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Feedback Seminar on  
Energy – Efficiency Potential on South Africa

# Energy Demand Forecasting Model

Jan 27, 2009

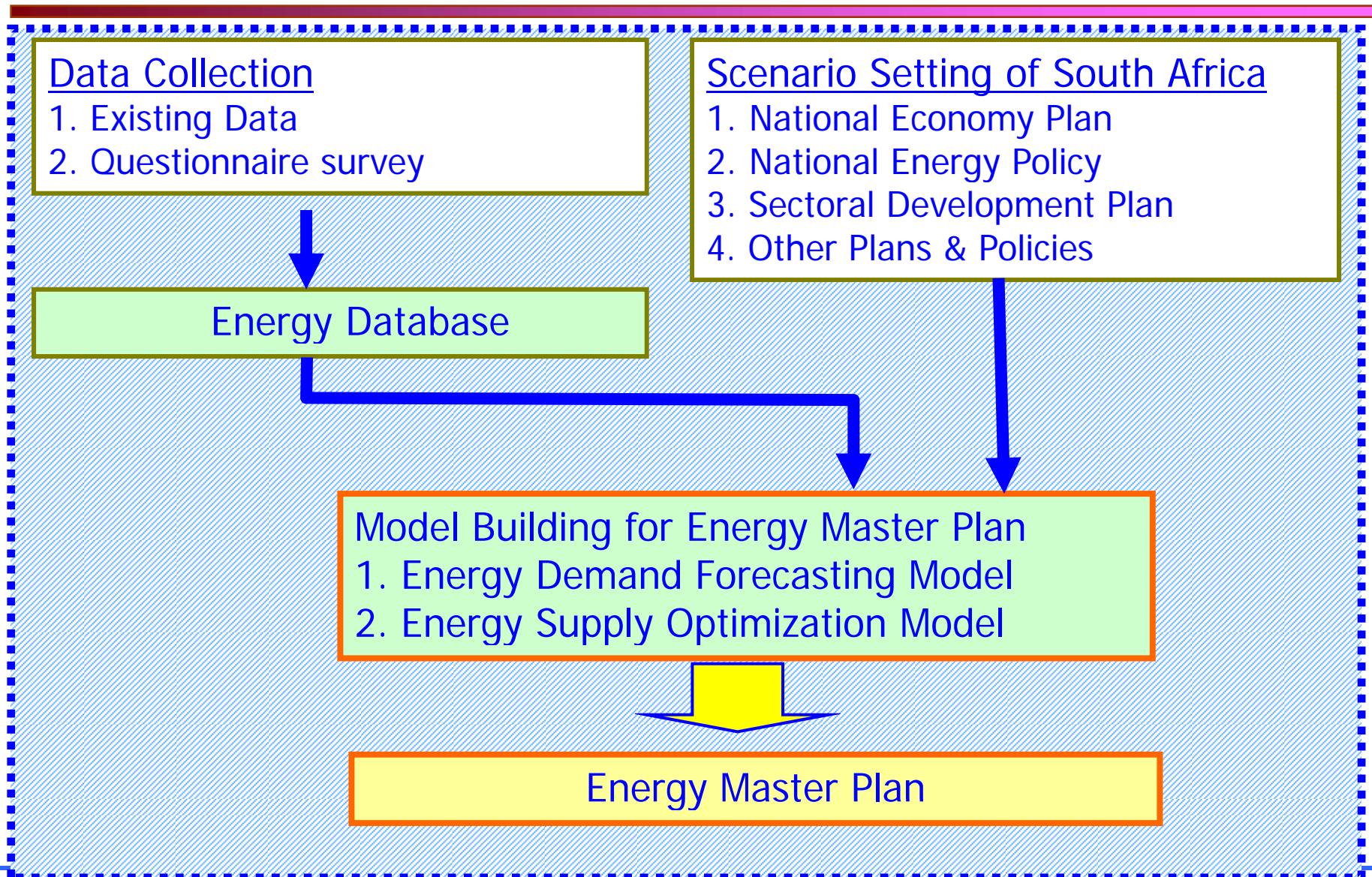
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(JICA Study Team)

