



International Research Network for Low Carbon Societies: Clean growth and innovation in a changing world

**12 September 2017
Warwick University, UK**

Thailand's NDC 2030: Resources productivity and Innovation

THAILAND



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Technology**

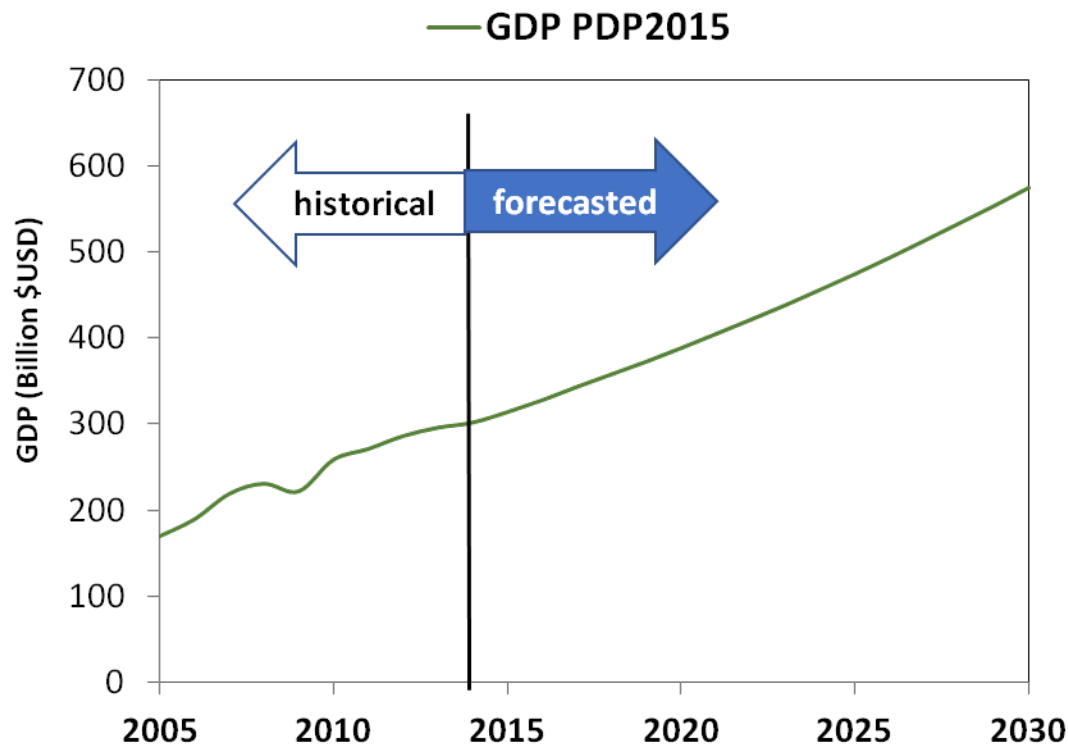
Thammasat University, Thailand

Long-Term Economic Growth (2015-2036)

| Year | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|------|------|------|------|------|------|------|------|------|
| GDP | 4.0 | 4.4 | 4.7 | 4.3 | 4.1 | 4.2 | 4.2 | 4.1 |

| Year | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |
|------|------|------|------|------|------|------|------|------|
| GDP | 4.0 | 4.1 | 4.0 | 4.0 | 4.0 | 3.9 | 3.8 | 3.8 |

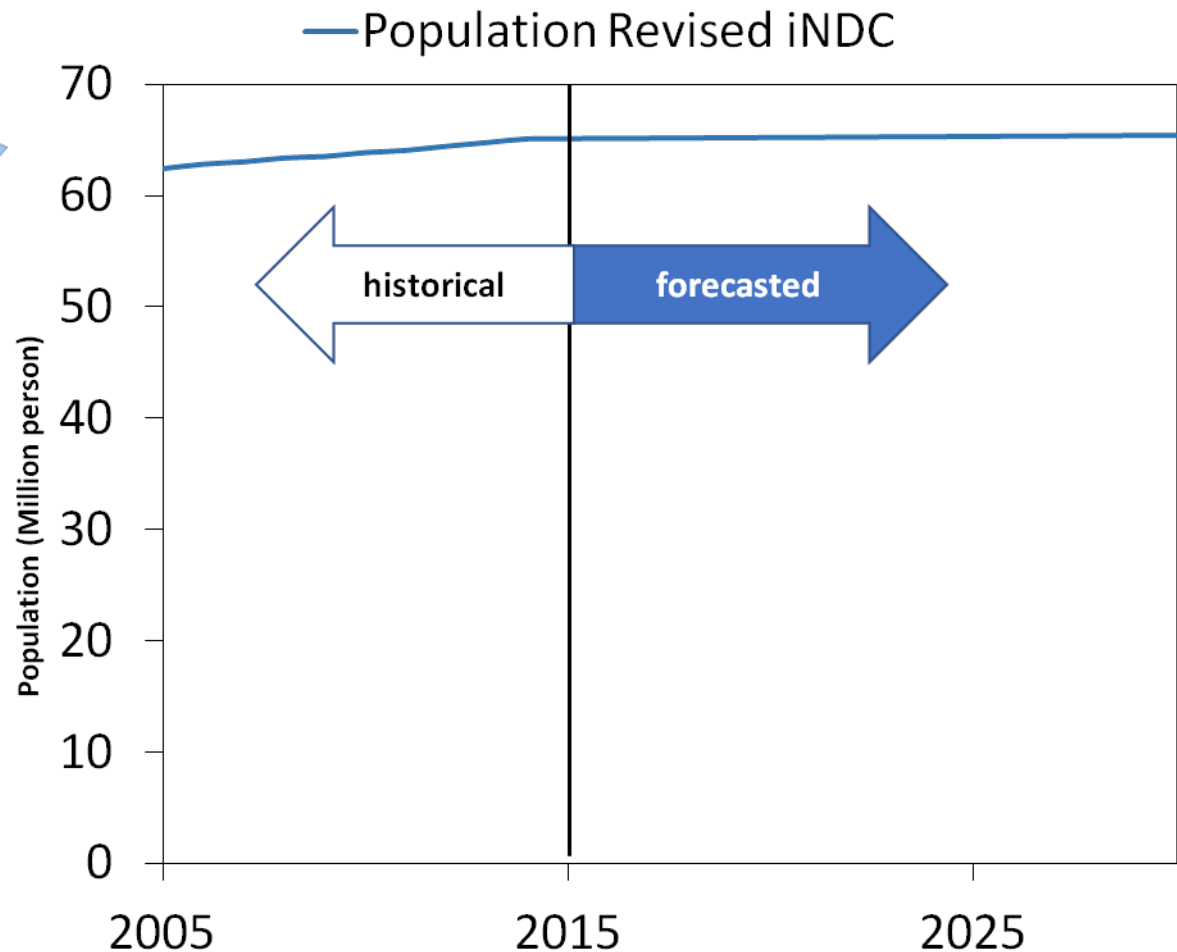
Source: PDP2015



Population Forecast

Population Assumption

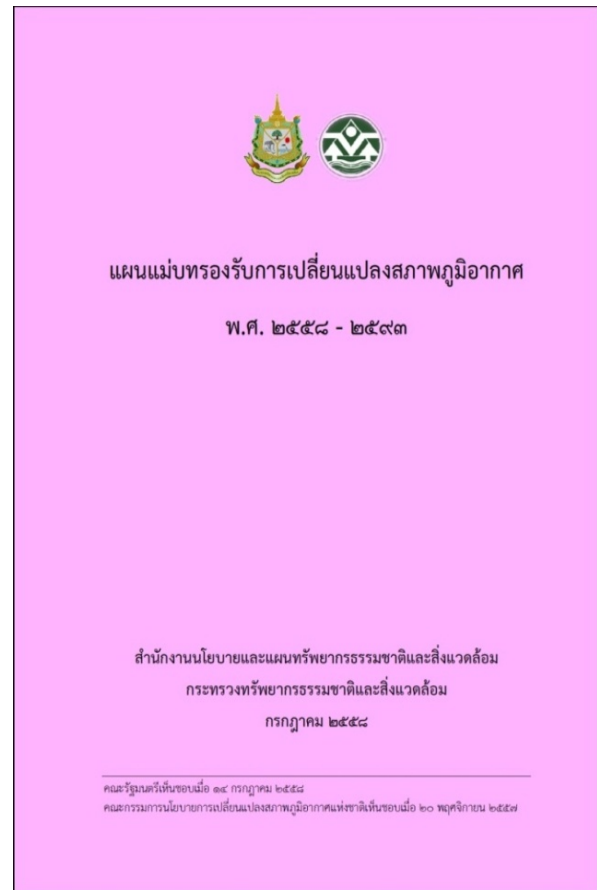
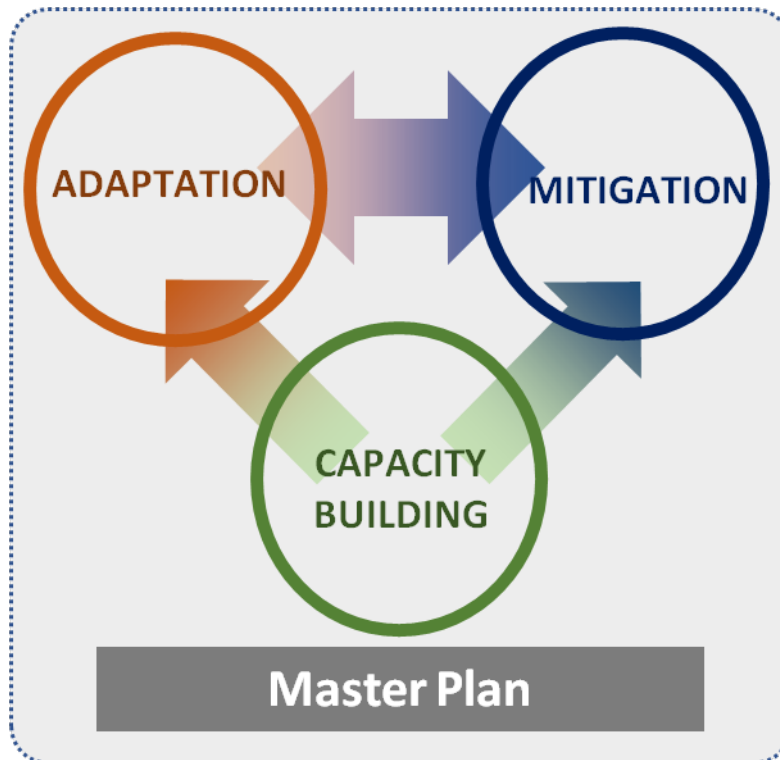
- PDP2015:
0.03% per annum



Thailand's Climate Change Master Plan 2050

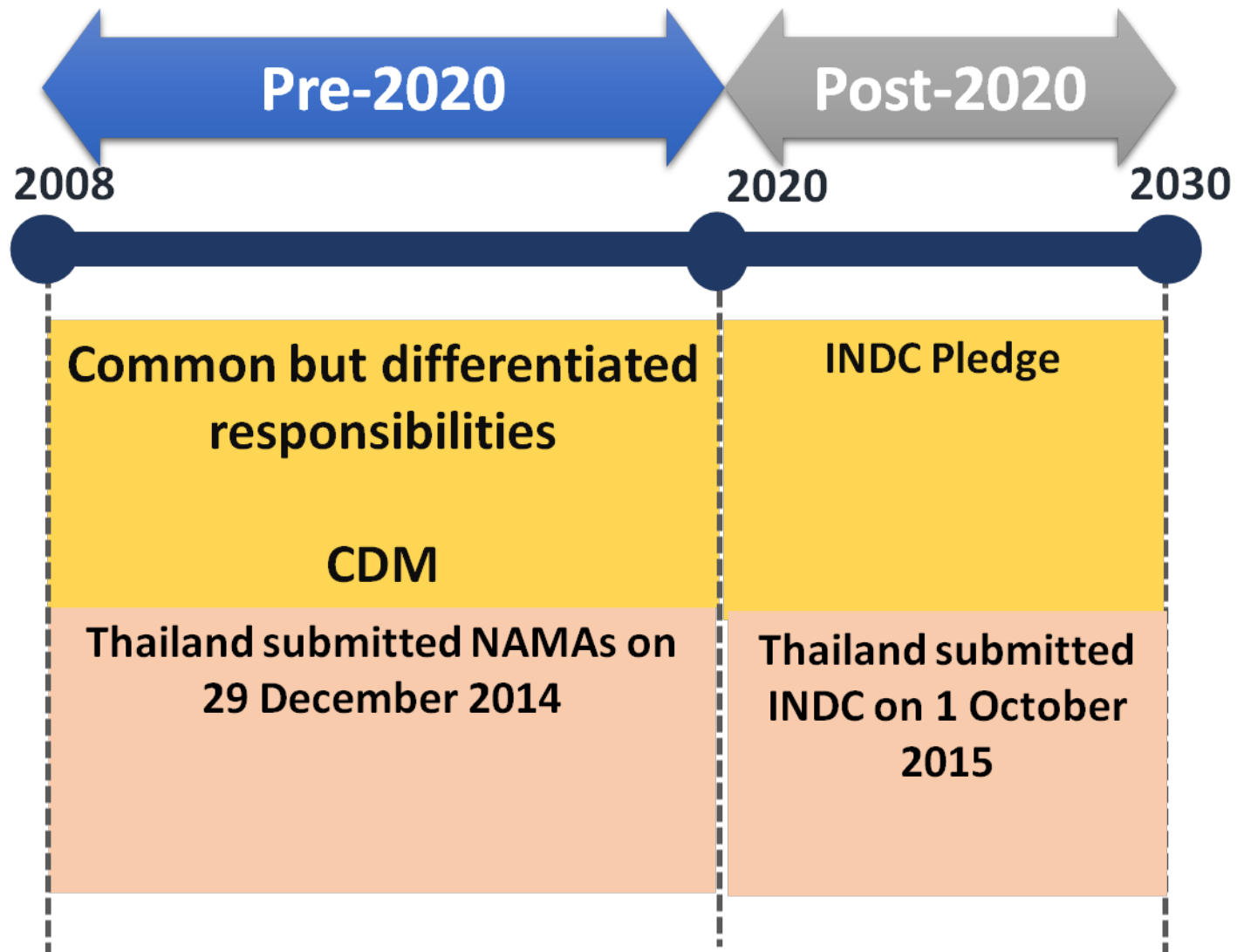
Vision

“Thailand can achieve adaptation to climate change and will be a low carbon society in sustainable approach”

