Activities to Reduce CO_2 Emissions at Nippon Oil

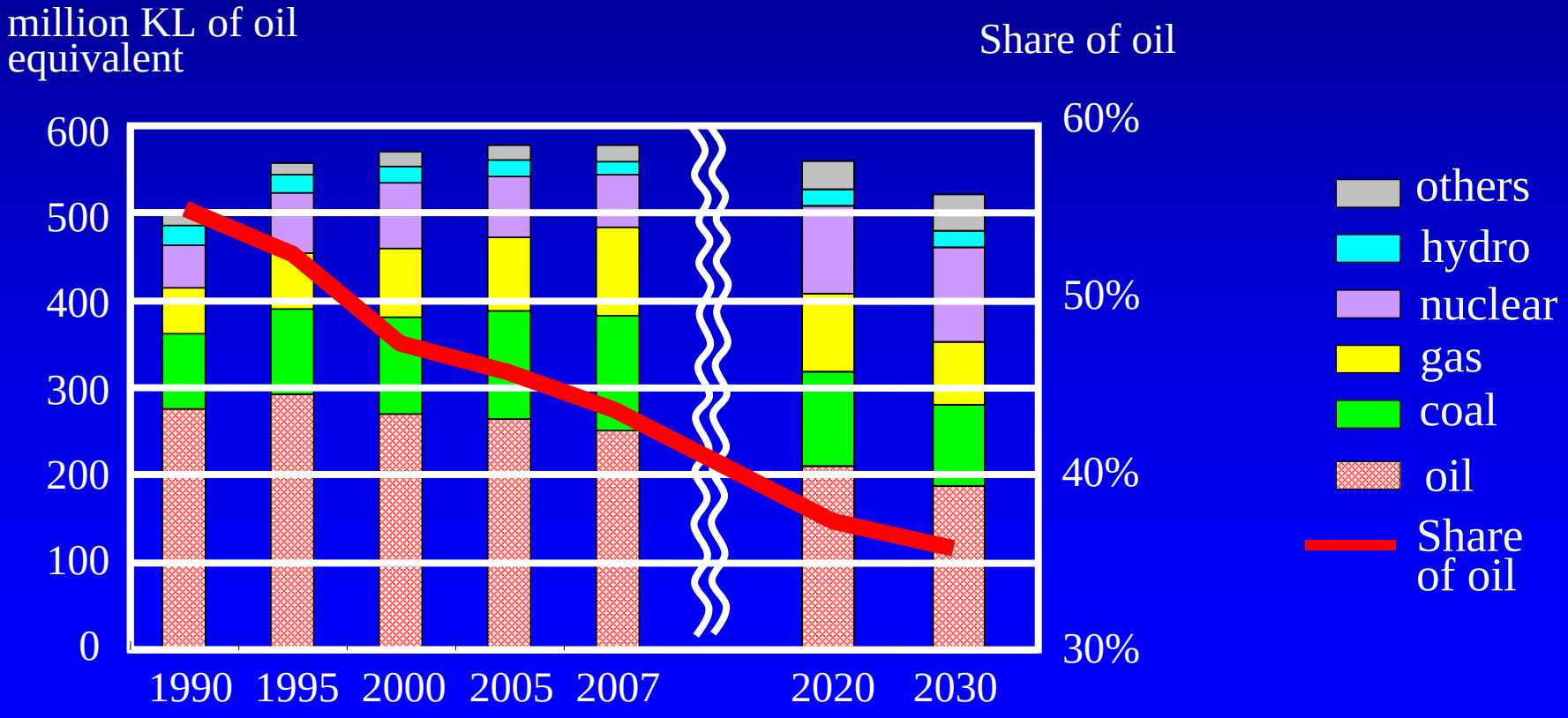
Ono Hiroshi
Environment & Safety Department
Nippon Oil Corporation

Outline of Presentation

- Brief introduction of Nippon Oil
- Activities to counter the global warming in the Japanese oil industry
- Activities to reduce CO_2 emissions at Nippon Oil
  - » Activities and results
  - » New energies

Overview of Primary Energy Supply in Japan

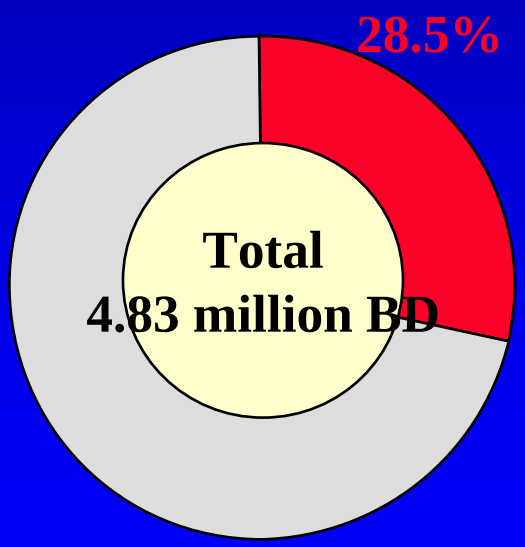
- Oil has been playing a leading role in the primary energy supply in Japan, but its share has been declining continuously.



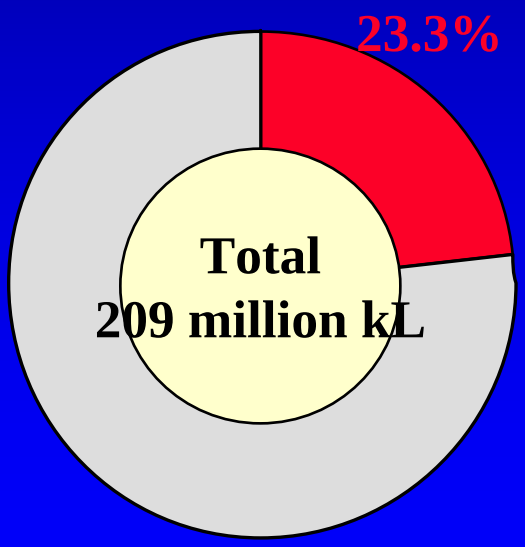
Nippon Oil Corporation

- Nippon Oil Corporation is the leading company in the Japanese oil industry.