**Tomoyuki INOUE**

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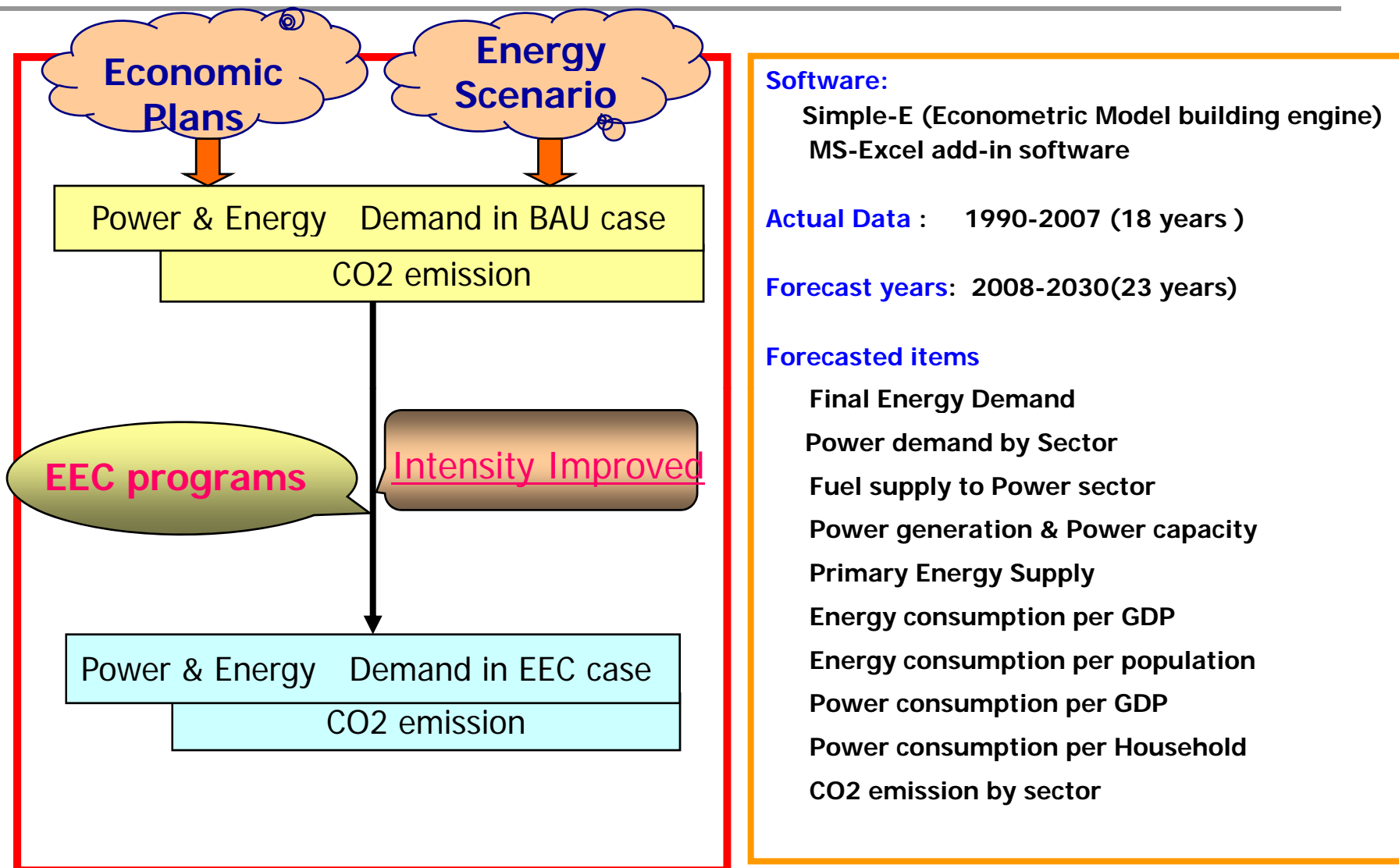
1. Concepts of Energy Master Plan
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# 1. Concepts of Energy Master Plan



