

# The Method to Choose Technology in TH-3EM(TsingHua Energy- Environment-Economic Model )

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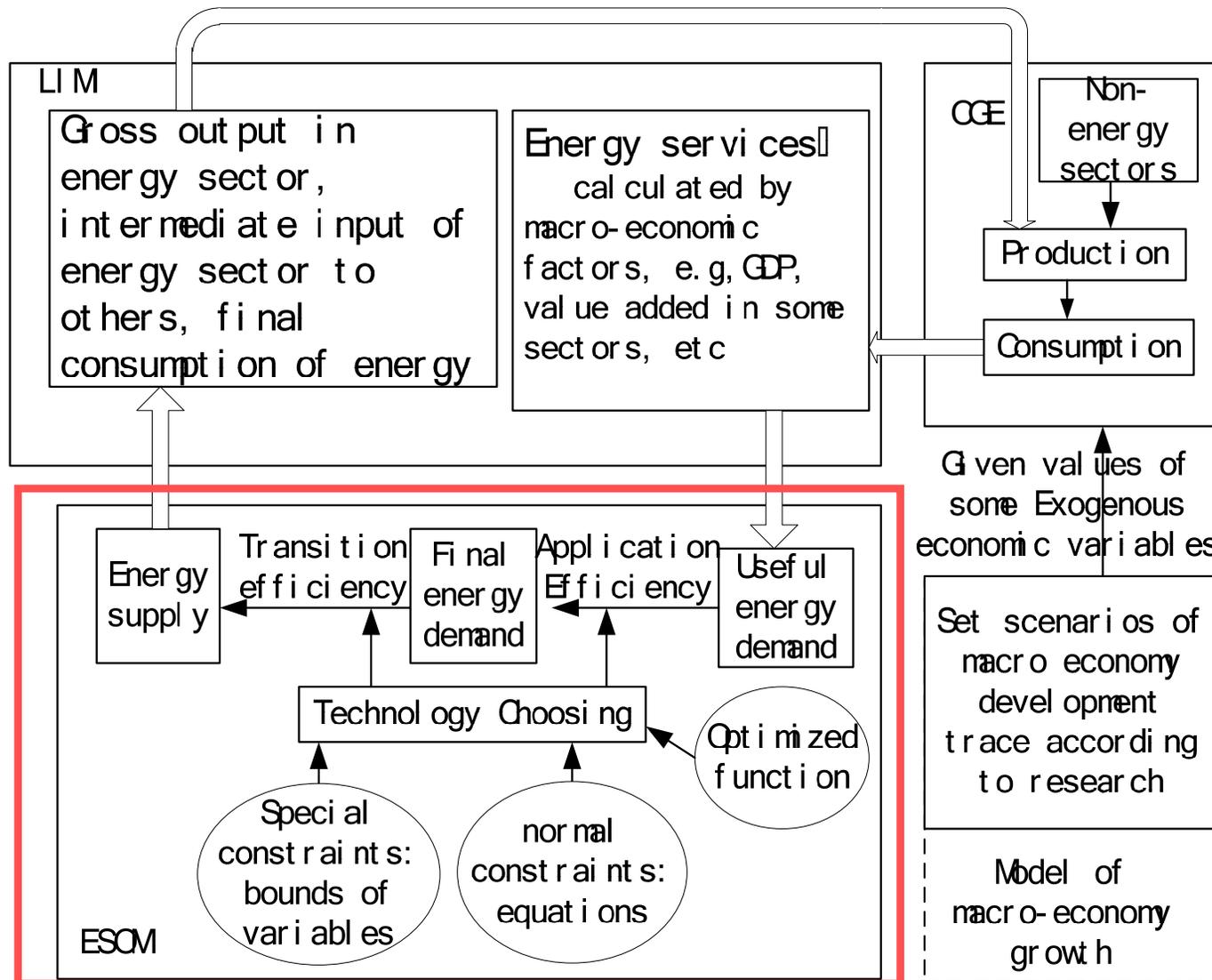
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# Simplified Framework of TH-3EM



# One purpose of TH-3EM development

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under the given macro-economic scenarios , draw the roadmap of economic system and energy system development from three aspects:

## **macro-:**

gross level (GDP, right rate, people's income, primary energy consumption, etc)

## **mid-:**

in sector (investment, labor, value added of sectors)

## **micro-:**

Which, when and how long the technologies are chosen in energy production, transition and consumption