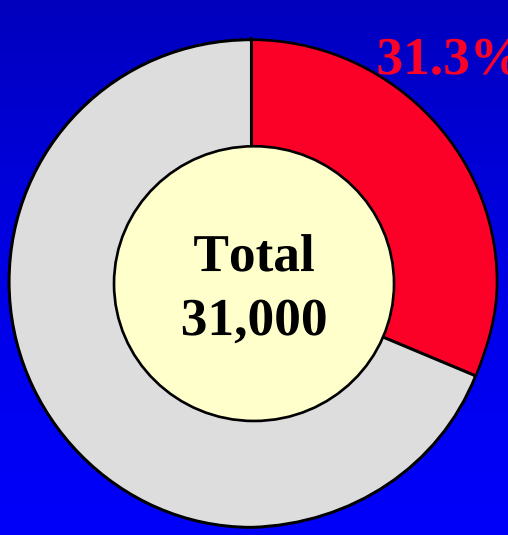
CDU capacity



Sales of fuel oil



Number of gas stations



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Activities of Japanese Industries

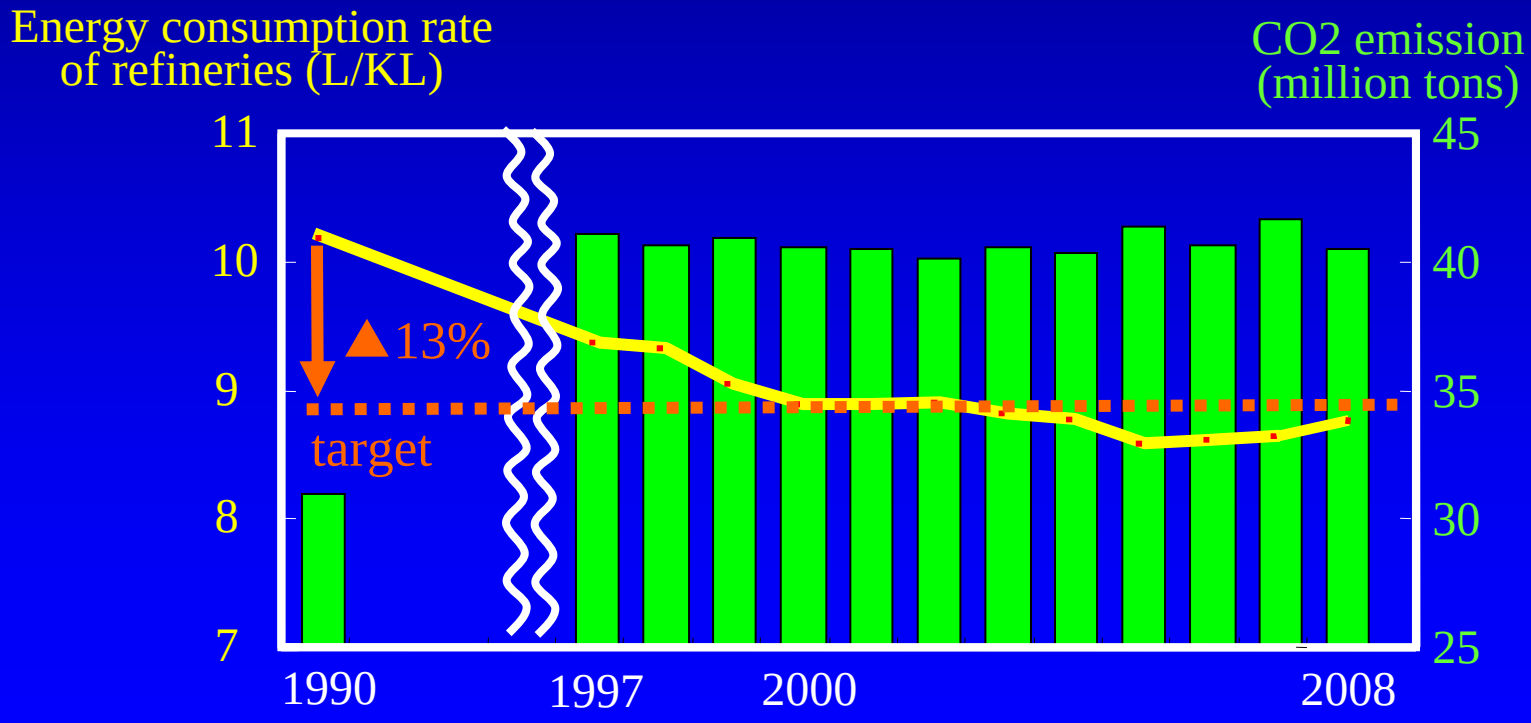
- Keidanren Action Plan
  - » Action plan of Japanese industries to meet Kyoto protocol which requires Japan to reduce CO_2 by 6% from the 1990 level.
  - » Individual action plan of 36 industries with quantitative targets.
  - » CO_2 covers more than 80% of the industrial emissions.
  - » Subject to the annual review by the government.
  - » Self binding action plan including use of emission-credit as the last resort to reach the target.
  - » Many industries have already accomplished their targets in 2007.