## 2. Trial Energy Demand Forecasts for SA

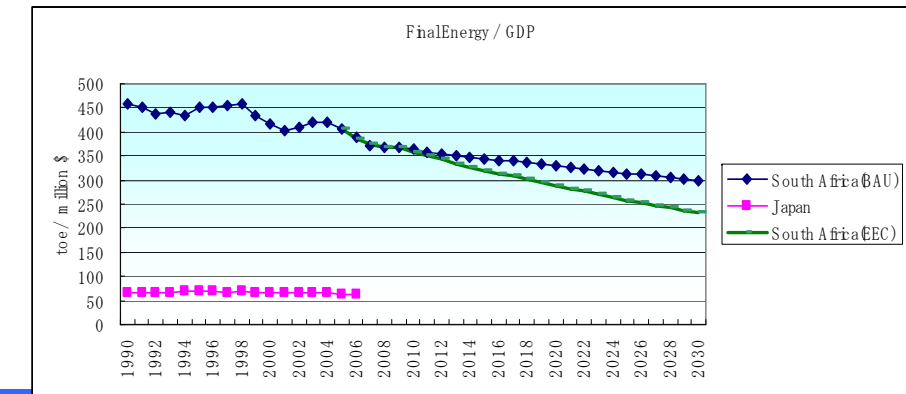
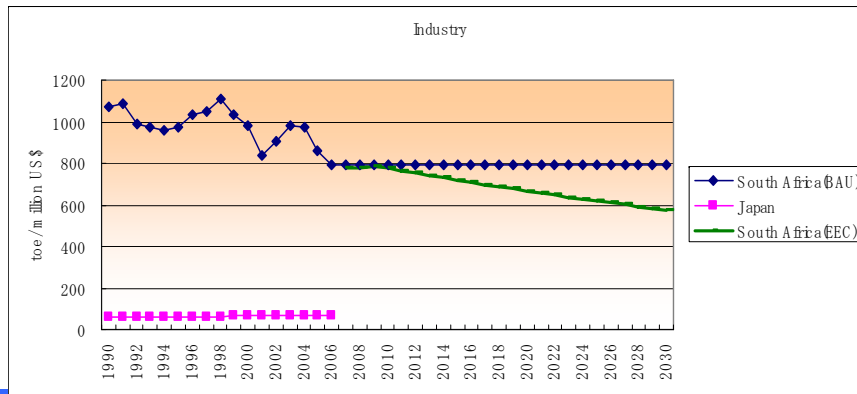
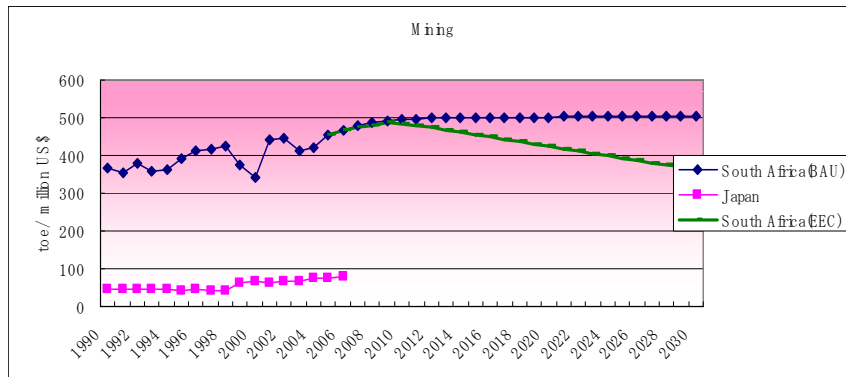
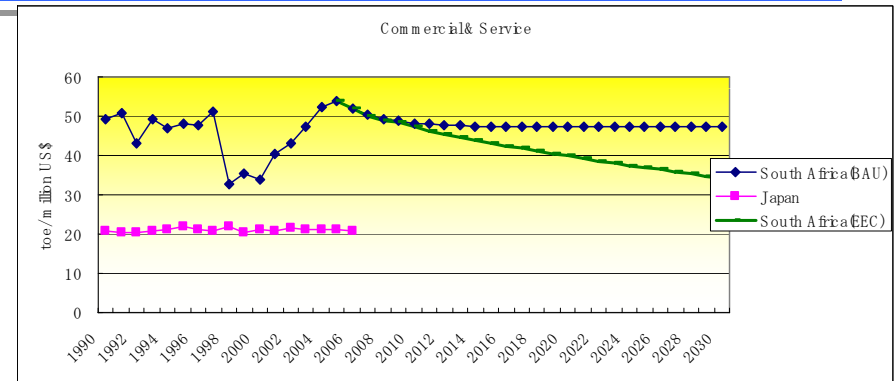
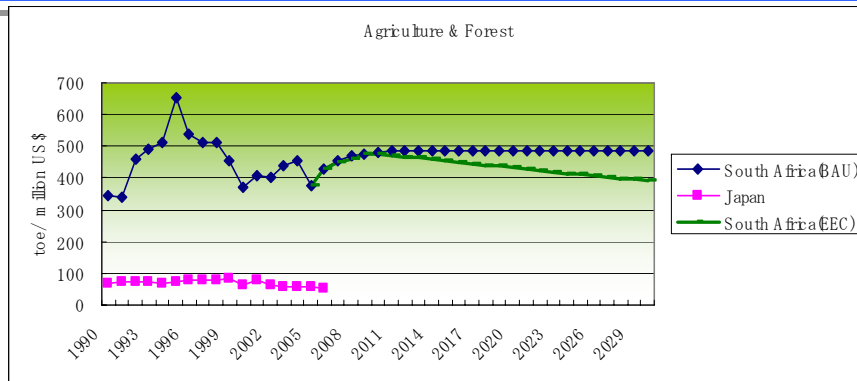
## 2.1 Framework of Energy Demand Forecasting Model