# Two puzzles of Original ESOM

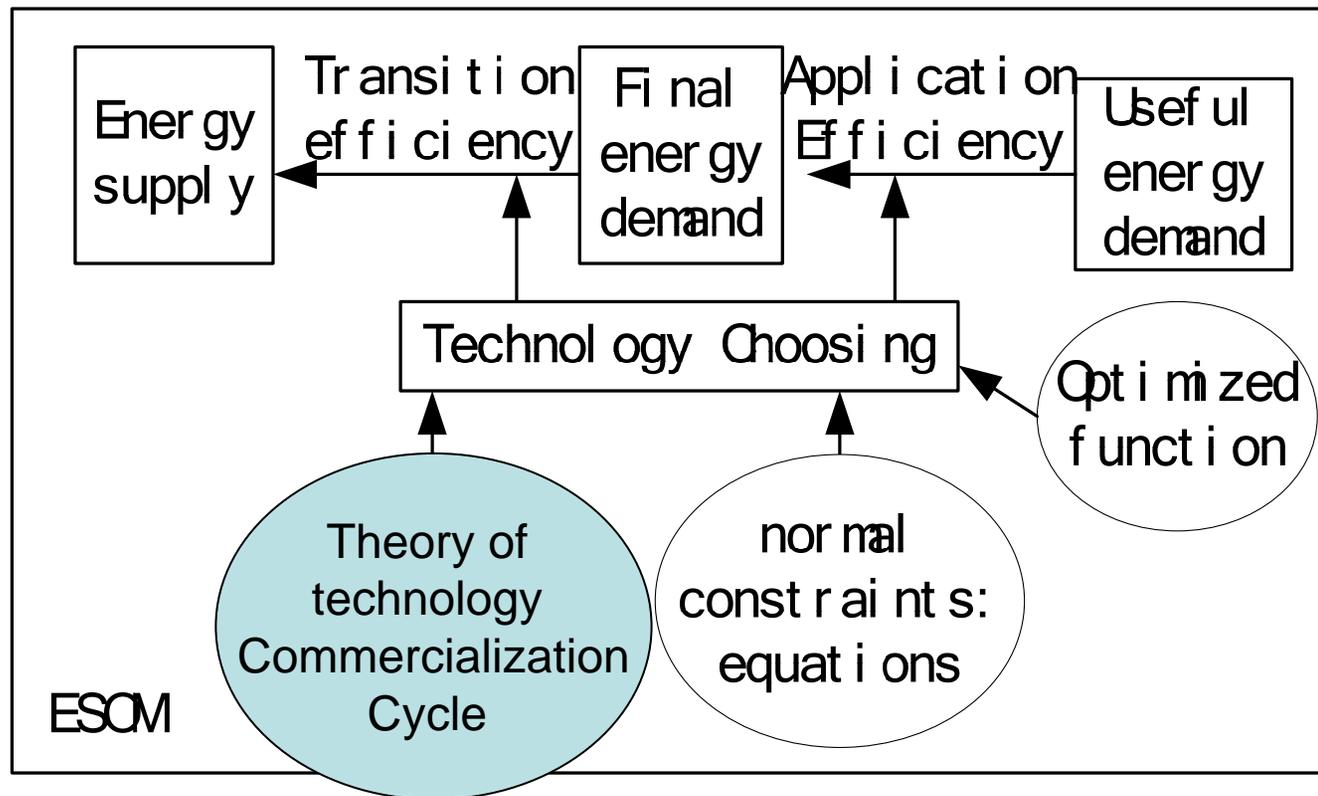
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In order to make the developing trace of technologies more rational, **Original ESOM** needs a large amount of special constraints. However, too many special constraints could decrease the optimizing function of ESOM.

