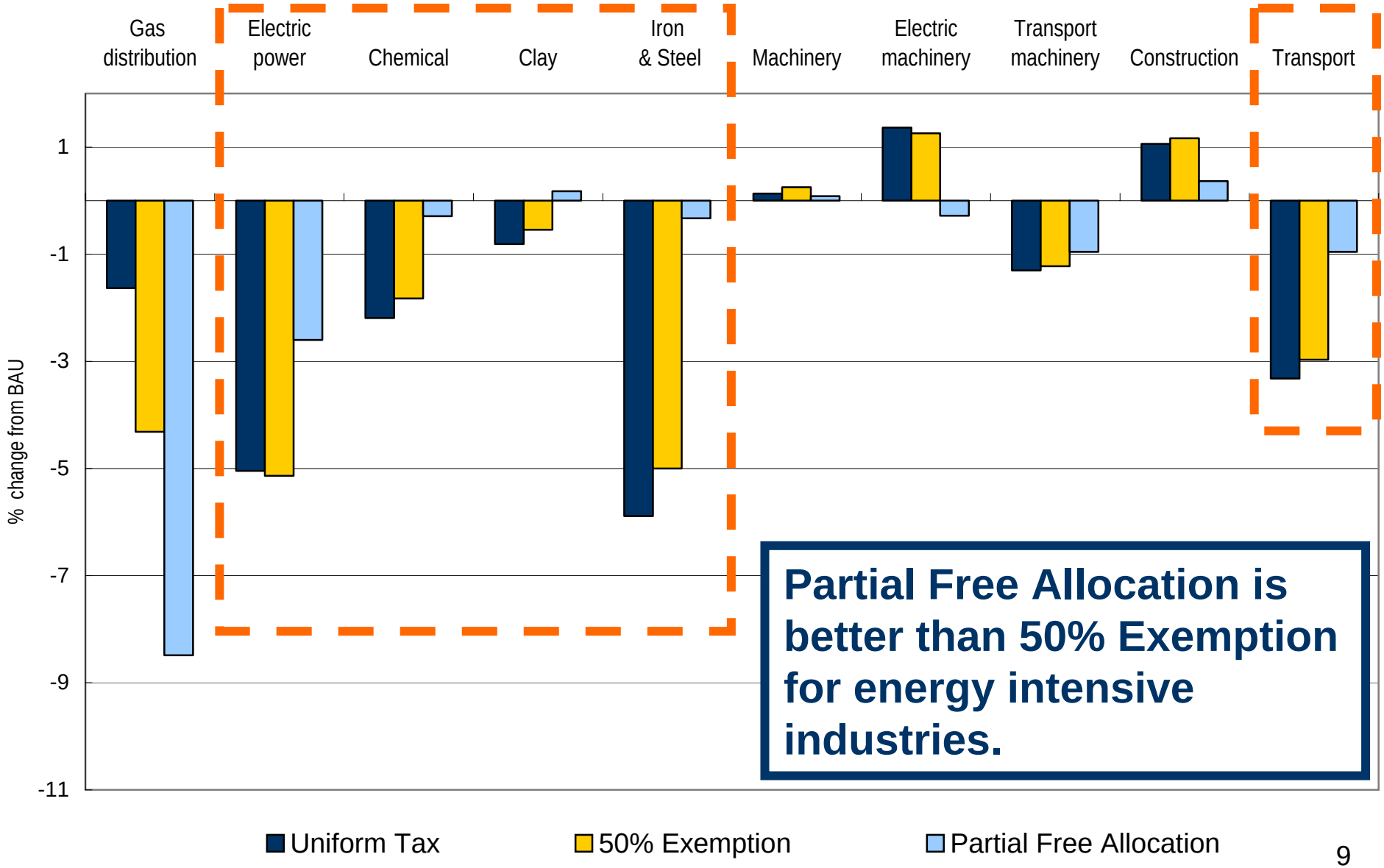
| | GDP (%*) | Social Welfare (%) | Environmental Tax Rate** (US$/t-C) |
|---|---|---|---|
| Uniform Tax | -0.71 | -0.18 | 165 (19,805 yen***) |
| 50% Exemption | -0.78 | -0.19 | 268 (32,142 yen) |
| Partial Free Allocation | -0.41 | -0.24 | 316 (37,935 yen) |

* % Change from BAU ** Permit price in the Partial Free Allocation case *** 1 US$ = 120 yen

**2 Findings:**

1. **The assistance to energy intensive industries lead to more costs compared to the Uniform Tax case.**
2. **Partial Free Allocation is more costly than 50% Exemption. The reason is that the demand for permits is high because output levels of energy intensive industries don't decrease.**

# Sectoral Output (% change)




**Partial Free Allocation is better than 50% Exemption for energy intensive industries.**

# Conclusions

1. Assistance to energy intensive industries leads to more welfare loss and higher abatement costs compared to the no assistance case.
2. Partial Free Allocation of permits is the most costly to the whole economy but the most effective for the 9 energy intensive industries to accept the environmental policy.

Thank you!