Action Plans of the Japanese oil industry

- Emission reduction target of refineries:
  - » In 2008-2012, energy consumption rate will be reduced by 13% from the 1990 level.
  - » The above covers 100% of the refineries in Japan.
- Introduction of bio-gasoline of 840,000KL a year in 2010.

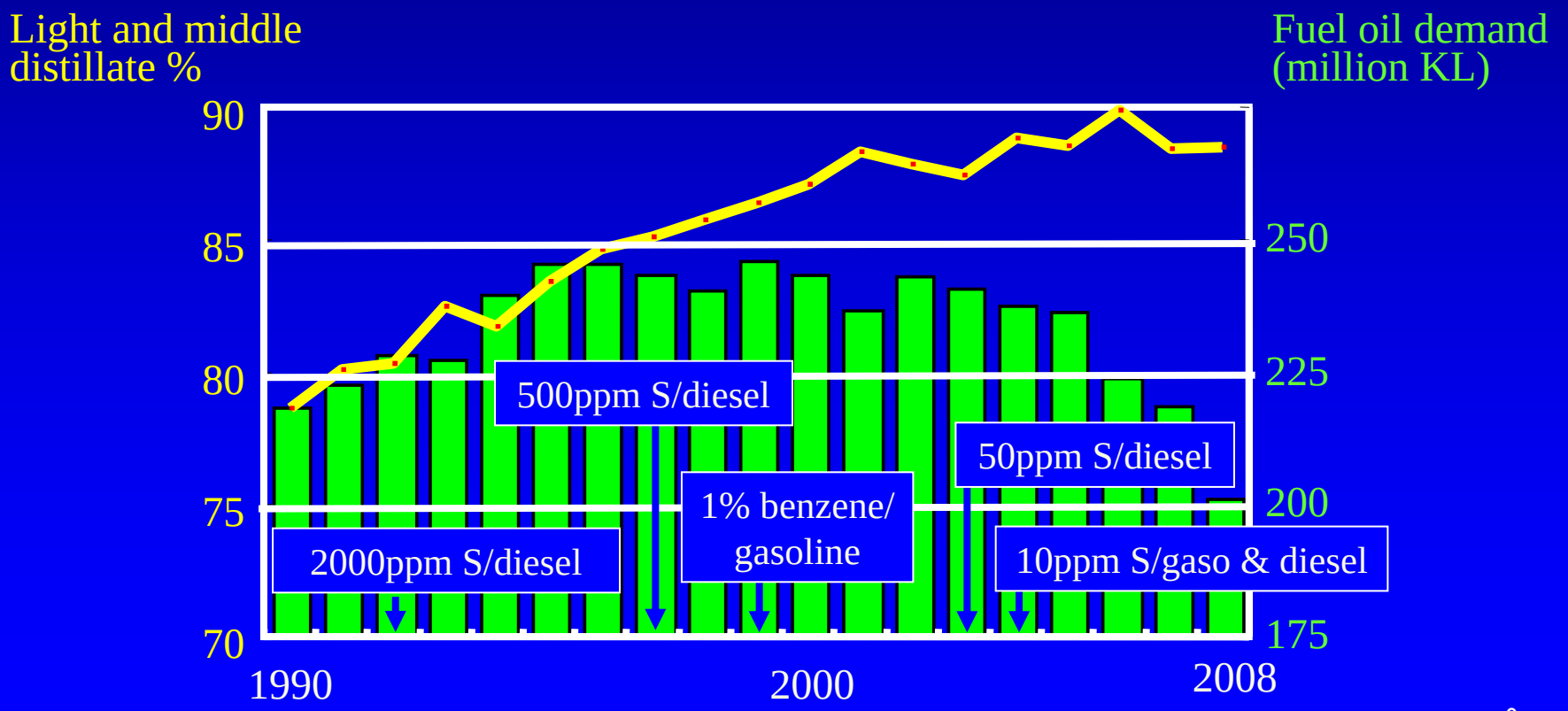
Current Situation

- The initial target for the refinery energy consumption rate was achieved in 2003.
- However, it is uncertain if the Japanese oil industry could keep it in 2008-2012, since it would deteriorate as the total petroleum demand (refinery through-put) declines.



Trend of Japanese Fuel Oil Market

- Continuous increase of lighter products ratio.
- Frequent revision of regulation on quality of gasoline and diesel.
- Rapid decrease of fuel oil demand since 2006.



Refinery Operation Affected by Market Change

- Change in the petroleum product structure has required the installation and expansion of cracking units.
- Regulations on oil products quality has required the installation and expansion of desulfurizing units and benzene extraction units.
- Fuel consumption rate at refineries has been deteriorating due to fuel oil demand decrease in recent years.
- Due to these changes in the oil market, the fuel consumption in the Japanese refineries has increased since 1990 despite that many energy conservation (Encon) efforts and projects were implemented.

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Policies at Nippon Oil

- Nippon Oil Group Philosophy
  - » Your Choice of Energy
    - Create the energy of future, promoting prosperity and harmony with nature.
- Policy on Environment Protection
  - » Nippon Oil will endeavor to decrease emissions continuously being a top-runner for environment protection.