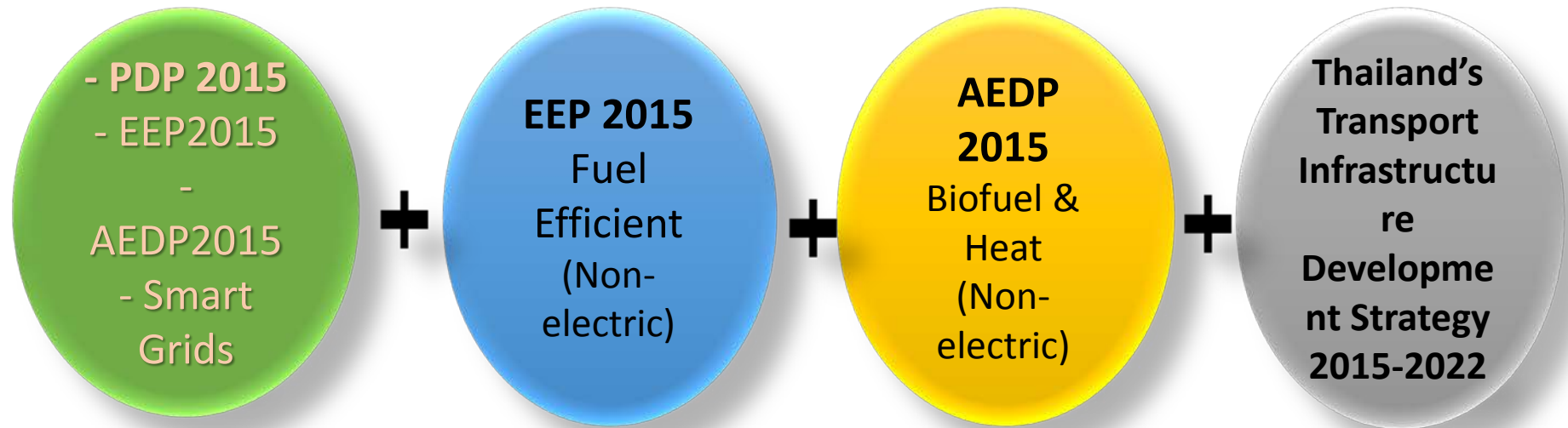


**Approved by Cabinet on
14 July 2015**

Thailand CO₂ emission targets



Innovation of Thailand's INDC – 2030 Mitigation Potential



Thailand Power Development Plan 2015-2036 (PDP2015)

- 3.94% of the average GDP growth rate (2014-2036), was estimated by NESDB
- **0.03% of the average population growth**
- 89,672 GWh was saved by EEDP in 2036
- 19,634 MW was set for the renewable energy development target by AEDP in 2036
- The power demand from BTS sky train, MRT train, and 10 mass rapid transit projects in Bangkok was included except those of the unclear high speed train projects.
- **Thailand smart grid master plan was included supporting the renewable energy sites**

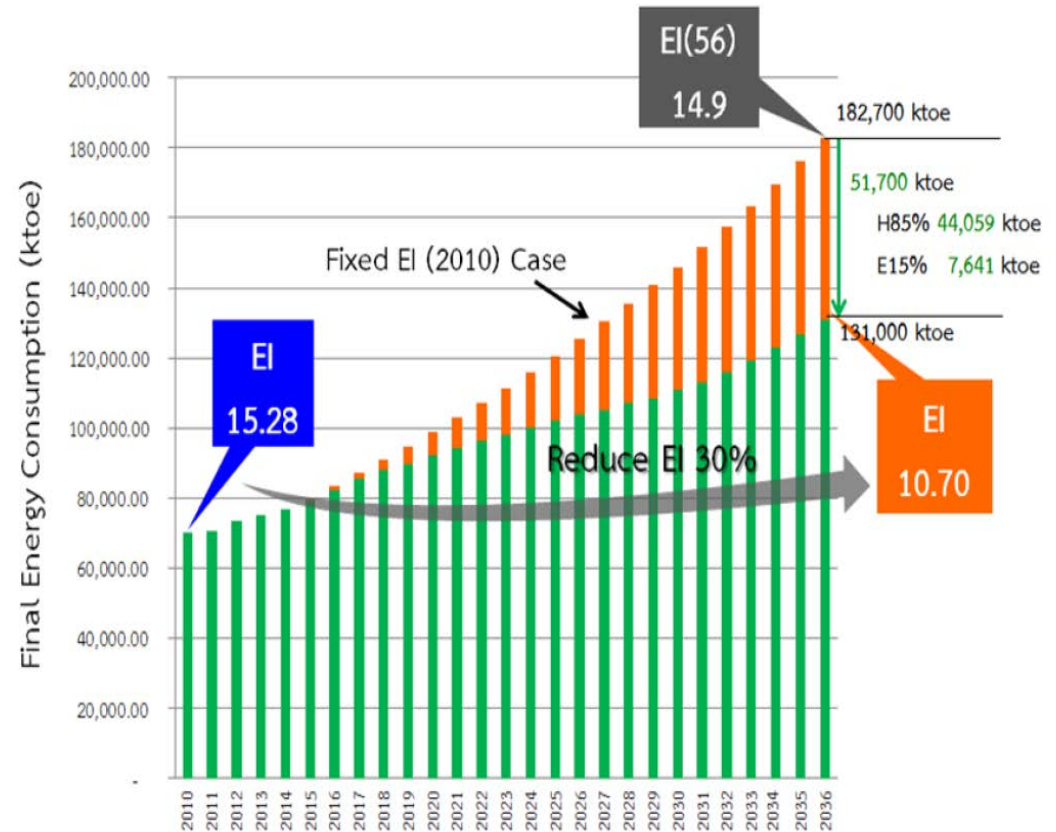
The Estimated Fuel Requirement for The PDP2015

| Fuel types | 2014 | 2026 | | 2036 | |
|-------------------------------------|------|-------------------------|-------|-------------------------|-------|
| | (%) | Installed capacity (MW) | (%) | Installed capacity (MW) | (%) |
| Import | 7 | 6,421 | 10-15 | 12,347 | 15-20 |
| Clean Coal & Lignite | 20 | 6,480 | 20-25 | 8,133 | 20-25 |
| Renewable Energy (include Hydro) | 8 | 15,654 | 10-20 | 20,279 | 15-20 |
| Natural Gas | 64 | 33,362 | 45-50 | 26,298 | 30-40 |
| Nuclear | - | | - | 2,000 | 0-5 |
| Diesel and Fuel oil | 1 | 342 | - | 1,277 | - |
| Total | | 62,260 | | 70,335 | |

Source: Thailand Power Development Plan 2015 (English Version)

Energy Efficiency Plan: EEP2015

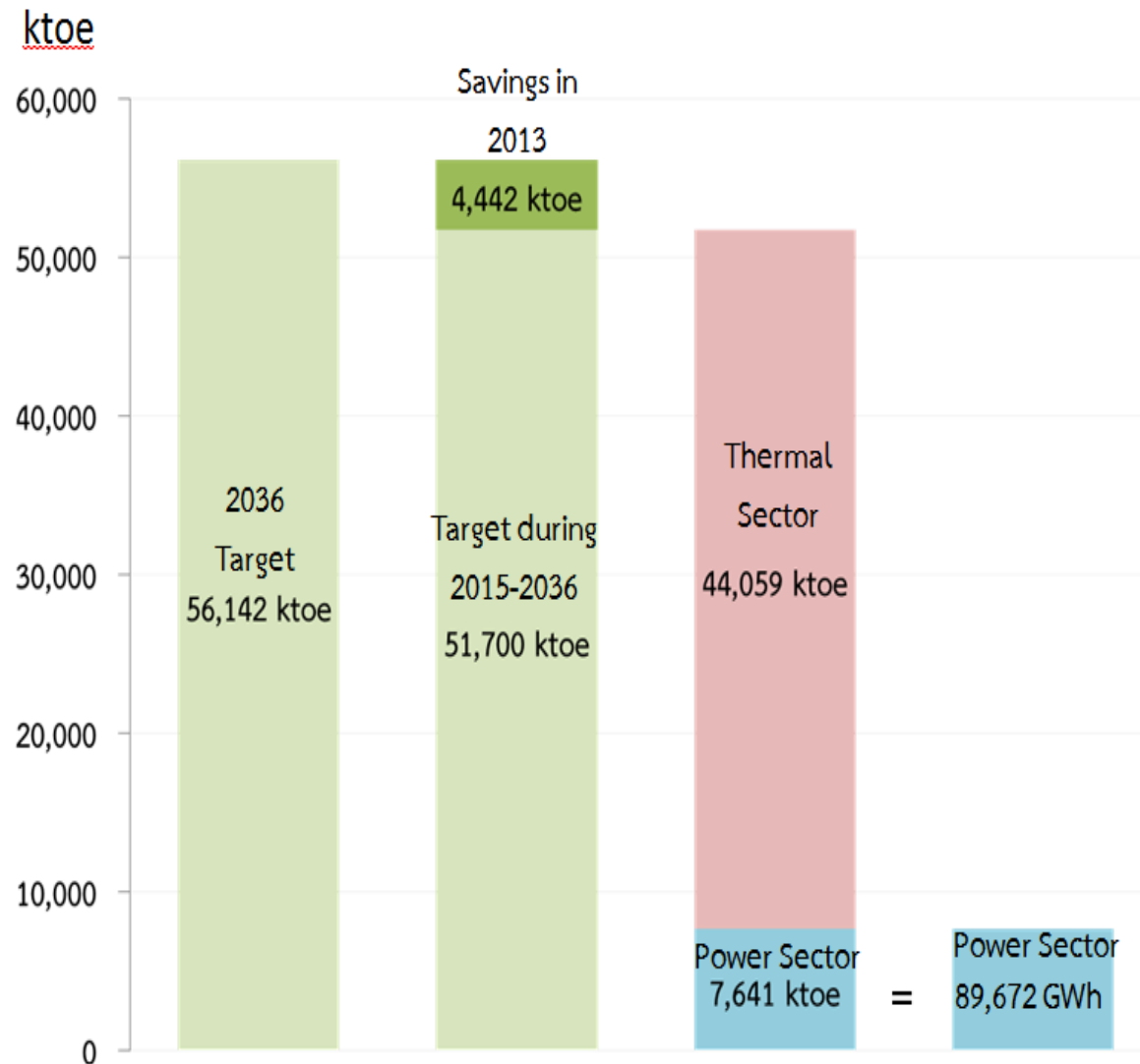
- PDP2015 already included the electricity demand from EEP
- 30% energy intensity reduction in 2030 compared to 2010



Final Energy Consumption Target by EEP

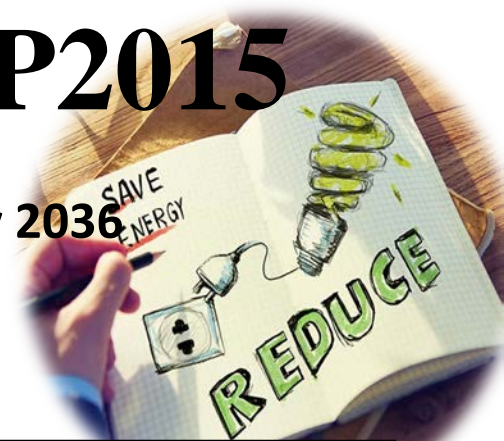


Targets in EEP2015



Electricity Savings in EEP2015

- 89,672 GWh of electricity consumption can be saved by 2036



| SECTOR | Electricity Reduction Target (GWh) | | | | |
|-----------------------------|------------------------------------|---------------|---------------|---------------|---------------|
| | 2016 | 2021 | 2026 | 2031 | 2036 |
| Industry | 2,174 | 9,420 | 17,497 | 22,845 | 31,843 |
| Commercial | 853 | 5,156 | 12,687 | 22,406 | 37,052 |
| Residential and agriculture | 395 | 1,914 | 4,877 | 8,760 | 13,633 |
| Government buildings | 302 | 1,713 | 2,960 | 4,683 | 7,144 |
| Total | 3,724 | 18,203 | 28,021 | 58,694 | 89,672 |

Alternative Energy Development Plan: AEDP2015

| Fuel type | 2014 (MW) | 2036 (MW) |
|--|-----------------|------------------|
| 1 Municipal Solid Waste | 65.72 | 500.00 |
| 2 Industrial Waste | - | 50.00 |
| 3 Biomass | 2,451.82 | 5,570.00 |
| 4 Biogas (Waste Water/Waste) | 311.50 | 600.00 |
| 5 Small Hydro | 142.01 | 376.00 |
| 6 Biogas (Energy Crops) | - | 680.00 |
| 7 Wind | 224.47 | 3,002.00 |
| 8 Solar | 1,298.51 | 6,000.00 |
| 9 Large hydro | - | 2,906.40 |
| Total Installed Capacity (MW) | 4,494.03 | 19,684.40 |
| Total Electricity Generation (GWh) | 17,217 | 65,588.07 |
| Total Electricity Demand (GWh) | 174,467 | 326,119.00 |
| ¹² Generated Electricity Ratio by RE (%) | 9.87 | 20.11 |

Alternative Energy Development Plan: AEDP2015

| Fuel type | 2014 (MW) | 2036 (MW) |
|---------------------------------------|-----------------|------------------|
| 1 Municipal Solid Waste | 98.10 | 495.00 |
| 2 Biomass | 5,144.00 | 22,100.00 |
| 3 Biogas | 528.00 | 1,283.00 |
| 4 Solar | 5.10 | 1,200.00 |
| 5 Other Heating* | - | 10.00 |
| Total | 5,775.20 | 25,088.00 |
| Total Heating Demand | 33,419.54 | 68,413.40 |
| Generated Heat Ratio by RE (%) | 17.28 | 36.67 |