## 2.2 Scenario and Case Setting

	BAU case	EEC case
<b>Economic Policy &amp; Plans</b>	<ul style="list-style-type: none"> <li>○GDP growth rate GDP: 2008-2010:3.0%, 2011-2020:4.0%, 2021-2030:5.0%</li> <li>○Stability of macro economy (exchange rate, inflation and money supply) Exchange rate: 7.5R/\$ - 10.0R/\$ from 2008 to 2030</li> <li>○Investments Road, Water supply, Energy supply, Housing, Public facilities</li> <li>○Sectoral Industry policy Enhancing Labor intensive industry (Business outsourcing, Tourism, Bio fuels)</li> </ul>	
<b>Energy Policy &amp; Plans</b>	<ul style="list-style-type: none"> <li>○CTL : +10,000ktoe in 2010</li> <li>○GTL: +4% per year from 2009 to 2025</li> </ul>	
<b>Power Policy &amp; plans</b>	<ul style="list-style-type: none"> <li>○Open cycle gas turbine: 750MW in 2009, 300MW in 2010</li> <li>○Nuclear power : Additional +1GW per year from 2020 to 2030 (total= +11GW)</li> <li>○NG power generation : 800 MW in 2011, 800 MW in 2015, 800MW in 2020, 800 MW 2026</li> <li>○Renewable Energy: 1.0% in 2010 to 4.0% in 2025</li> <li>○Reserve margin : 5% in 2009 to 16% in 2017</li> <li>○IPP shares : 5% 2009 to 30% in 2023</li> </ul>	
<b>Energy Efficiency Policy</b>	<ul style="list-style-type: none"> <li>○Efficiency of coal power station: 34%</li> <li>○Distribution loss : 8.5% from 2009 to 2030</li> <li>○Sectoral Energy Efficiency Strategy (Refer to Next Page)</li> </ul>	<ul style="list-style-type: none"> <li>○38%</li> <li>○8.5% in 2009 to 5.0% in 2016</li> <li>○Mining:15%, Transport:9%, Commerce:15% Residential : 10% Total:12%</li> </ul>