Organizations on Environment

- Environment and safety committee
  - » Corporate policy on environment protection
- Environment and safety conferences
  - » Annual corporate action plan
- Environment and Safety Department
  - » Total management of the action plan
  - » Planning and execution of CDM
- Departments at the headquarters
  - » Capital investment policy
  - » Planning and execution of emission reduction
- Refineries
  - » Operation management
  - » Planning and implementation of Encon items

CO_2 Emission Reduction Through Supply Chain

CDM at oil fields

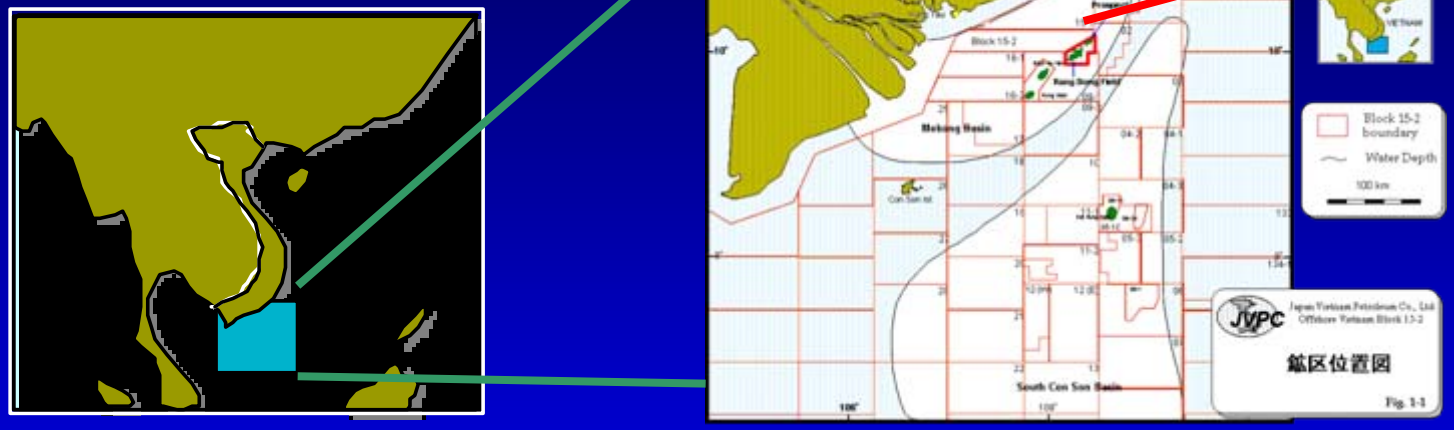
Encon at refineries

Fuel saving in distribution

CDM Policy

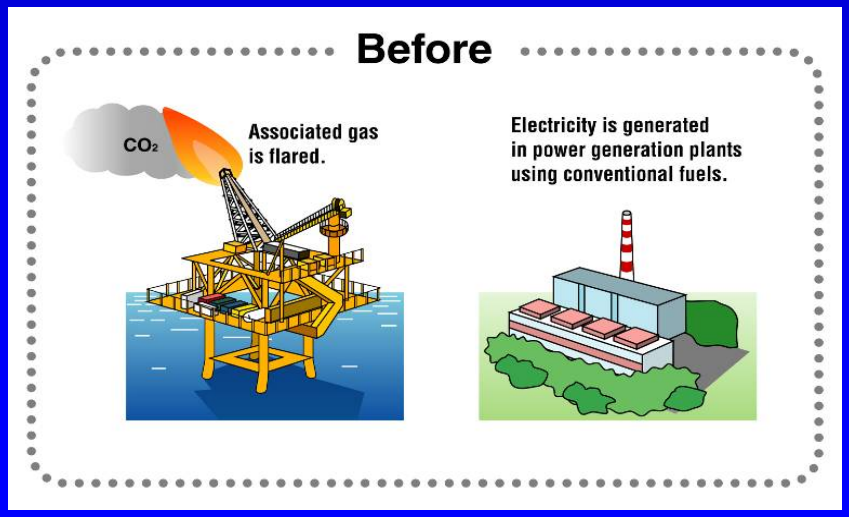
- Nippon oil aggressively pursues the opportunities of CDM projects, by ourselves as well as through CDM funds.

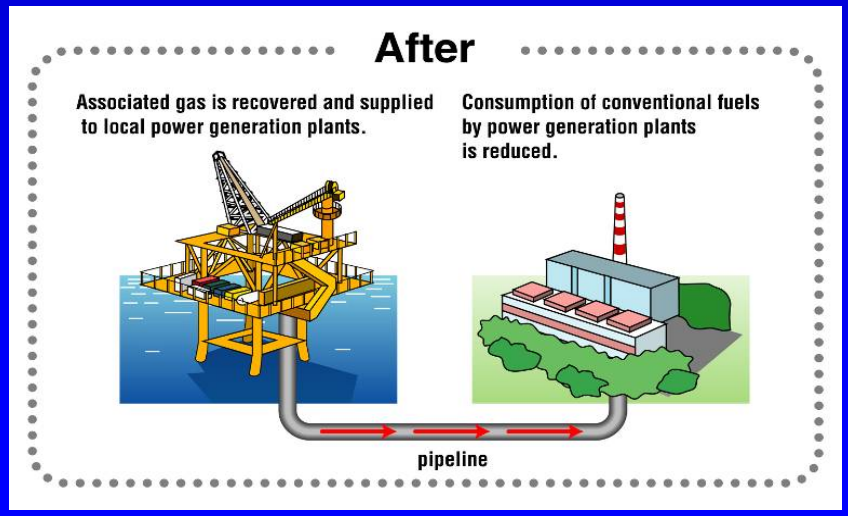
Rang Dong Oil Field (Vietnam)