* Remark: Including Geothermal and oil from tires

Alternative Energy Development Plan: AEDP2015

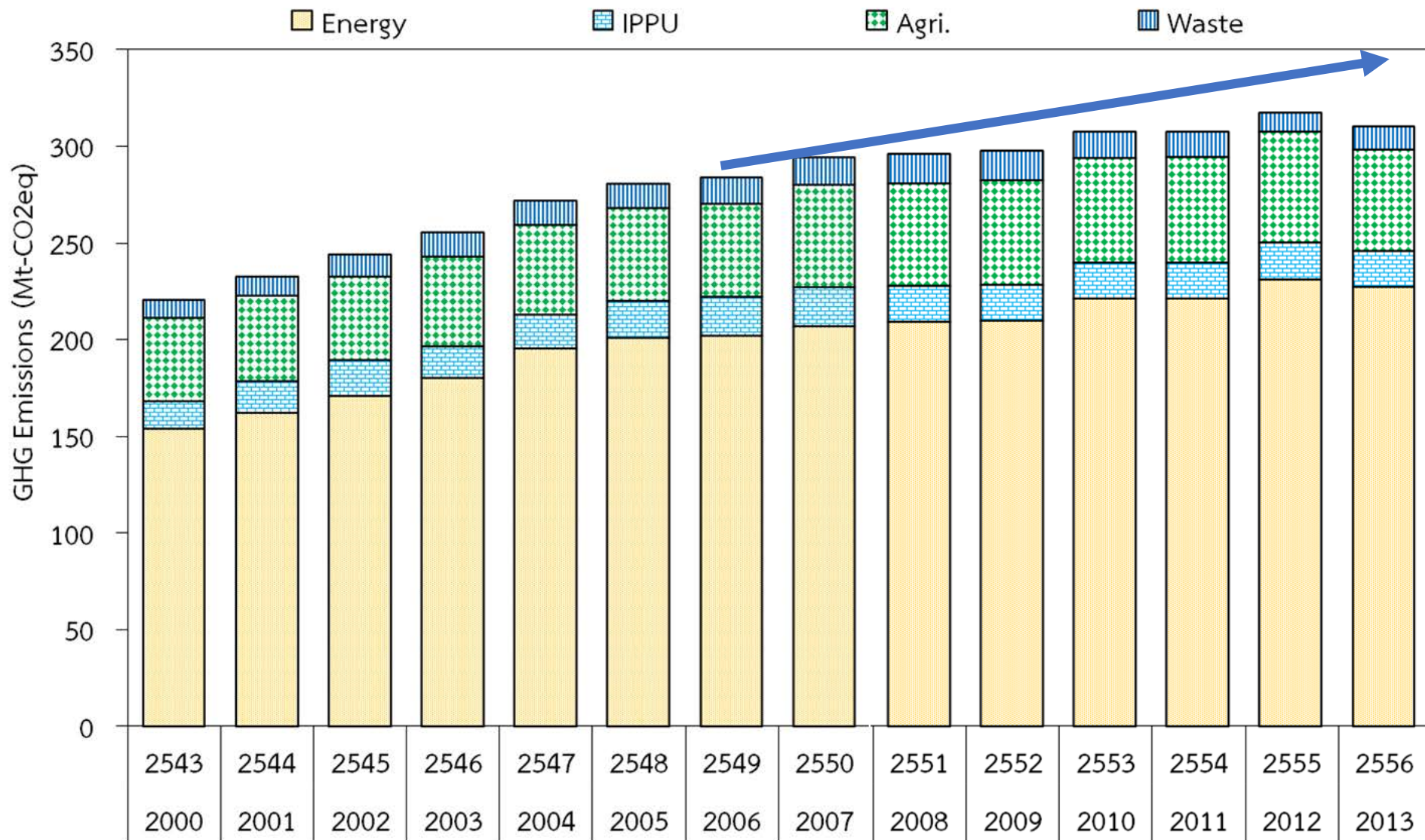
| Fuel type | 2014 | | 2036 | |
|---|--------|-----------------|----------|-----------------|
| | ML/day | ktoe | ML/day | ktoe |
| 1. Biodiesel | 2.89 | 909.28 | 14.00 | 4,404.82 |
| 2. Ethanol | 3.21 | 872.88 | 11.30 | 2,103.50 |
| 3. Pyrolysis | - | - | 0.53 | 170.87 |
| 4. Compressed Biogas (ton/day) | - | - | 4,800.00 | 2,023.24 |
| 5. Other Renewable Energy | - | - | - | 10.00 |
| Total (ktoe) | | 1,782.16 | | 8,712.43 |
| Total Bio-fuel in Transport Sector | | 26,801.00 | | 34,798.00 |
| Bio-fuel Ratio in Transport Sector | | 6.65 | | 25.04 |

PM applauds 2030 Agenda, pledges word towards a sustainable Thailand including INDC 2030, UN NY, 30 Sept 2015



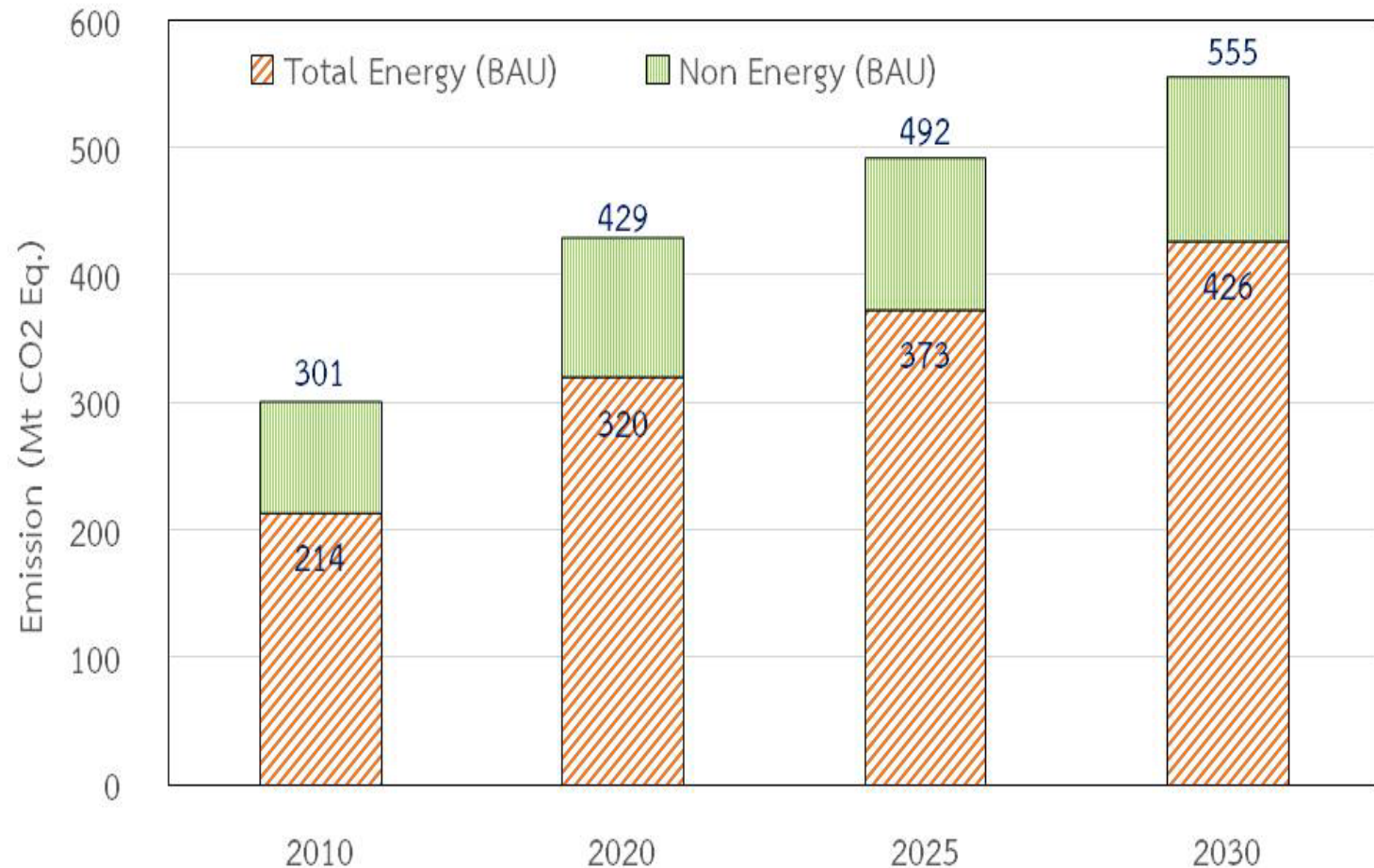
“... On Thailand’s part, we reaffirm our Commitment under the **Intended Nationally Determined Contributions (INDCs)** to reduce our GHG emissions **between 20 and 25% by 2030**”...

Thailand's GHG inventory by sector (BUR1)