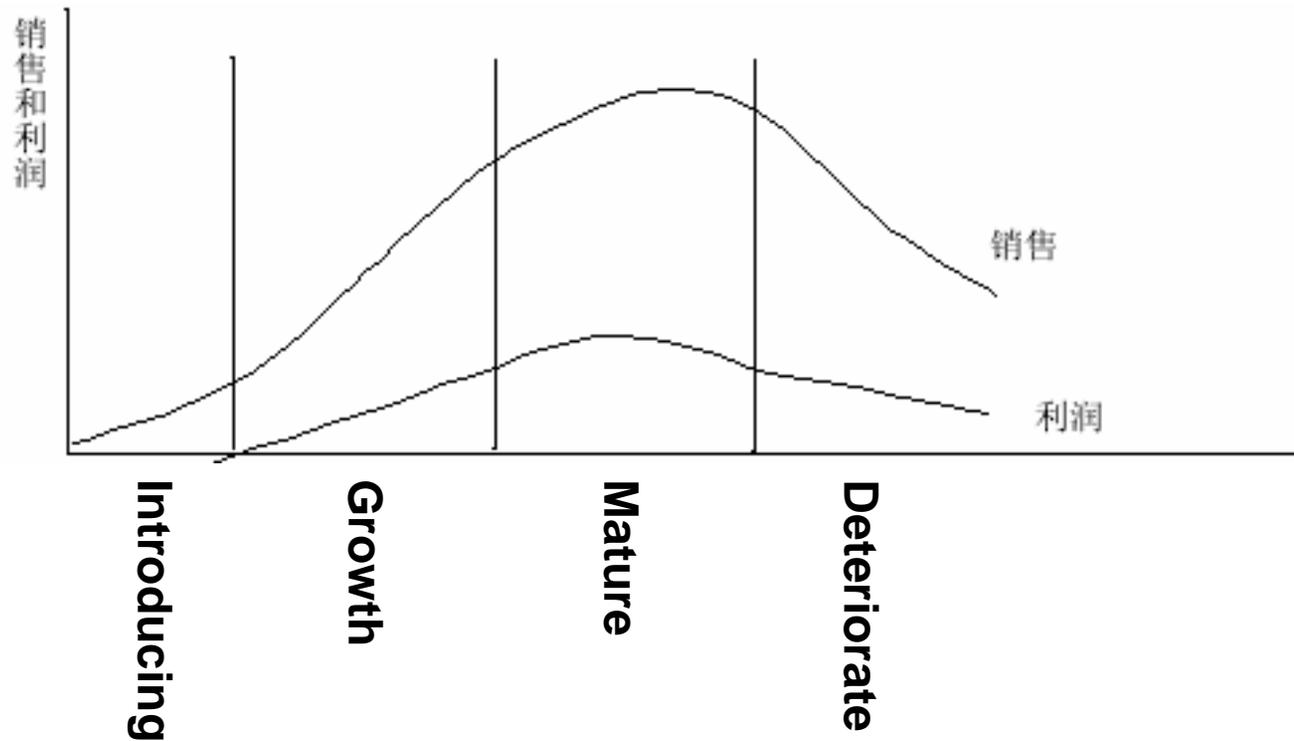
some unforeseen and unreasonable results of technology choosing