CDM: Associated Gas Recovery at Rang Dong

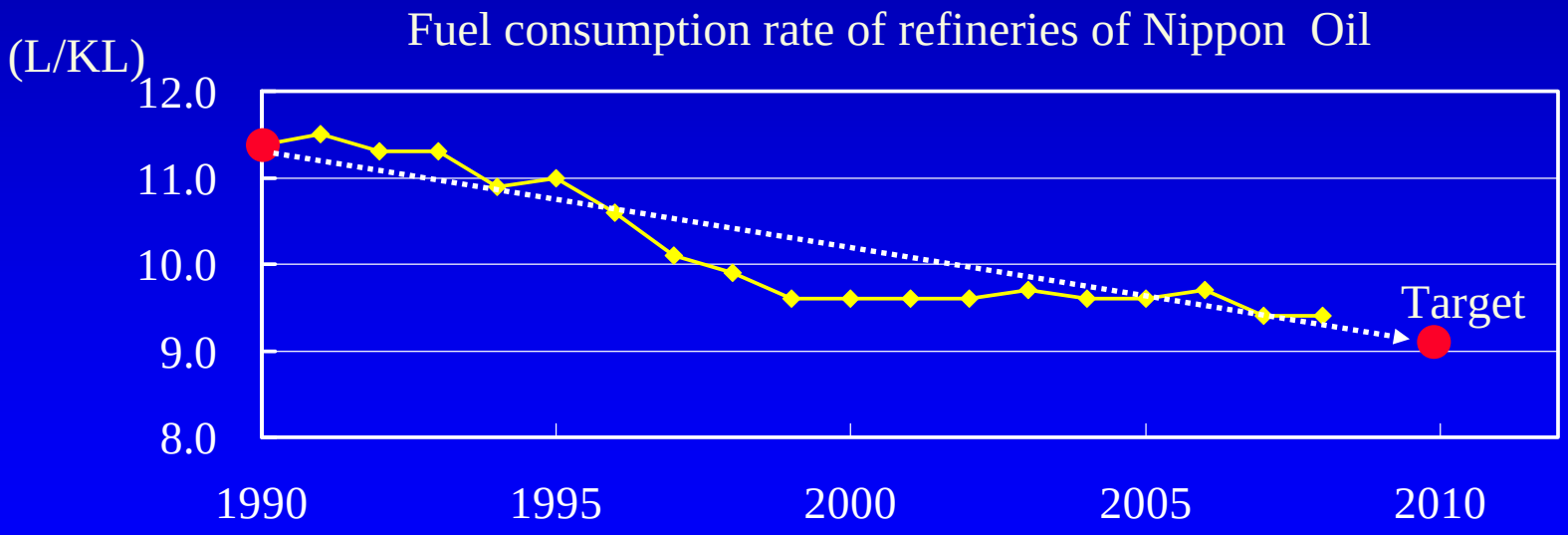
- Associated gas is recovered at Rang Dong oil field and utilized to generate electric power in Vietnam. Some 8 million tons of CO_2 emissions will be reduced by this project.
- This project was registered by the UN CDM Committee in February 2006 as the world first CDM project to utilize associated gas.
- Thus, Nippon Oil has established a CDM methodology, which has been applied to 23 potential CDM projects in the world.





Energy Conservation at Refineries

- The target of the fuel oil consumption rate for 2010 is set at a level 20% lower than 1990.
- Currently the progress is on schedule.
- However, similarly with other Japanese refiners, more efforts are required to meet the target for 2010.



Energy Conservation Activities in 2008

- Target:
  ▲24,000KL of fuel oil (63,000 ton-CO_2)
- Result:
  ▲69,000KL of fuel oil (180,000 ton-CO_2)
- Major Energy Conservation Items:
  - » Sophisticated control of operation (▲10,000KL)
  - » Enhanced heat recovery (▲13,000KL)
  - » Improved furnace operation (▲4,000KL)
  - » Improved utility system (▲2,000KL)
  - » Improved fractionator operation (▲2,000KL)

Example-1: Sophisticated Control System

- Advanced process control is applied at more than 30 refining units and utility systems.
- Real-time optimization is implemented at two refining units successfully.
- Implementation and maintenance of the sophisticated control system is being managed by the in-house control specialist team.

Real-time Optimization

RTO
(Real-Time Optimization)

Performance

Set points

APC
(Advanced Process Control)

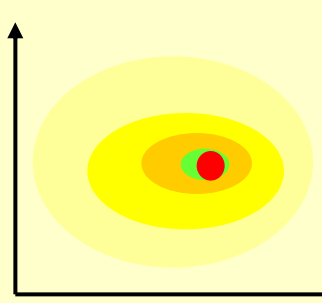
Performance

Set points

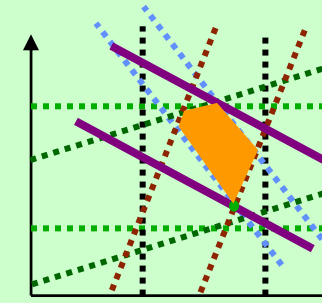
DCS
(Distributed Control System)