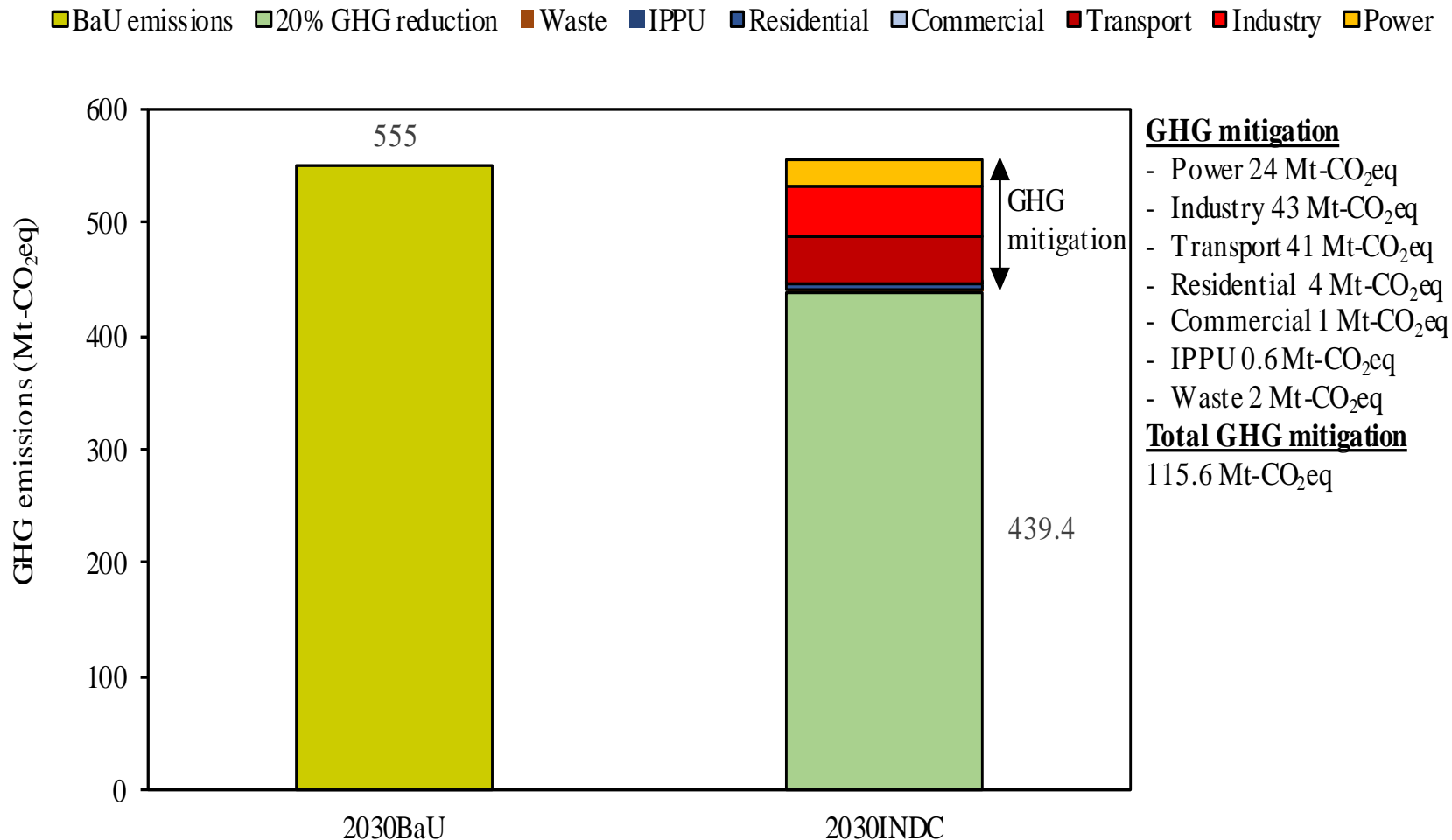


Thailand's INDC

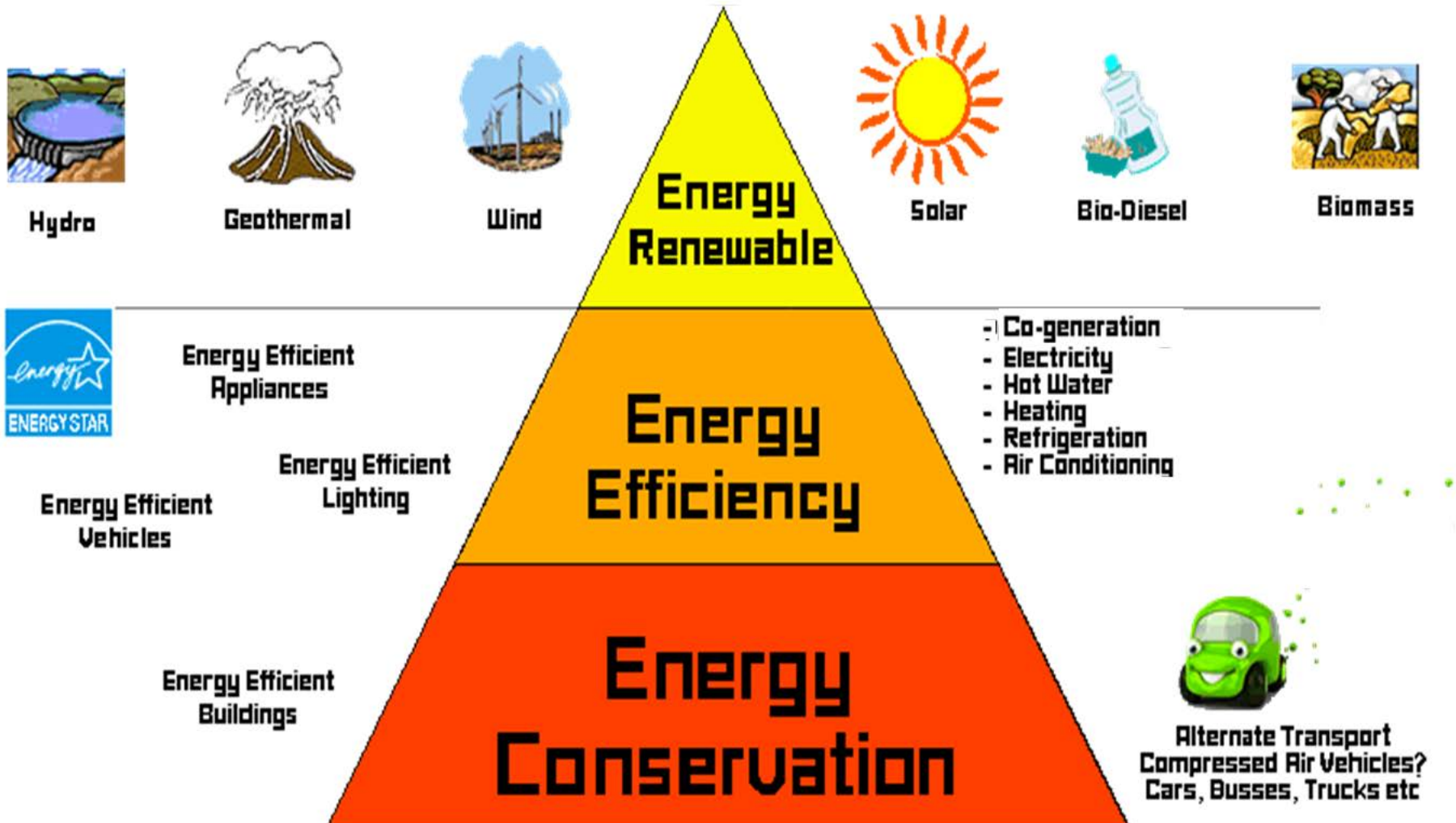
Economy-wide GHG Emissions in 2030



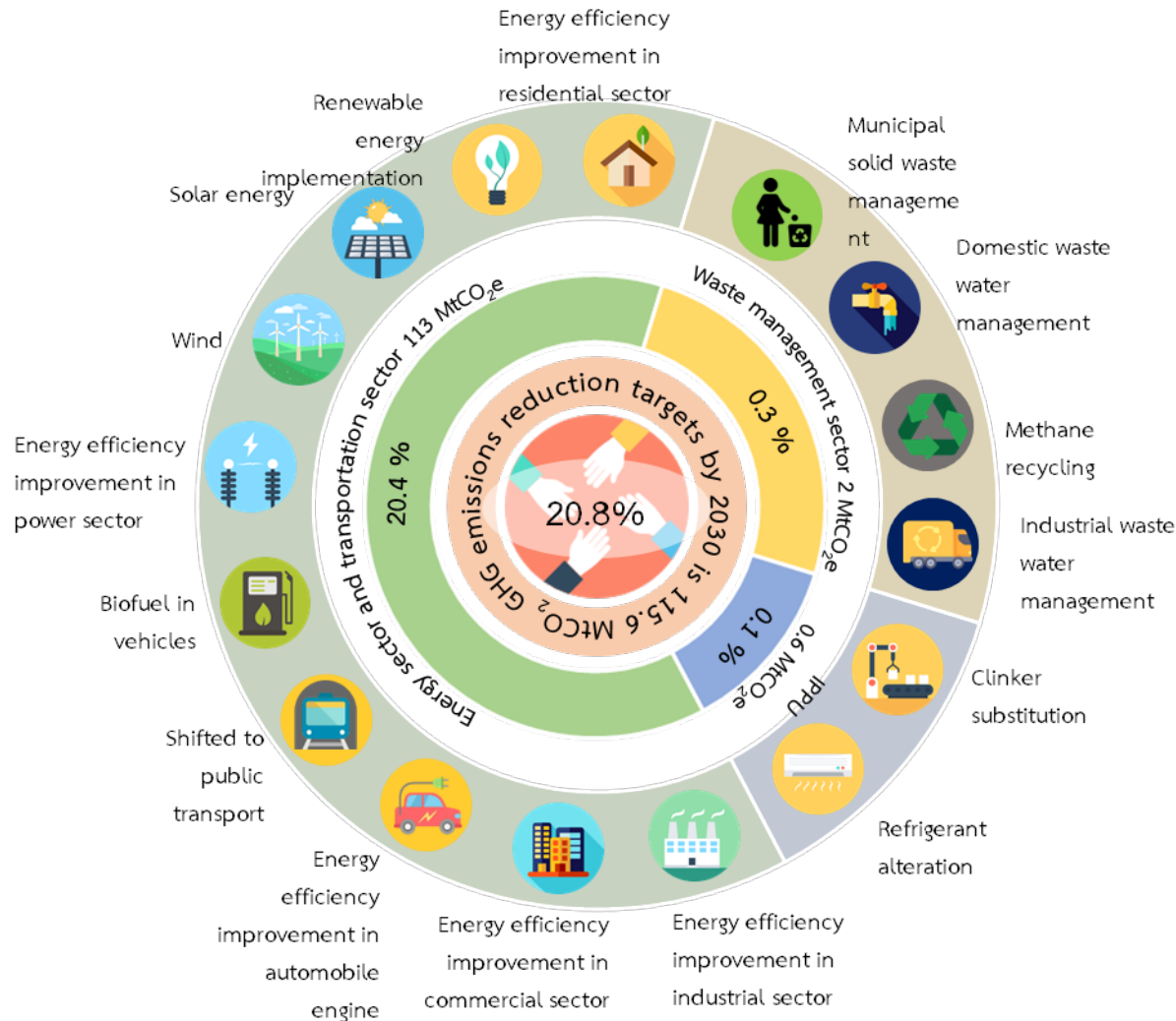
GHG reduction target in NDC Roadmap



Revolution of Efficient use of energy in Thailand



Thailand's NDC Roadmap 2030



Integrated Plans

- AEDP2015-2036
- EEP2015-2036
- PDP2015-2036
- Smart Grid (2015-2026)
- Transport Infrastructure Development Plan 2030
- Green Industry 2021
- Waste MP 2016-2021
- Invir Quality Improvement Plan 2017-2021
- RAC NAMA



CMs in Energy sector and Transport Sector

Unit: Mt-CO₂e

| Measure | 2020 | 2025 | 2030 | |
|--|--------------|--------------|---------------|------|
| Electricity generation sector | 14.62 | 20.71 | 24.00 | 4.3% |
| 1. Energy efficiency improvement | 2.87 | 5.84 | 6.00 | |
| 2. Implementation and deployment of renewable energy (e.g. biomass, ground-mounted solar farm, wind, MSW, hydropower) | 11.75 | 14.87 | 18.00 | |
| Residential sector | 1.63 | 2.82 | 4.00 | 0.7% |
| 3. Energy efficiency improvement (e.g. lighting and cooling system etc.) | 1.19 | 2.06 | 2.79 | |
| 4. Renewable energy and alternative energy deployment | 0.44 | 0.76 | 1.21 | |
| Commercial sector | 0.19 | 0.56 | 1.00 | 0.2% |
| 5. Energy efficiency improvement (e.g. heating system and cooling system etc.) | 0.19 | 0.56 | 1.00 | |
| Manufacturing industrial sector | 13.82 | 27.92 | 43.00 | 7.4% |
| 6. Energy efficiency improvement (e.g. heating system, cooling system etc.) | 2.38 | 8.27 | 11.00 | |
| 7. Renewable energy and alternative energy deployment (e.g. solar rooftop) | 11.45 | 19.65 | 32.00 | |
| Transport sector | 9.37 | 23.83 | 41.00 | 7.8% |
| 8. Energy efficiency improvement (e.g. engines efficiency improvement) | 7.08 | 18.02 | 31.00 | |
| 9. Biofuel used in vehicles | 2.28 | 5.81 | 10.00 | |
| 20.4% Total | 39.63 | 75.83 | 113.00 | |



CMs in Waste sector

Unit: Mt-CO₂e

| Measure | 2020 | 2025 | 2030 | |
|---|-------------|-------------|-------------|-------|
| Municipal Solid Waste (MSW) management | 0.36 | 0.79 | 1.30 | 0.2 % |
| 10. MSW reduction | | | | |
| Waste water management | 0.20 | 0.43 | 0.70 | 0.1 % |
| 11. Collect methane gas from industrial waste water to increase biogas capacity | | | | |
| 12. Other Industrial waste water management | | | | |
| 13. Domestic waste water management | | | | |
| 0.3% Total | 0.56 | 1.22 | 2.00 | |



CMs in Industrial Processes and Product Use (IPPU)

Unit: Mt-CO₂e

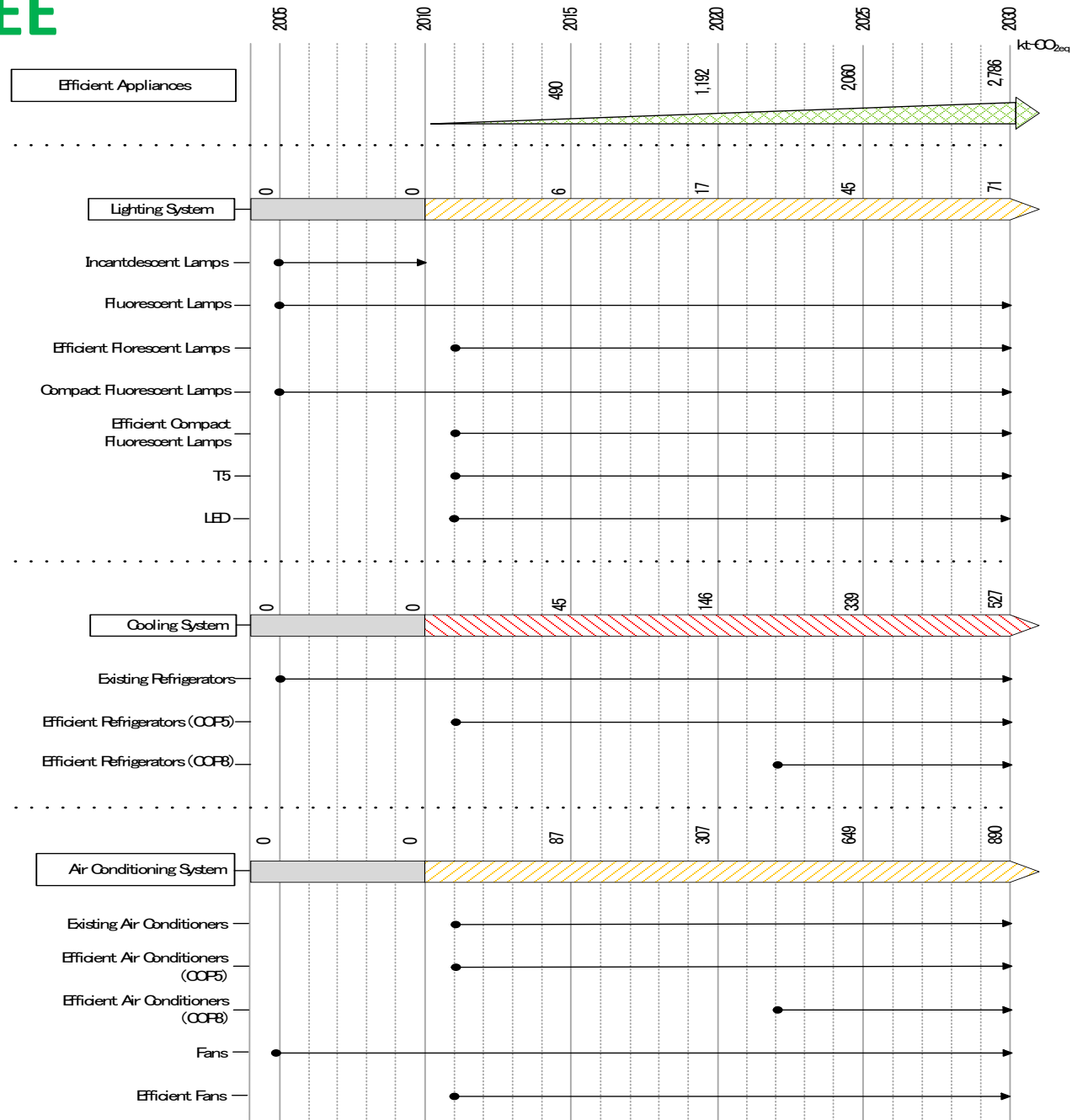
| Measure | 2020 | 2025 | 2030 |
|--|-------------|-------------|-------------|
| IPPU | 0.06 | 0.30 | 0.60 |
| 14. Clinker substitution (Clinker to cement ratio) | 0.00 | 0.15 | 0.30 |
| 15. Refrigerant substitution/alteration | 0.06 | 0.15 | 0.30 |
| 0.1% Total | 0.06 | 0.15 | 0.30 |