**Based on the original ESOM, using the new method to choose technology**

# Introduction of Method to choose technology in ESOM

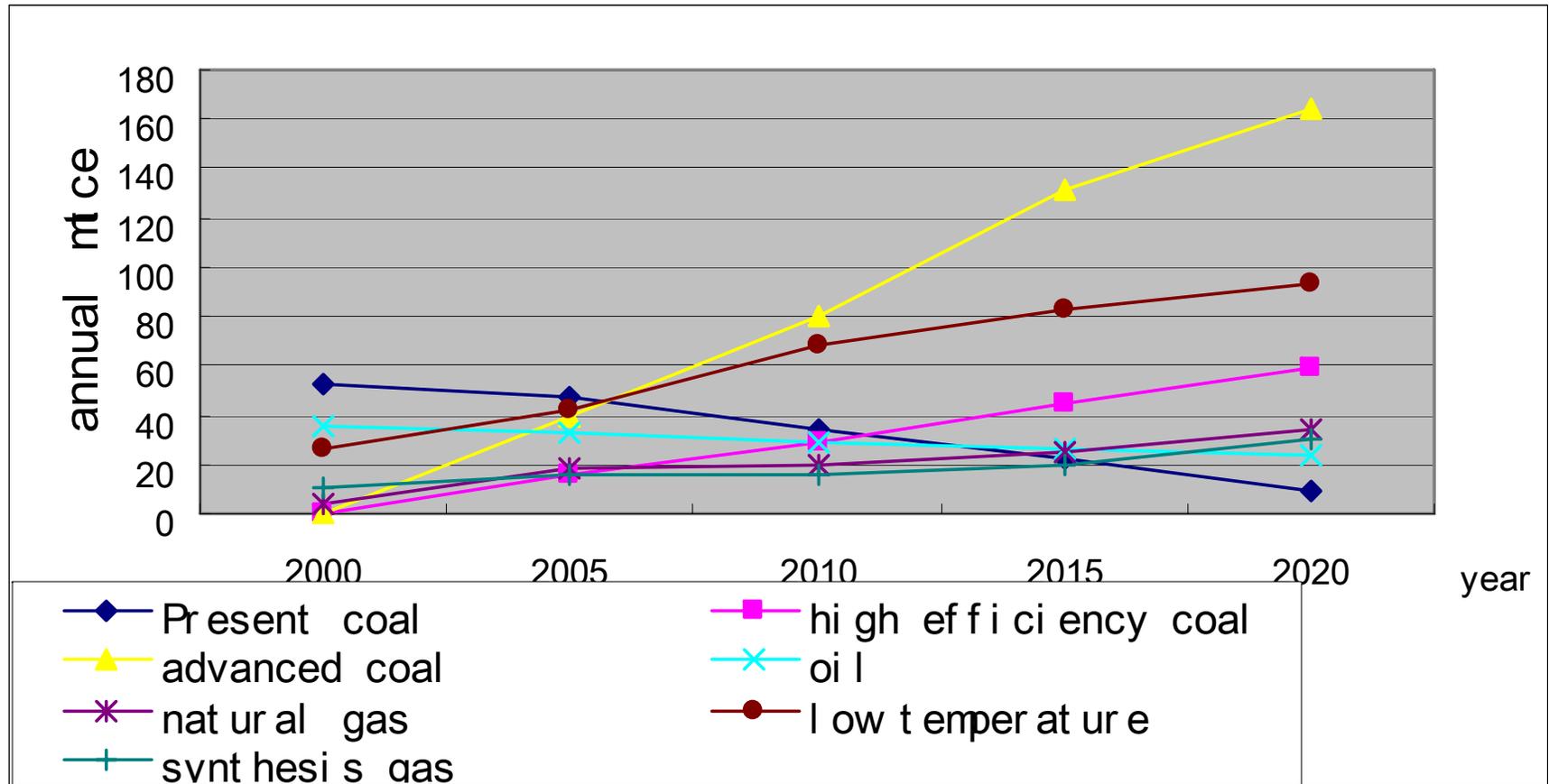


# Theory of technology commercialization cycle



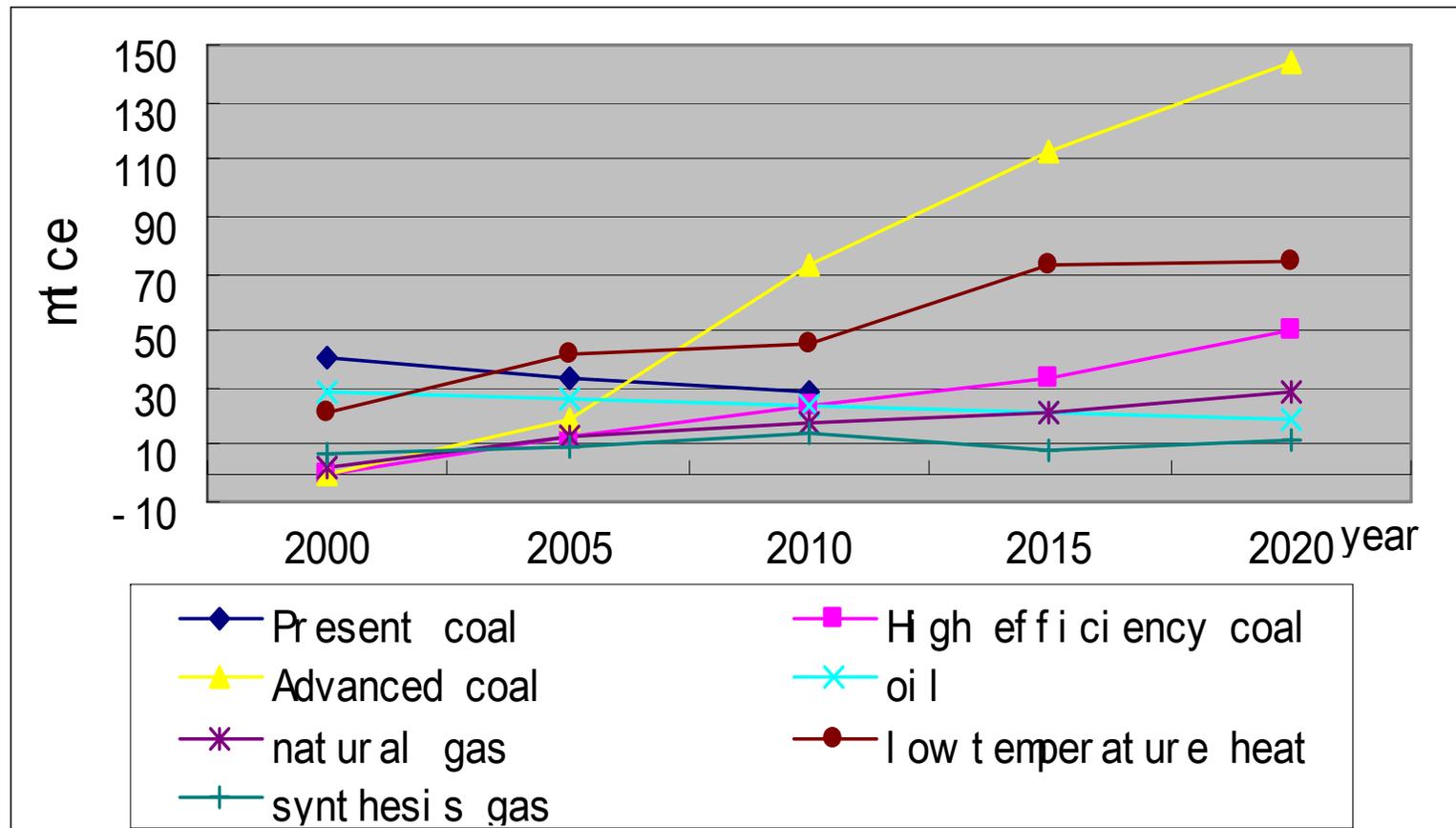
If the technology in the model develops following the trace, the result of choosing will be more rational.