Process variables

Process



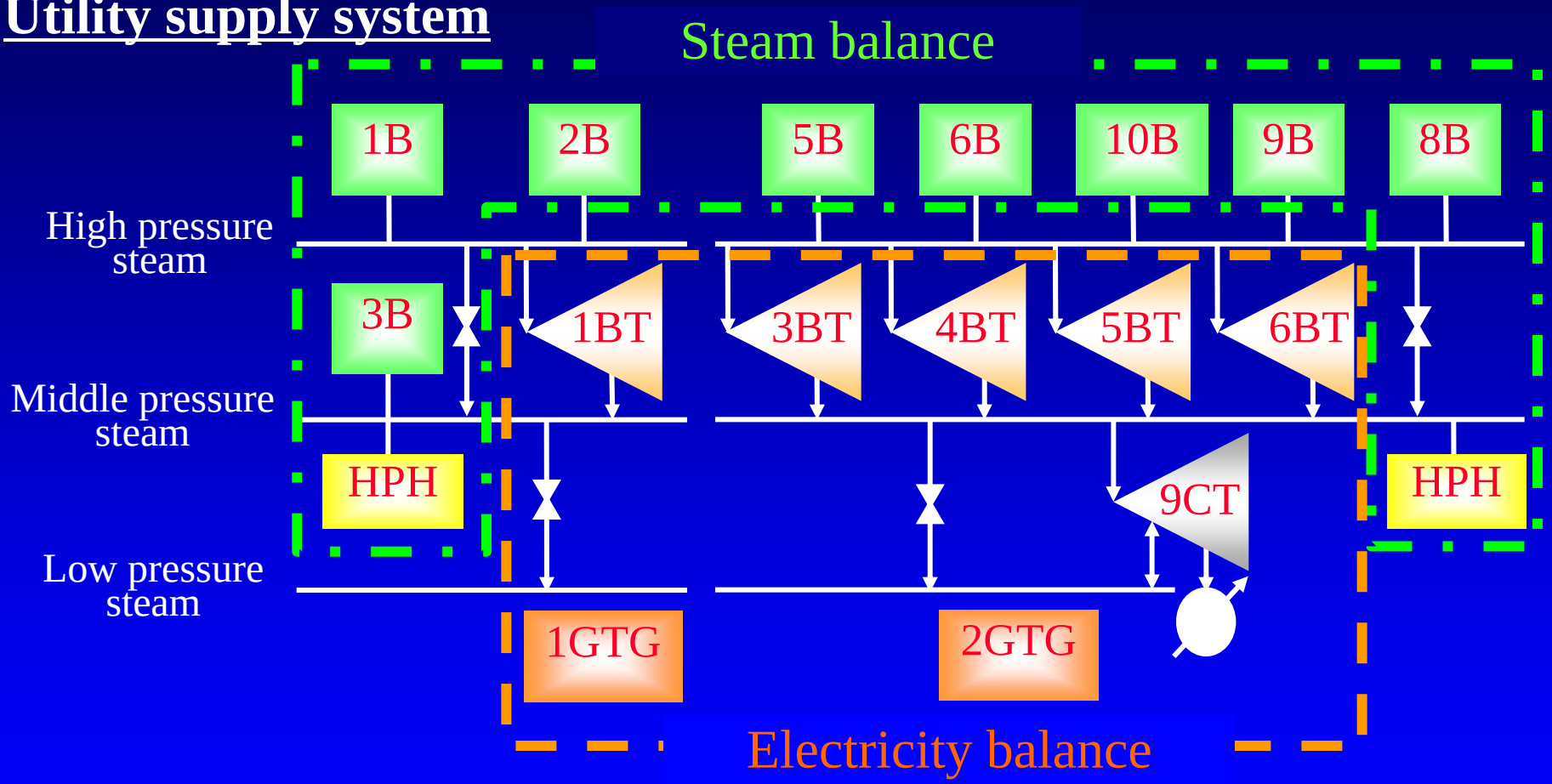
- Process simulation
- Optimization based on non-linear equations



- Multivariable predictive control
- Optimization based on linear equations

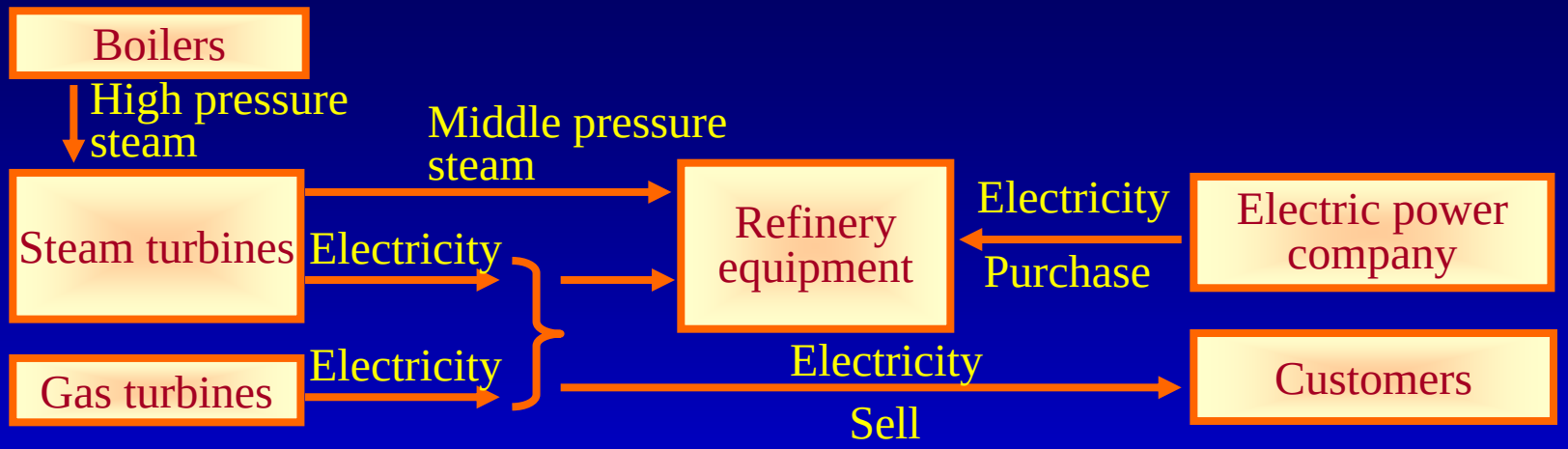
Advanced Control of Utility System: 1

Utility supply system



B: Boiler, GTG: Gas turbine generator, BT: Back pressure turbine,
CT: Condensing turbine, HPH: Feed water heater