0.1%

EE

NDC Roadmap in Households

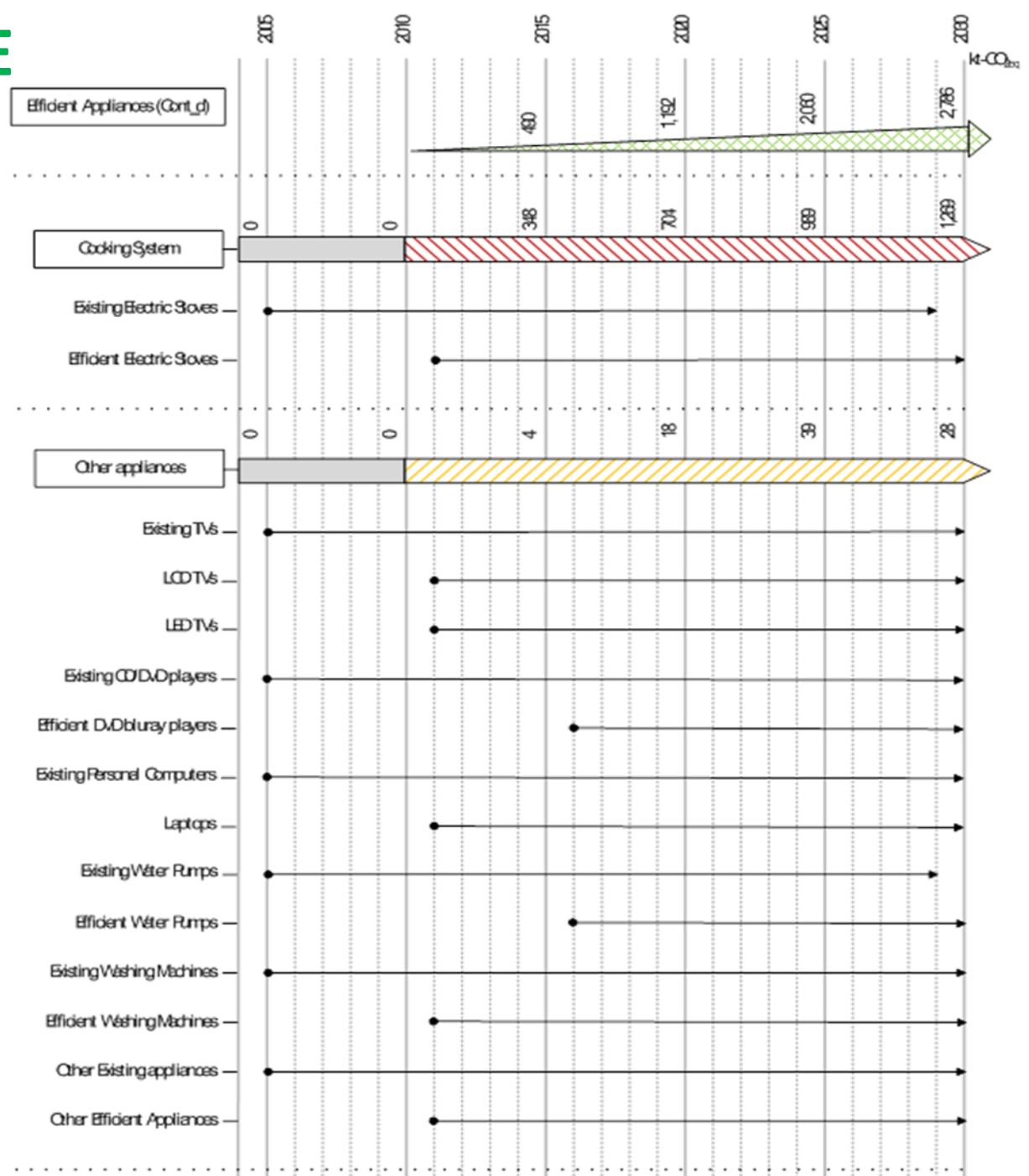
Energy Efficiency Measures



EE

NDC Roadmap in Households

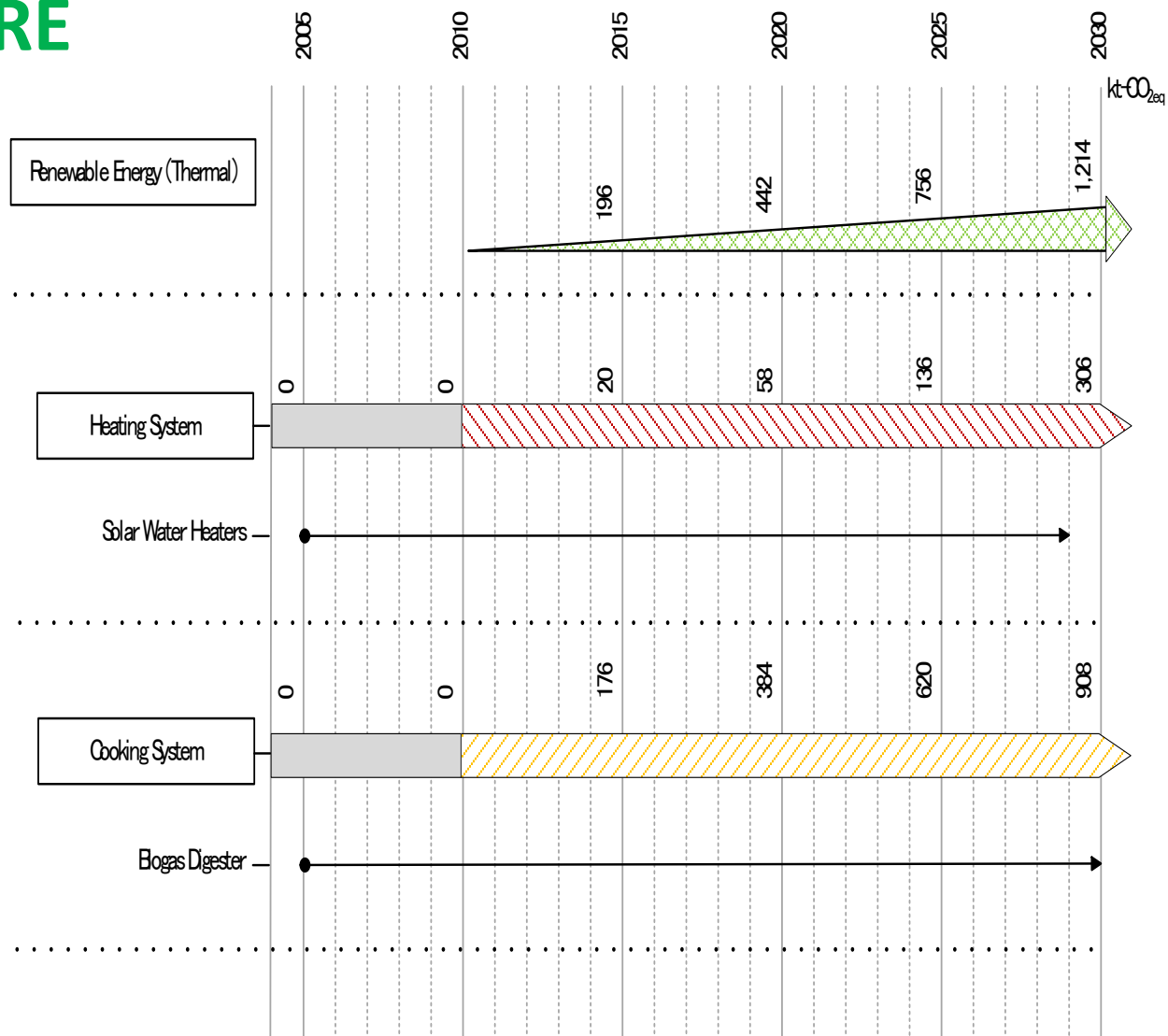
Energy Efficiency Measures (cont'd)



NDC Roadmap in Households

Renewable Energy

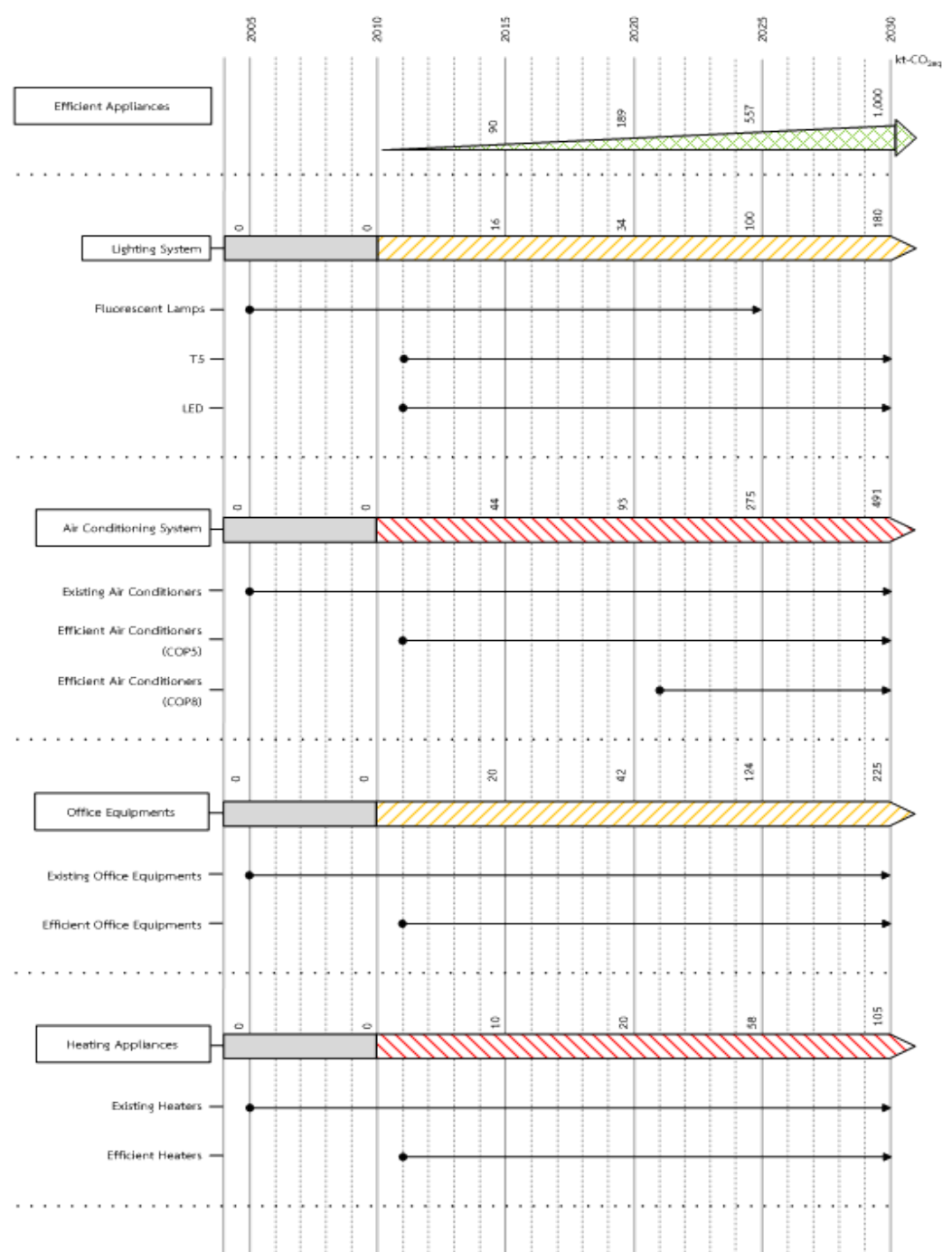
RE



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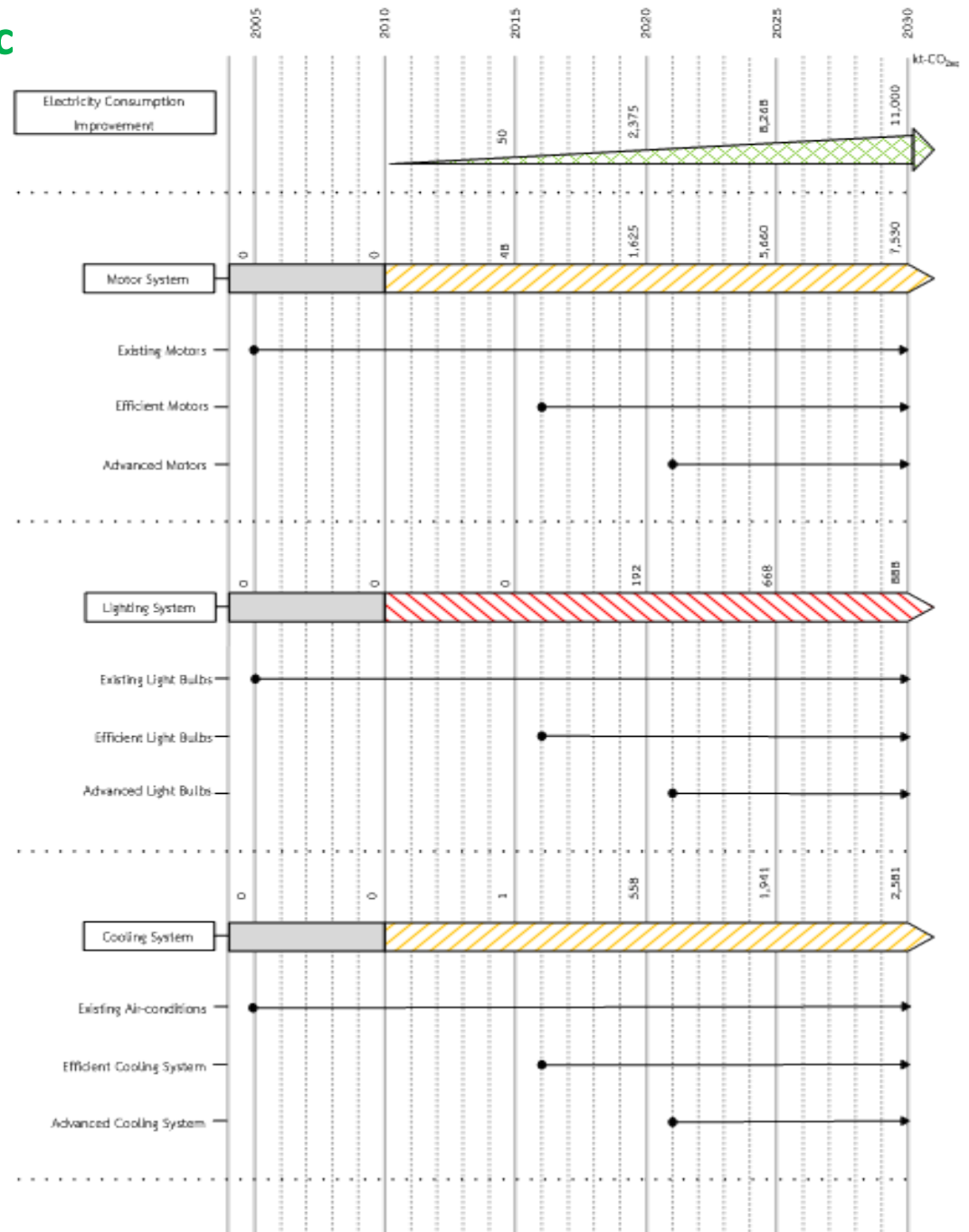
NDC Roadmap in Buildings