# 2.3 Intensities in BAU and EEC



## 2.4 Final Energy Demand

### BAU case

unit: million toe

	2005	2010	2015	2020	2025	25/10
Agriculture	1.6	1.8	1.9	1.9	1.9	0.1
Mining	4.5	4.7	4.8	4.8	4.8	0.1
Manufacturing	22.5	24.1	28.8	34.3	42.9	3.9
Commercial	4.0	4.5	5.6	7.1	9.4	5.1
Transportation	15.7	17.9	21.3	25.8	32.9	4.1
Residential	16.7	17.6	19.3	21.3	23.6	2.0
<b>Total</b>	<b>65.0</b>	<b>70.7</b>	<b>81.7</b>	<b>95.1</b>	<b>115.4</b>	<b>3.3</b>

### EEC case

unit: million toe

	2005	2010	2015	2020	2025	25/10
Agriculture	1.6	1.8	1.8	1.7	1.6	-0.9
Mining	4.5	4.6	4.4	4.1	3.7	-1.4
Manufacturing	22.5	23.8	26.3	29.0	33.7	2.4
Commercial	4.0	4.4	5.1	6.0	7.4	3.5
Transportation	15.7	17.7	20.2	23.4	28.4	3.2
Residential	16.7	17.4	18.1	19.0	20.0	0.9
<b>Total</b>	<b>65.0</b>	<b>69.8</b>	<b>75.9</b>	<b>83.2</b>	<b>94.9</b>	<b>2.1</b>

12.5% down in 2020

17.8% down in 2025

## 2.5 Power Demand

**BAU case**

unit: TWh

	2005	2010	2015	2020	2025	25/10
Agriculture	5.5	6.5	6.9	7.3	7.6	1.1
Mining	28.3	29.8	30.3	30.3	30.1	0.1
Manufacturing	81.5	98.8	126.3	160.1	213.2	5.3
Commercial	27.1	30.8	38.6	48.8	64.9	5.1
Transportation	5.4	6.2	7.4	8.9	11.3	4.1
Residential	37.0	43.8	53.6	65.6	79.3	4.0
<b>Total</b>	<b>184.8</b>	<b>215.9</b>	<b>263.0</b>	<b>321.0</b>	<b>406.4</b>	<b>4.3</b>

**EEC case**

unit: TWh

	2005	2010	2015	2020	2025	25/10
Agriculture	5.5	6.4	6.5	6.5	6.5	0.0
Mining	28.3	29.3	27.6	25.6	23.7	-1.4
Manufacturing	81.5	97.3	115.3	135.6	167.4	3.7
Commercial	27.1	30.3	35.2	41.4	50.9	3.5
Transportation	5.4	6.1	7.0	8.1	9.8	3.2
Residential	37.0	43.4	50.5	58.7	67.5	3.0
<b>Total</b>	<b>184.8</b>	<b>212.9</b>	<b>242.1</b>	<b>275.9</b>	<b>325.8</b>	<b>2.9</b>