Advanced Control of Utility System: 2



	Boiler			Turbine		
	A	B	・・・・	A	B	・・・・
High pressure steam (t/h)						
Middle pressure steam (t/h)						
Electricity (MW)						
Fuel (kL/h)						

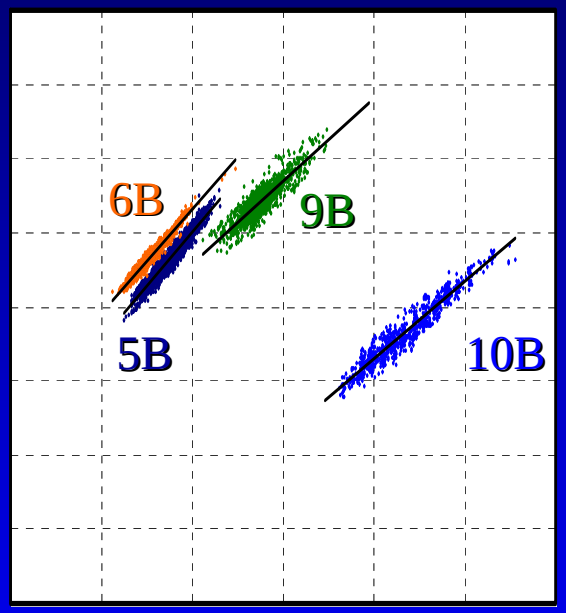
Steam balance

Electricity balance

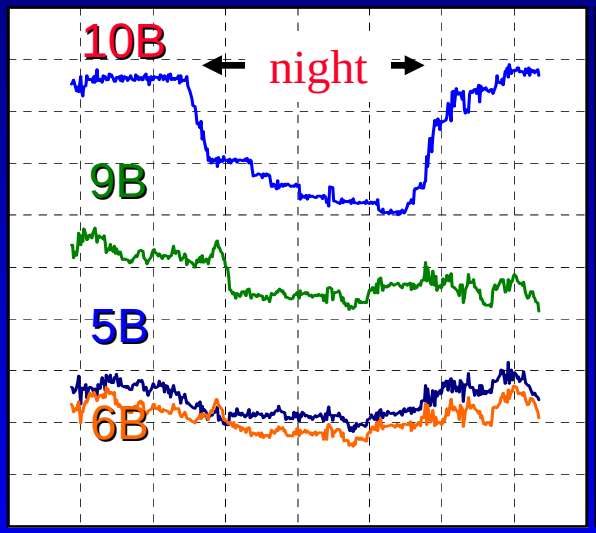
Fuel consumption

Minimize this fuel consumption

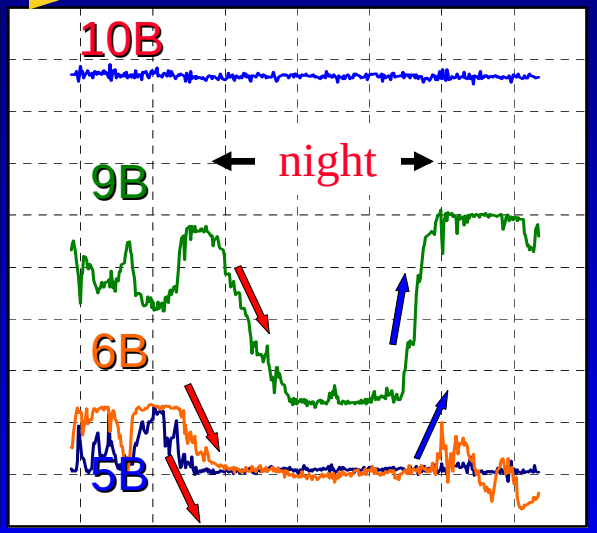
Advanced Control of Utility System: 3



Before → After



No priority in using boilers



Put priority in using boilers with higher efficiency

▲18,000 ton-CO_2 / year

Example-2: Maintenance of Steam Traps

Overall management structure of steam traps

Inspection of all steam traps

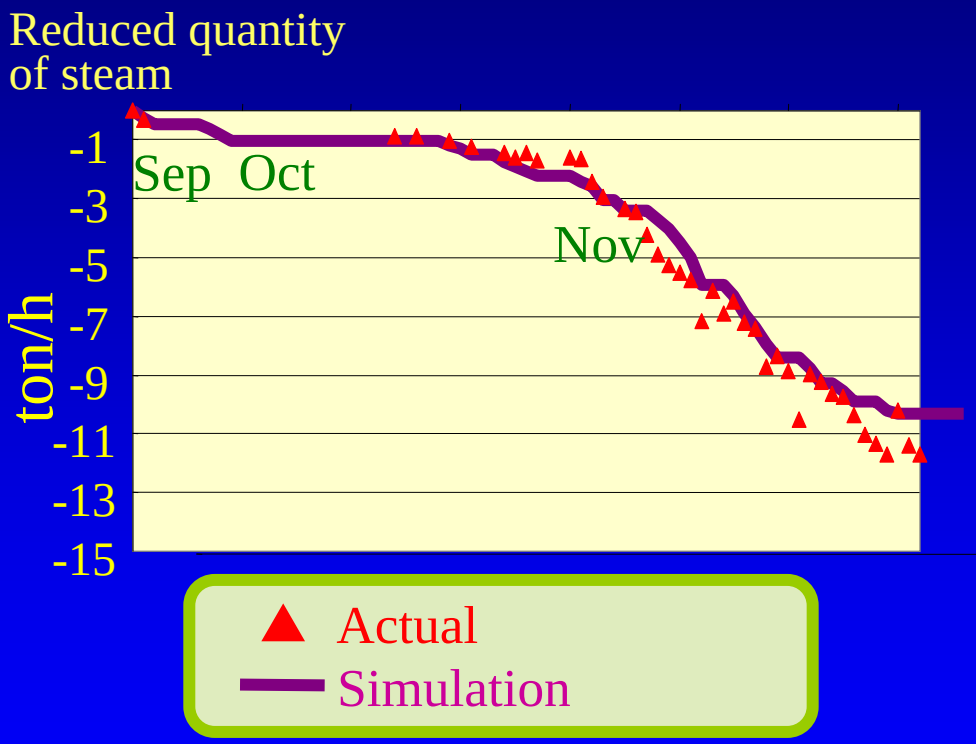
Construction/ updating the database

Criteria of replacement

Maintenance / replacement of failed steam traps

Follow-up analysis of the effect

Result



▲20,000 ton-CO_2 / year

CO_2 Reduction in Product Distribution

- Activities:
  - » Optimization of the distribution/delivery routes and loading levels.
  - » Increase of large capacity tank trucks.
- Results
  - » Unit fuel consumption rate in products distribution/delivery decreased by 8% from 2006 to 2008, resulting in CO_2 emission reduction of 28,000 tons a year.

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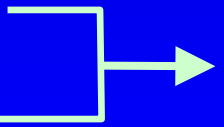
Bio-fuel : ETBE

- Bio-ETBE was introduced in 2007.
- It will be increased to 840,000KL by 2010, reducing 550,000 tons of CO_2 emissions a year.