Energy Efficiency Measures



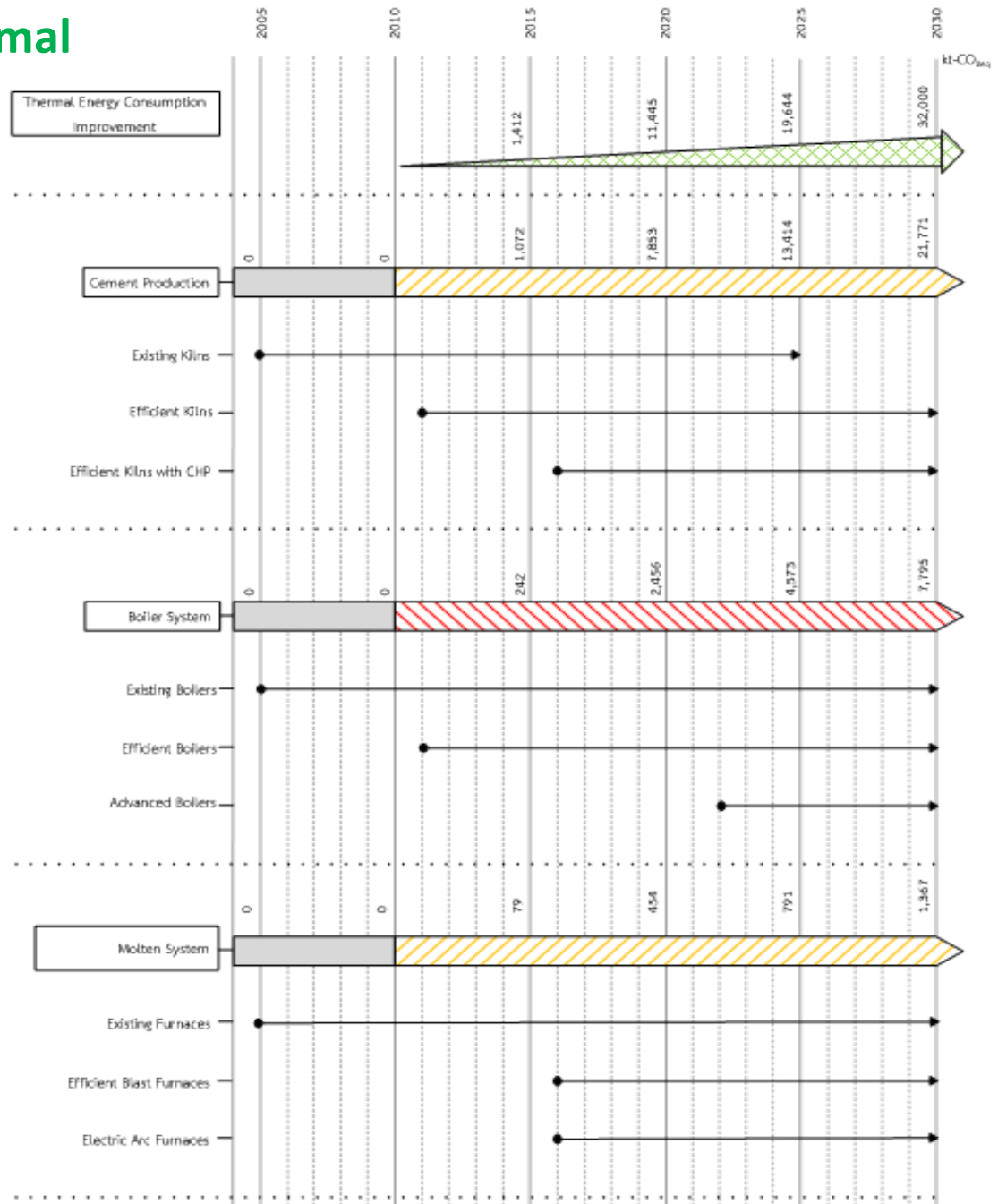
NDC Roadmap in Industries

Electricity Efficiency Measures



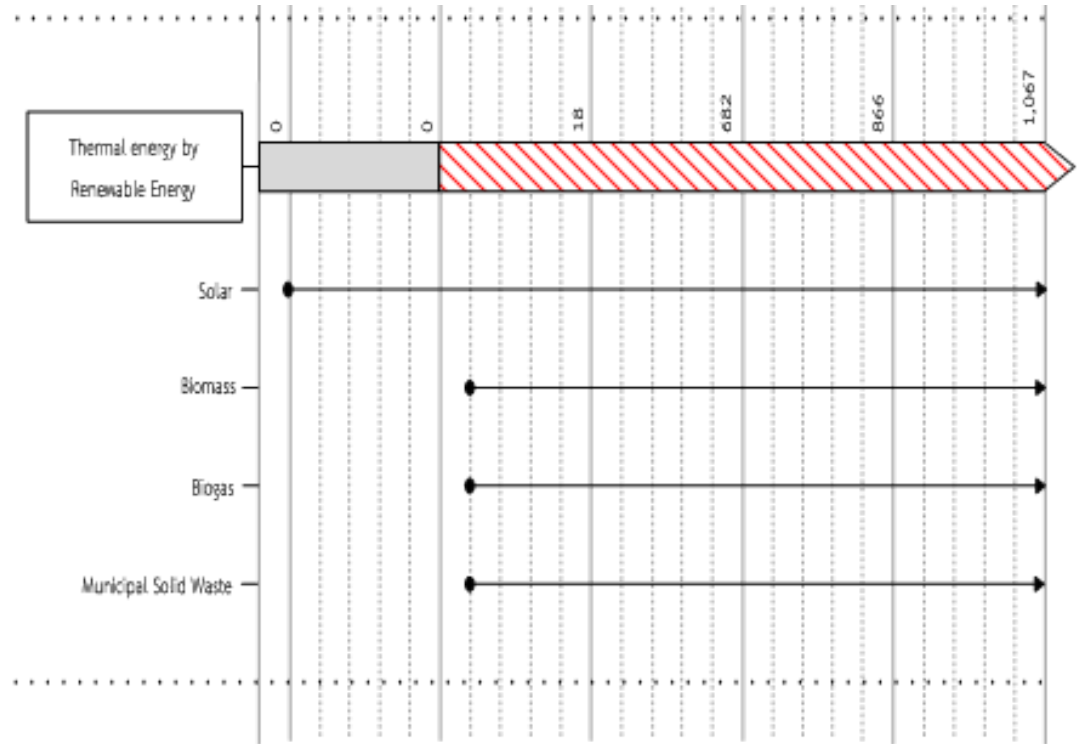
NDC Roadmap in Industries

Thermal energy Efficiency Measures



NDC Roadmap in Industries

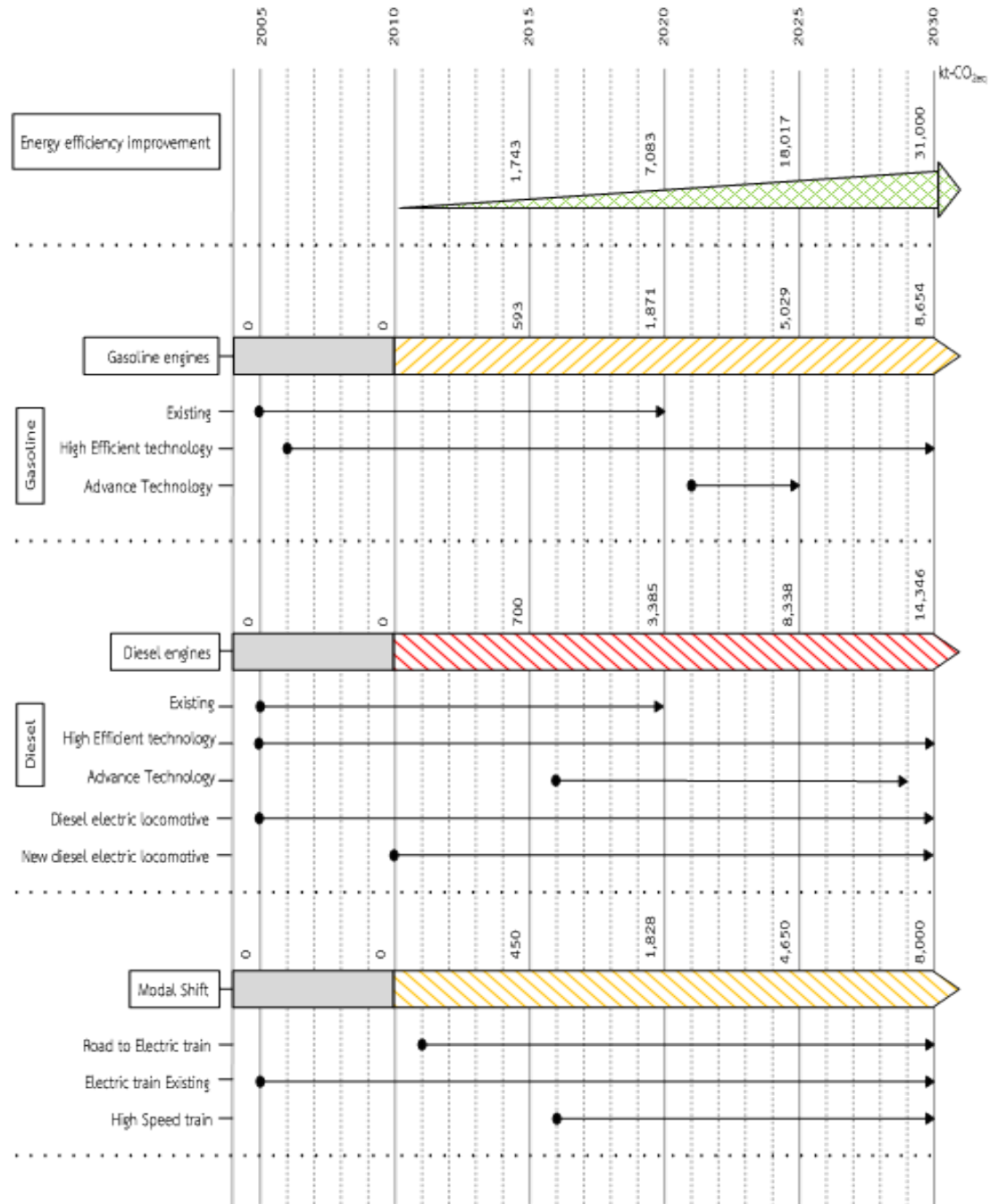
Renewable energy (Thermal) Measures



EE

NDC Roadmap in Transport

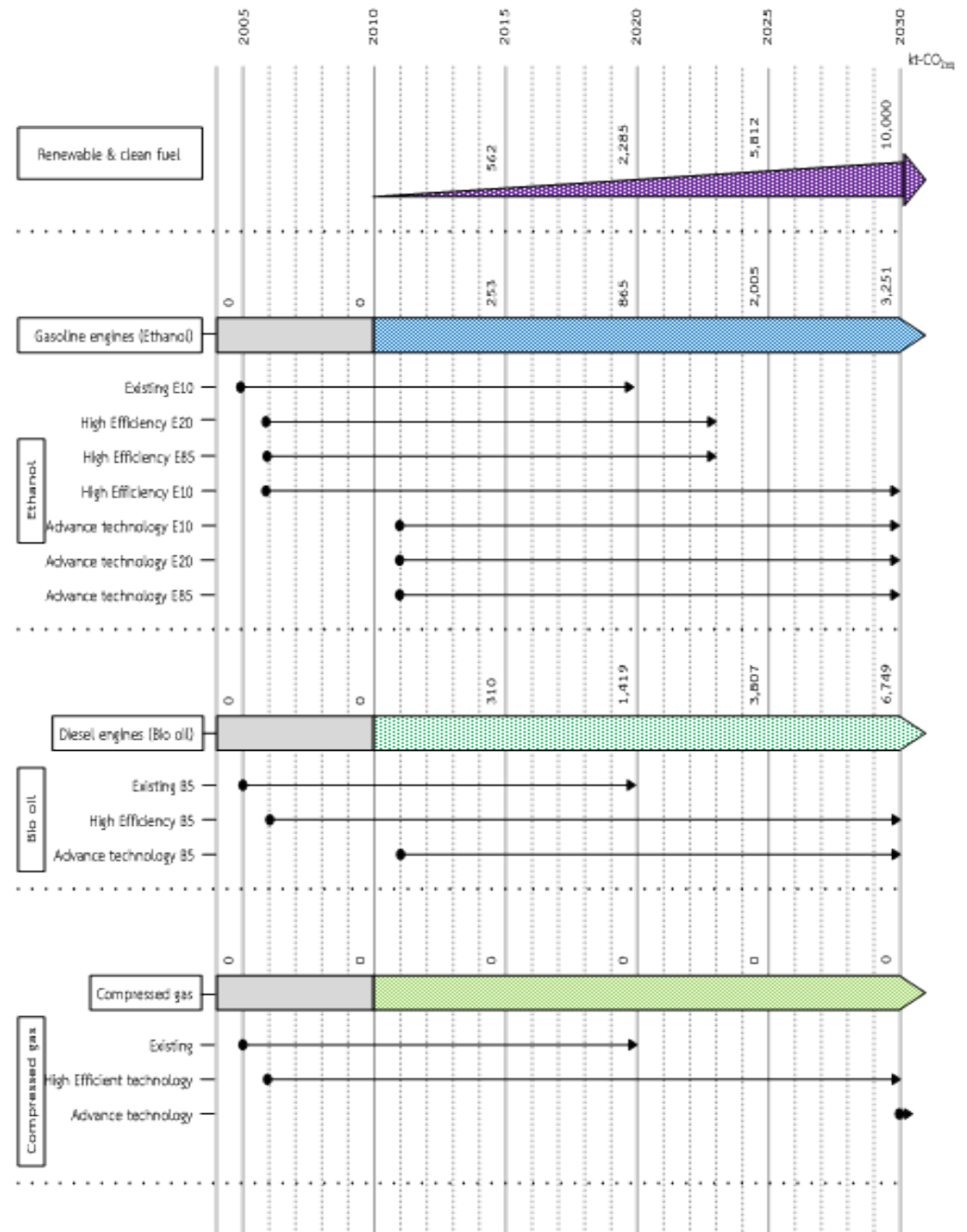
Energy Efficiency Measures