14.0% down in 2020

19.8% down in 2025

## 2.6 Power capacity

**BAU case** unit: MW

	2005	2010	2015	2020	2025	25/10(%)
Coal (Eskom)	39,378	40,484	44,134	46,510	50,015	1.4
Coal (Auto)	2,044	2,096	7,897	16,040	22,734	17.2
Natural gas	1	12	1,756	2,634	2,634	43.6
Hydro	1,321	2,342	2,342	2,342	2,342	0.0
Nuclear	1,840	1,842	1,842	2,780	7,472	9.8
Other	0	1106	1106	1106	1106	0.0
<b>Total</b>	<b>44,584</b>	<b>47,882</b>	<b>59,078</b>	<b>71,413</b>	<b>86,303</b>	<b>4.0</b>

**EEC case** unit: MW

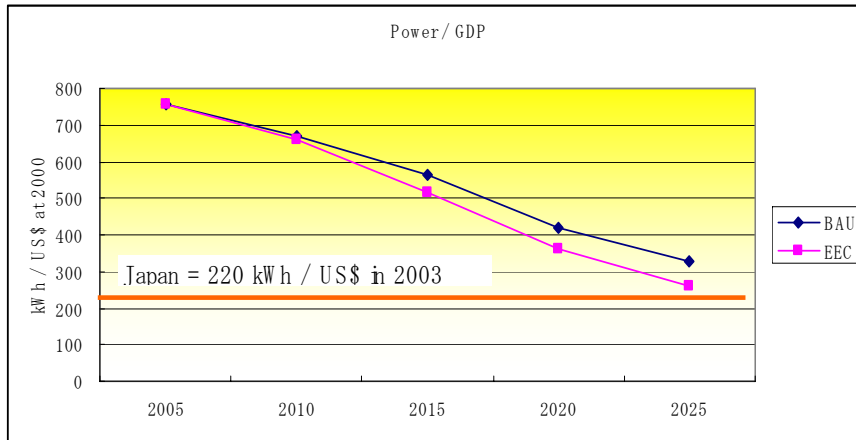
	2005	2010	2015	2020	2025	25/10
Coal (Eskom)	39,378	39,838	39,254	38,269	37,528	-0.4
Coal (Auto)	2,044	2,063	7,024	13,161	17,007	15.1
Natural gas	1	12	1,756	2,634	2,634	43.6
Hydro	1,321	2,342	2,342	2,342	2,342	0.0
Nuclear	1,840	1,842	1,842	2,780	7,472	9.8
Other	0	1,106	1,106	1,106	1,106	0.0
<b>Total</b>	<b>44,584</b>	<b>47,203</b>	<b>53,324</b>	<b>60,293</b>	<b>68,089</b>	<b>2.5</b>

Load Factor	70.0%	72.5%	72.5%	72.5%	72.5%	72.5%
Reserve Margin	6.0%	5.0%	12.0%	16.0%	16.0%	16.0%