# Future Study

- Introducing Imperfect Competition to Energy Intensive Goods
- Dynamic Model
  - Dynamic optimization
  - The Impacts of Assistance to Energy Intensive Industries on Investment

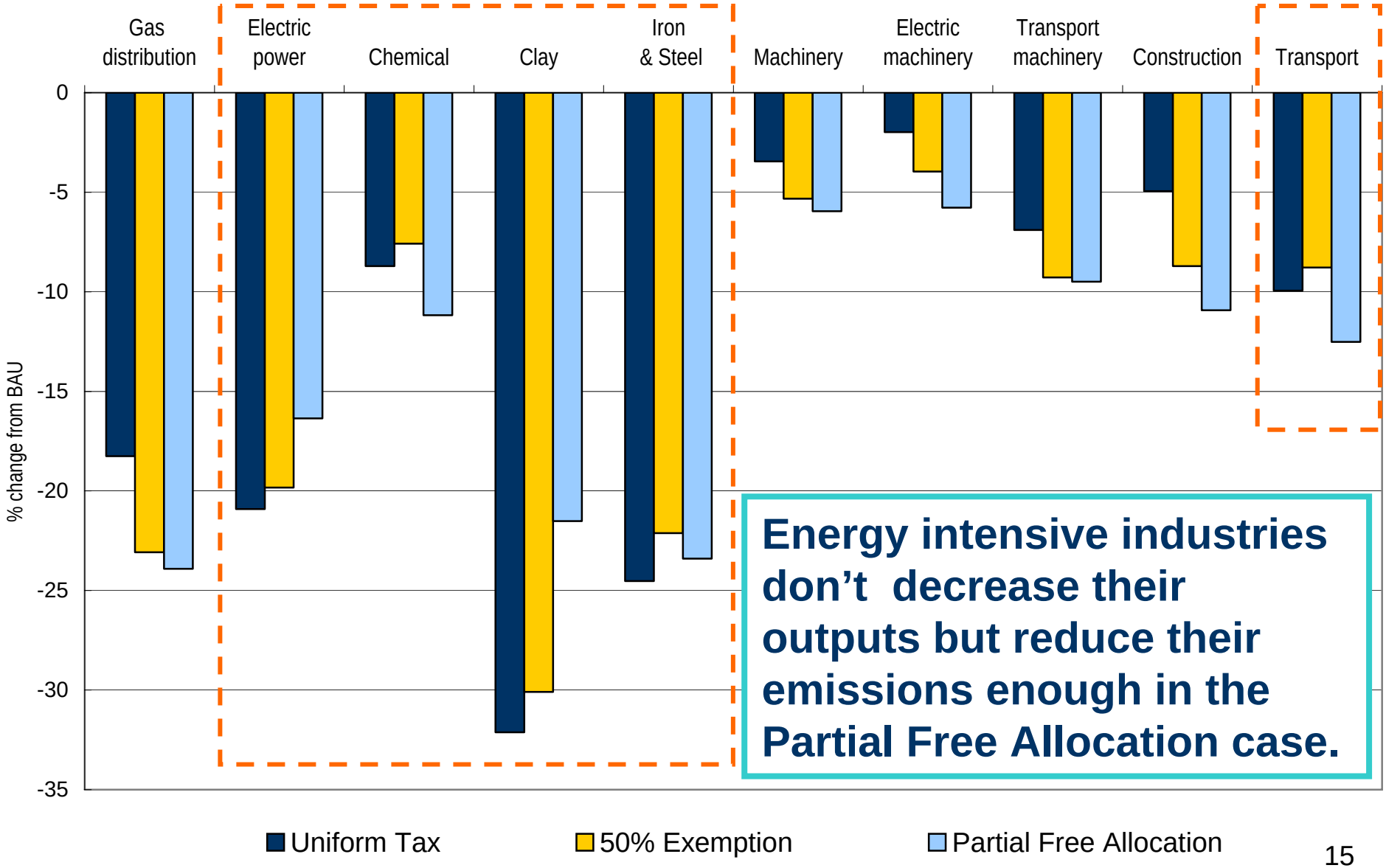
# Outline

1. Introduction
   - Background
2. Model
3. Simulation
   - Scenarios
   - Results
4. Conclusion

# Simulation Scenarios

- $CO_2$ emissions are reduced by 16% (to 94% of the level in 1990) in all scenarios.
- 2 types of environmental tax revenue recycling and free allocation of emission permits
  1. Uniform Tax
     - Uniform environmental tax is put on combustions of energy.
     - Environmental tax revenue funds government expenditure.
  2. 50% Exemptions
     - Differentiated Environmental Tax Rate
     - The tax rate for energy intensive industries is 50% level to other industries.
  3. Partial Free Allocation
     - Emission Trading System in Japan
     - All uses of fossil fuels require emission permits when combusted.
     - The government gives away permits freely only for energy intensive industries.
     - Other industries need to buy permits from the government.

# Sectoral $CO_2$ Emission (% change)




**Energy intensive industries don't decrease their outputs but reduce their emissions enough in the Partial Free Allocation case.**