# Samples of results of technology choosing in the ESOM-1



**Fig. Capacities of all technologies supplying industrial process heat**

# Samples of results of technology choosing in the ESOM-2



**Fig. Activities of all technologies supplying industrial process heat**

# The method to choose technology according the theory

## The new method

### PART1:

Using the plot-out hypotheses to identify the phases of the technologies at time T.

The endogenous variables “capacity” and “activity” of technologies at some time T are used in the plot-out, which can be considered as showing the productivity and the sales of products made with the technology respectively.

### PART2:

Defining the constraints to technology development in different phases by equations

Building the constraint equations of “capacity” and “activity” of technology

# The plot-out hypotheses:

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## Entering

- The initial status of technology, but at the end of which, there must be some installed and operated capacities

## Growth

- growth rates of “capacity” and “activity” are same or almost the same, that means the demand of product of technology may be driven by the supply

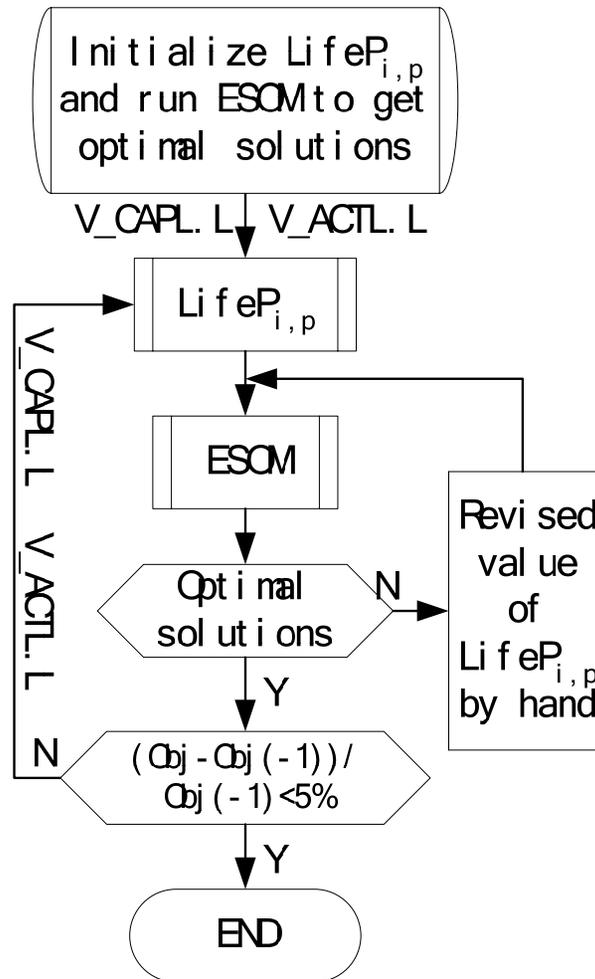
## Mature

- the growth rate of “capacity” is far larger than that of “activity”, that means the supply of product is driven by the demand

## Deteriorate

- when the “capacity” begins to decrease, that means the productivity of technology begins to shrink

# The operation process of the new method in TH-3EM



$LifeP_{i,p}$ : the identifying parameters of phases of technology  $i$  in time point  $P$ .

# Samples of results of technology choosing in the ESOM-3

	2000	2005	2010	2015	2020
General efficiency	0.72	0.81	0.85	0.89	0.91
Energy saving rate*		0.11	0.15	0.19	0.21

\*: calculation based on 2000 year.

Energy saving rate

= (demand /old efficiency-demand/new efficiency)/(demand\*old efficiency)

=(old eff-new eff)/new eff

**THANKS!**