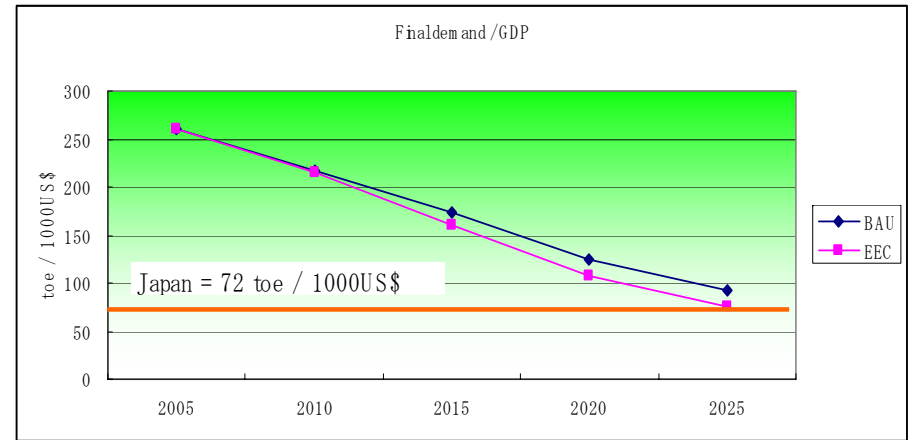
15.6% down in 2020

21.1% down in 2025

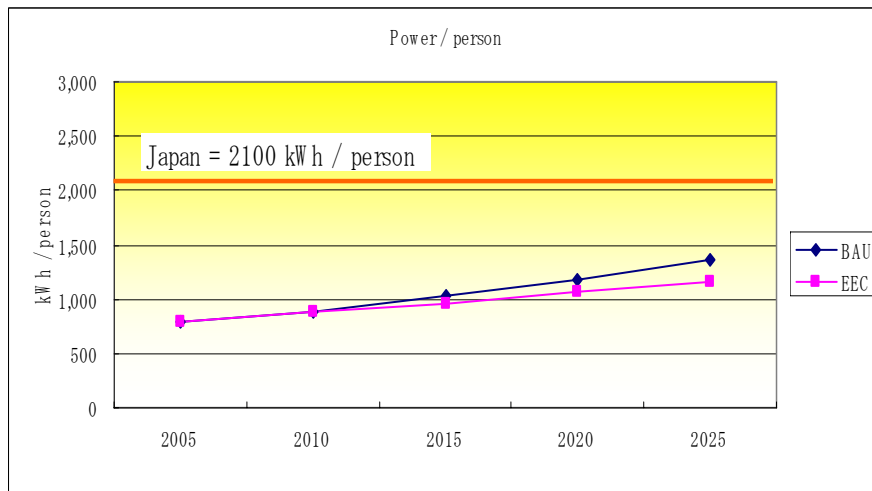
# 2.7 Power & Energy Demand Comparison



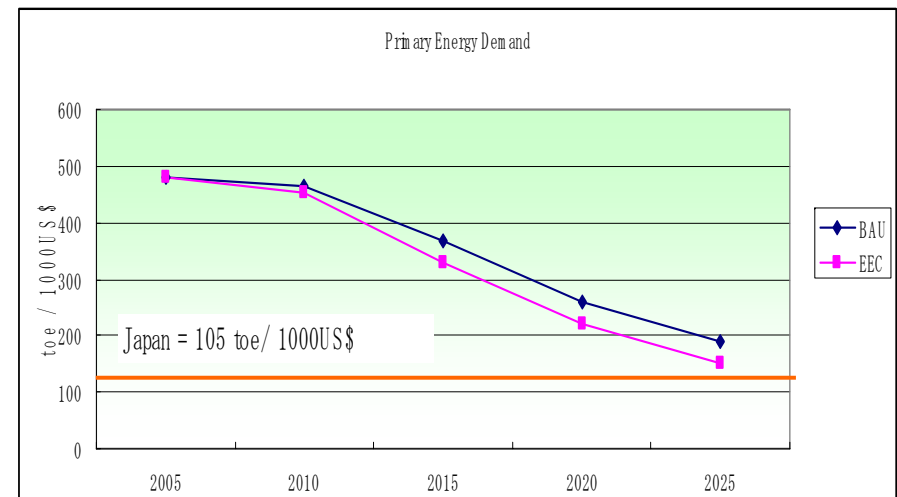
Power demand / GDP



Final Energy Demand / GDP



Residential Power Demand / population



Primary Energy Demand / GDP

## 3. Considerations

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- 3.1 The **consistency** between Economic strategy and Energy plan is important for making Strategic Energy Plan. In order to keep the consistency, Energy Demand Forecasting Model and Energy optimization model are required.
- 3.2 And also, for the consistency among several energy plans such as, power development plans, coal development plans and so on, the above models are used. The Models are used to evaluate **the energy projects programmed differentially** in view point of country wide energy balance.
- 3.3 For maintaining the models, several kinds of experts such as Energy policy maker and Model builder are required in energy responsible departments and/or agencies. Then **capacity building** for the experts are required.

**Thank you !!**