RE

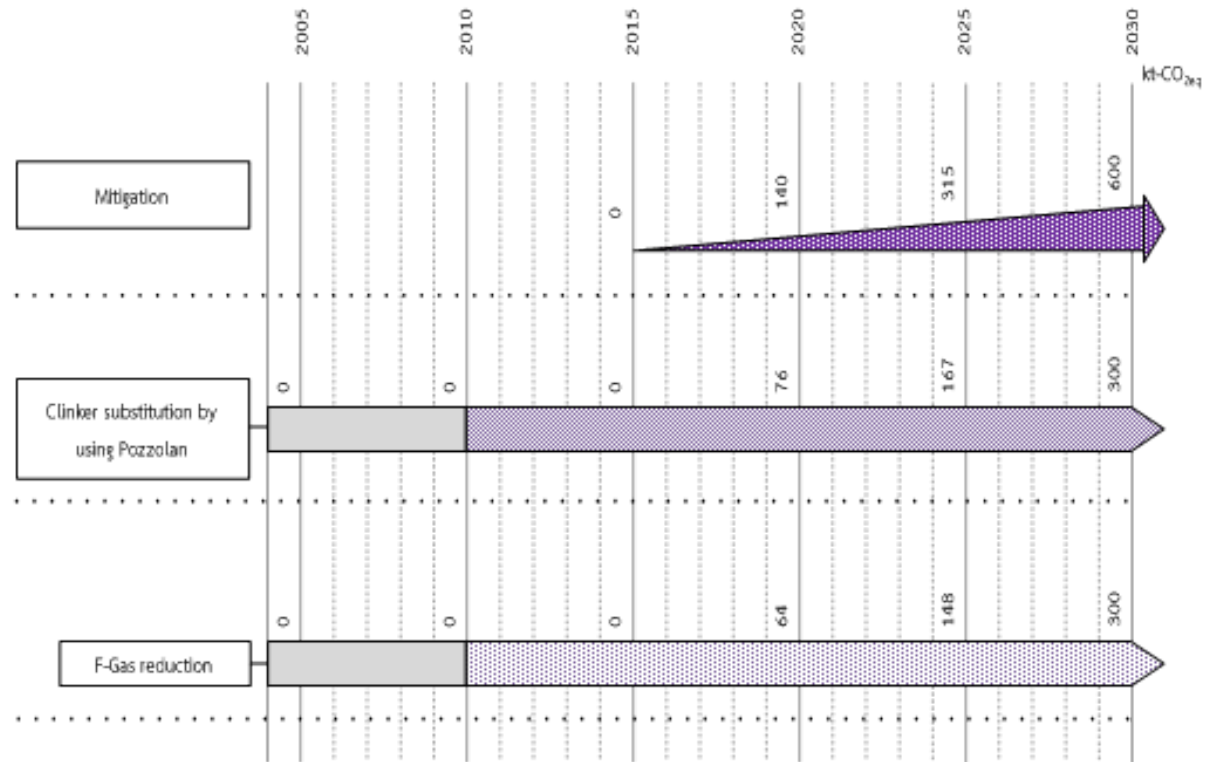
NDC Roadmap in Transport

Bio-fuel Measures



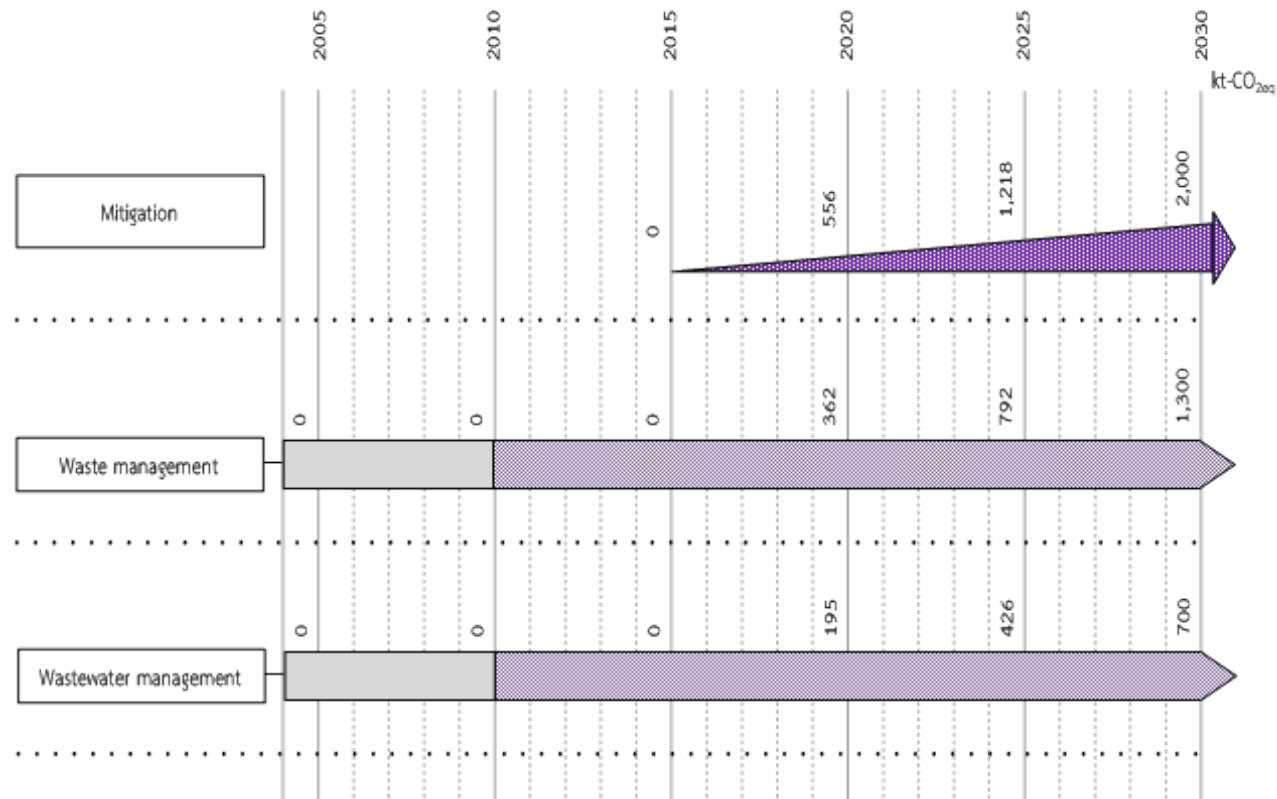
NDC Roadmap in IPPU Sector

Material Substitution Measures



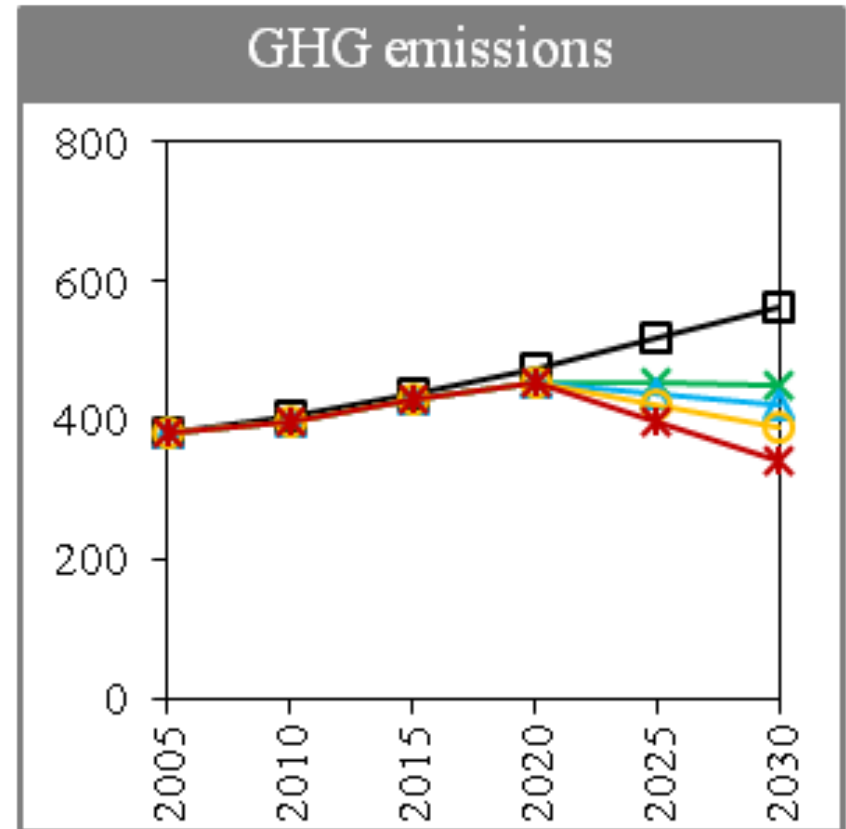
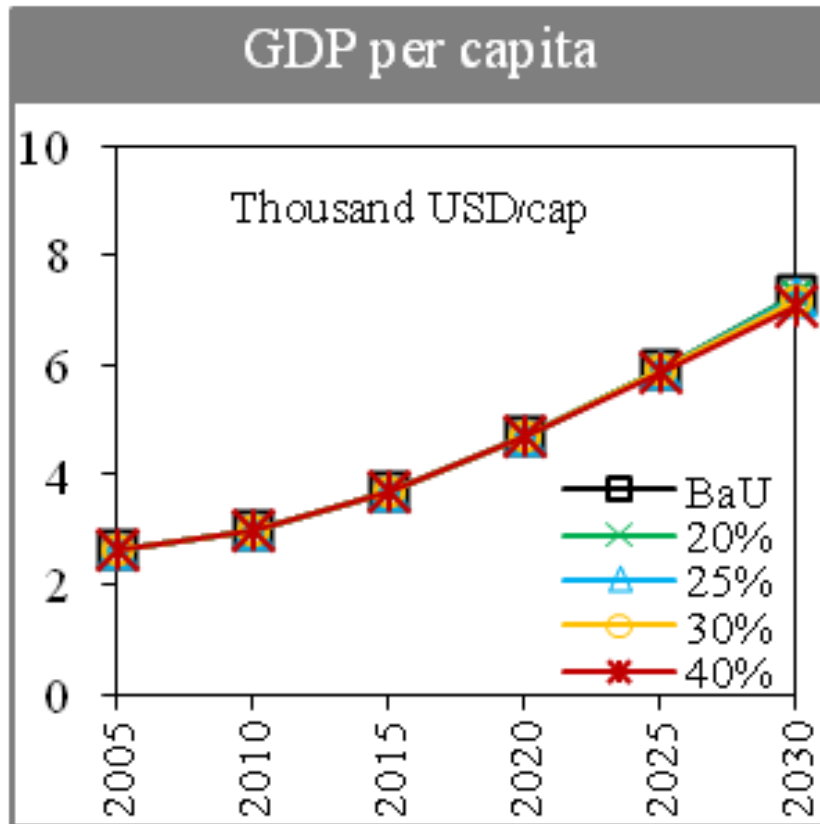
NDC Roadmap in Waste Sector

Management Measures

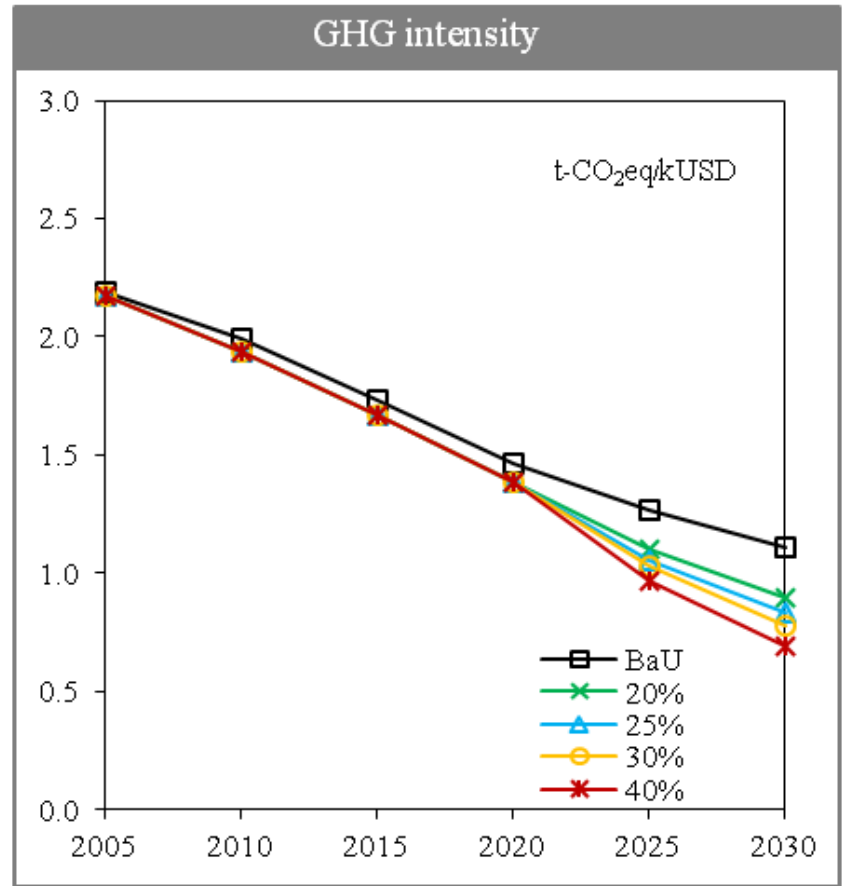
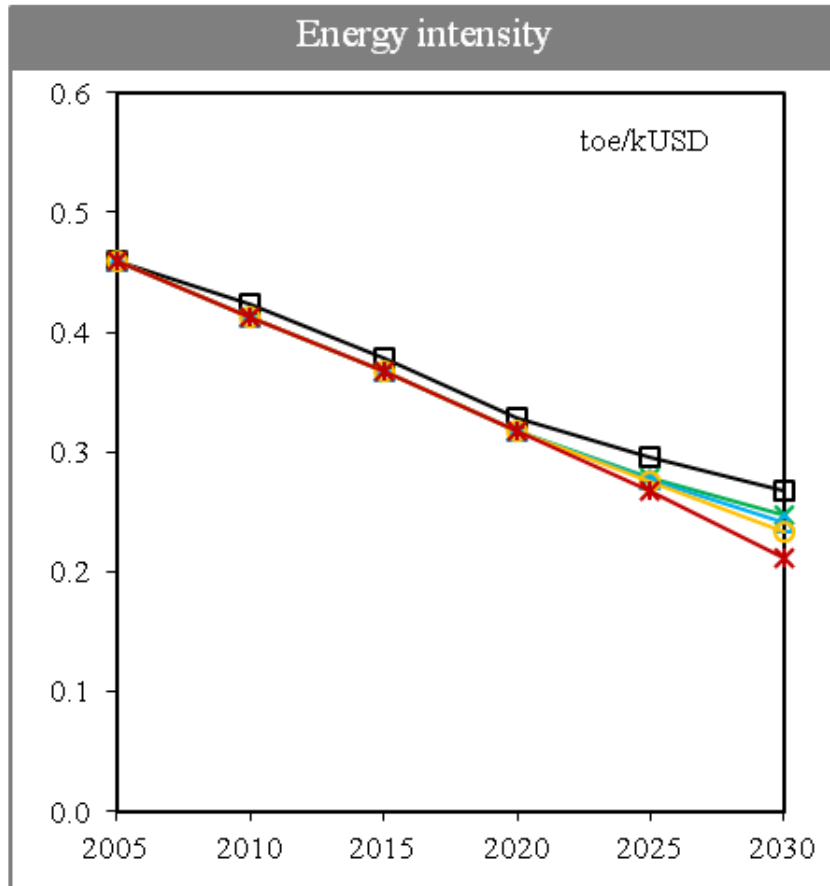


AIM/CGE Analyses:

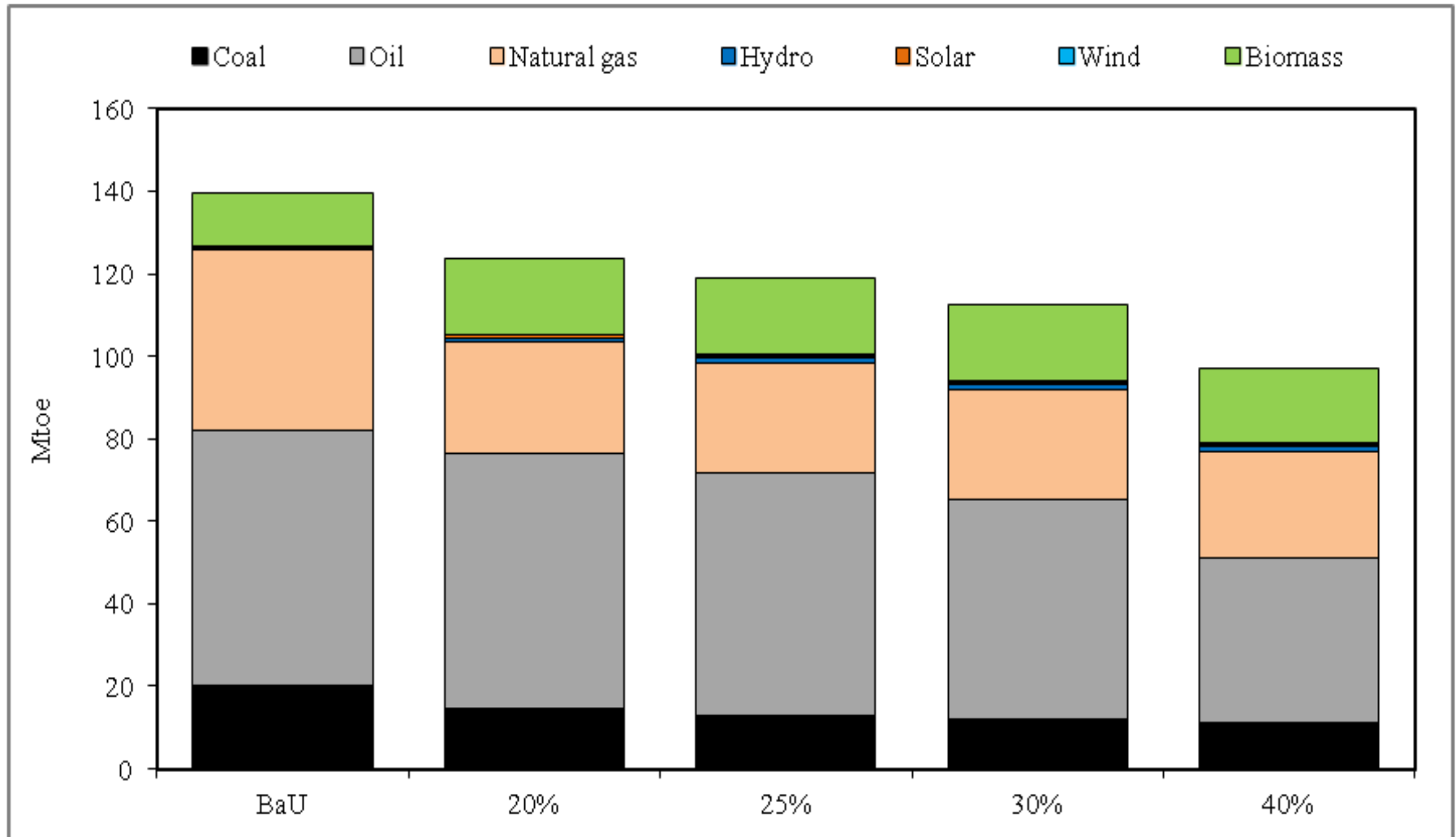
Effects of GHG mitigation targets on per capita GDP and GHG emissions



AIM/CGE Analyses: Effects of GHG mitigation targets on Energy Intensity and GHG Intensity

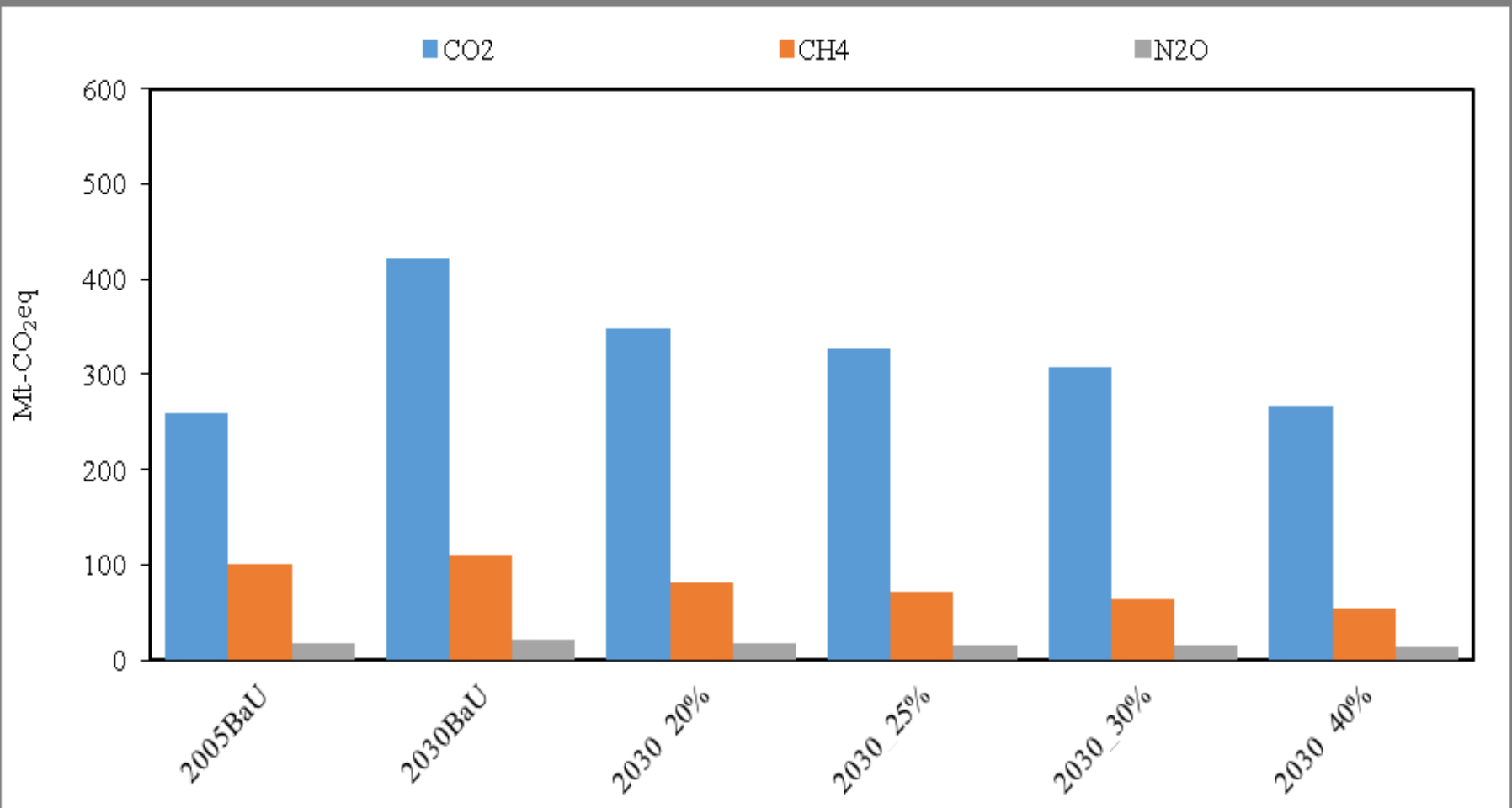


AIM/CGE Analyses: Effects of GHG mitigation targets on Energy Mix

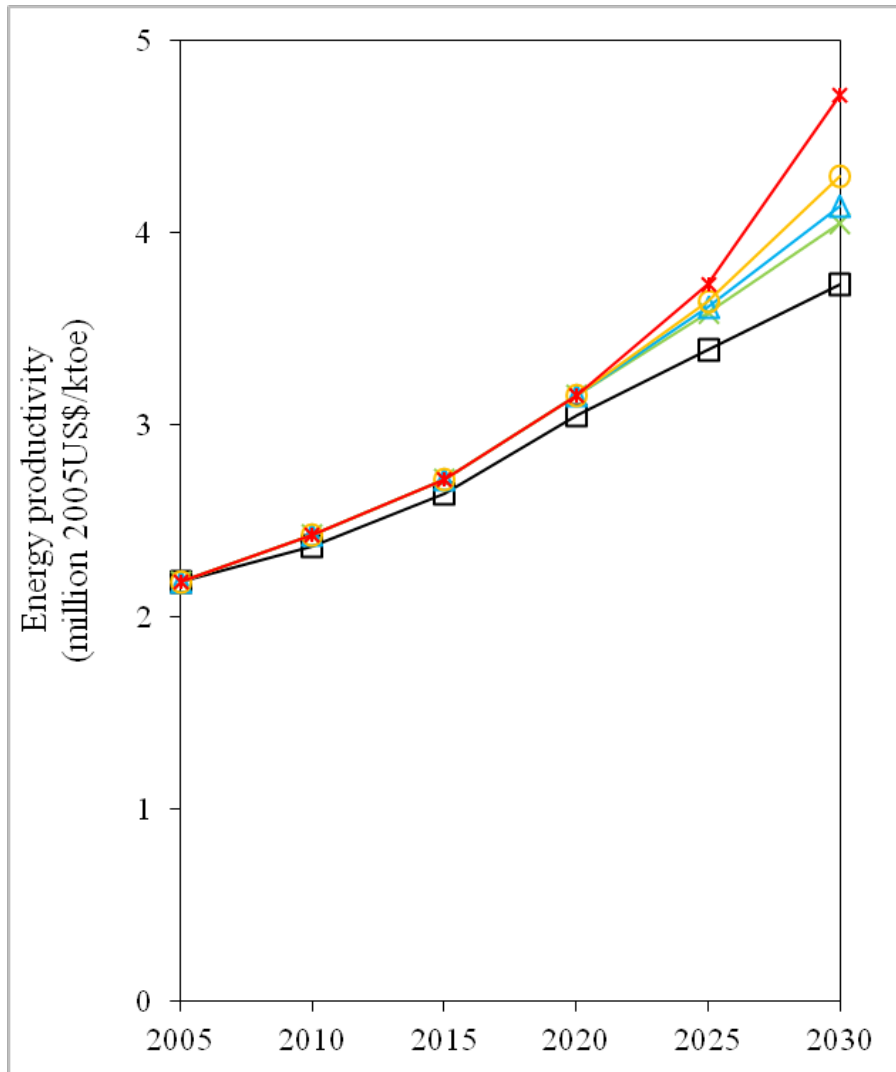


AIM/CGE Analyses: Effects of GHG mitigation targets on GHG Composition

GHG emissions composition



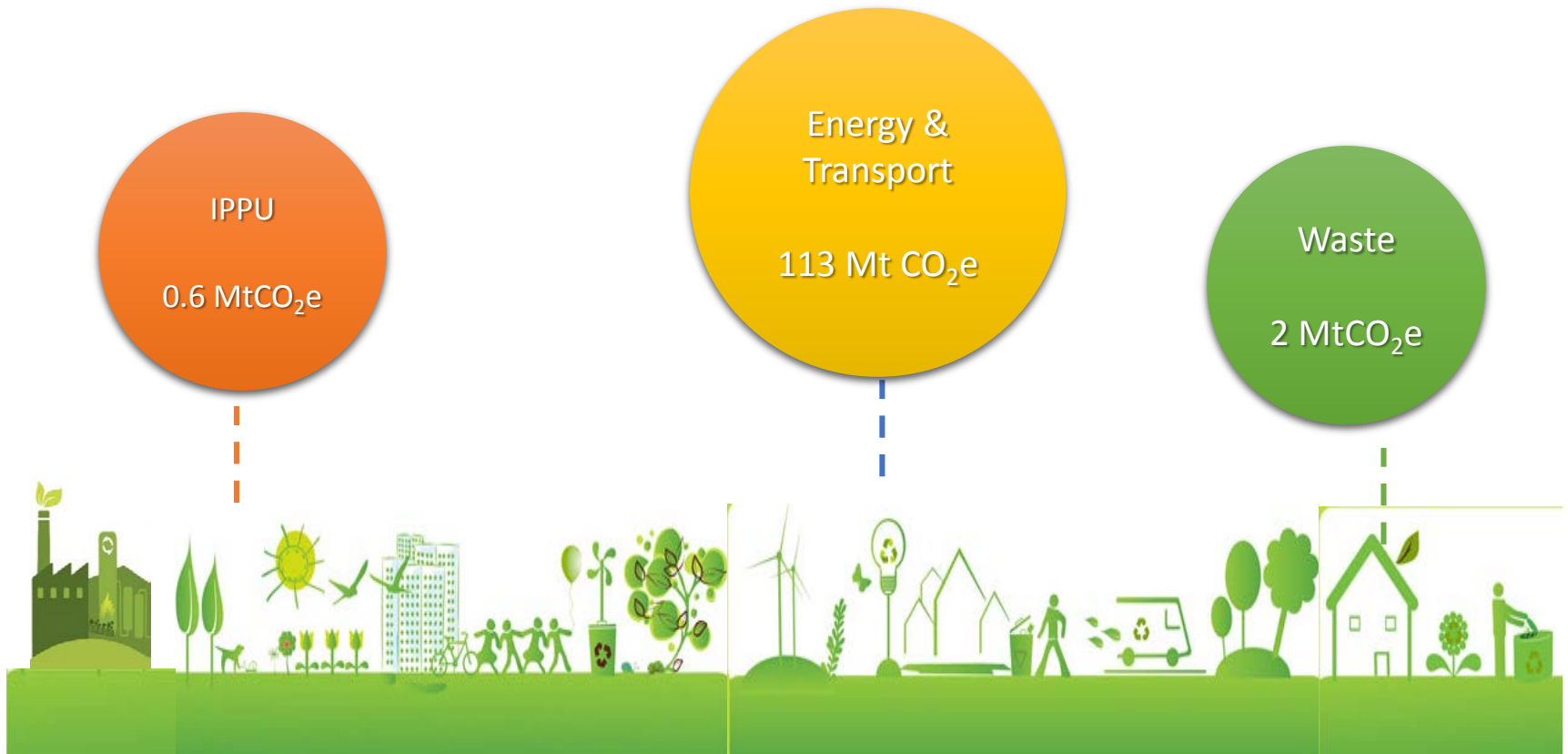
Energy Productivity (GDP/ktoe)



Unit: million 2005 US\$/ktoe

| | 2005 | 2010 | 2015 | 2020 | 2025 | 2030 |
|-----|------|------|------|------|------|------|
| BaU | 2.18 | 2.36 | 2.64 | 3.05 | 3.39 | 3.73 |
| 20% | 2.18 | 2.43 | 2.72 | 3.15 | 3.58 | 4.05 |
| 25% | 2.18 | 2.43 | 2.72 | 3.15 | 3.61 | 4.14 |
| 30% | 2.18 | 2.43 | 2.72 | 3.15 | 3.64 | 4.29 |
| 40% | 2.18 | 2.43 | 2.72 | 3.15 | 3.73 | 4.72 |

Acts for Earth



THANK YOU