- Nippon Oil will become a major supplier of ETBE in Japan.

Bio-ETBE

Bio ethanol C_2H_5OH

Isobutene C_4H_8



Bio-ETBE

Bio-fuel : Bio-Diesel

- Research work is being conducted together with a car manufacturing company on improvement of the product quality of bio-diesel via hydrogenation.

Rapeseed

Palm

Soybean

Vegetable oils

Direct Blend

Esterification

FAME

(Fatty Acid Methyl Ester)

Bio Hydrofined Diesel（BHD*）

BH-Fining Process

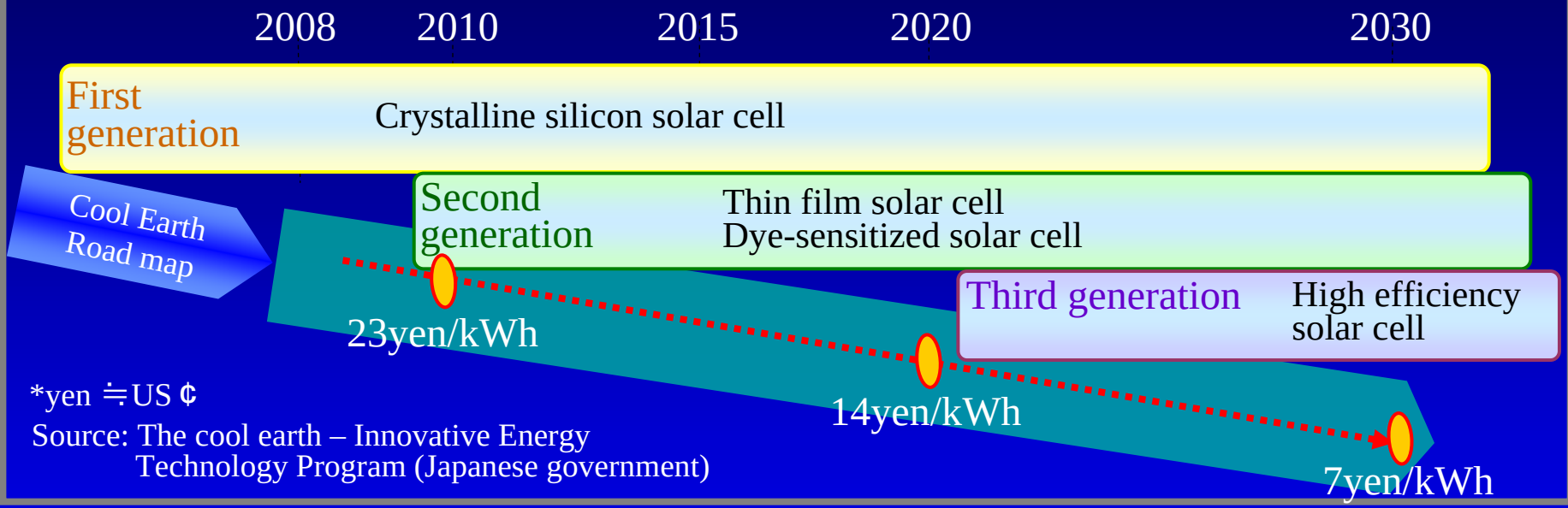
*BHD ・・Trademark of registration is now under application

Activities on New Energies

- Fuel Cell
  - » Nippon Oil has been conducting R&D on fuel cells extensively since 1990.
  - » Now Nippon Oil is marketing fuel cells as a home energy source, which would reduce CO_2 emissions by 30%.
  - » By 2008, 1,300 units have been sold, realizing CO_2 emission reduction of 1,600 ton/year.
- Solar Power (PV)
  - » Solar power is an important element in the Japanese government plan to reduce CO_2 emissions by 25%.
  - » Nippon Oil is marketing Solar power (PV) system for home use, aggressively implementing research and investment for higher efficiency solar cells.

Strategy on Solar Power Generation System

Roadmap of the Japanese Government



*yen ≒US ¢

Source: The cool earth – Innovative Energy Technology Program (Japanese government)

Strategy of Nippon Oil

First Generation

Development, manufacturing and marketing

Acquisition of 46% equity stake of Space Energy Corporation

Second Generation

Establishment of a joint venture SANYO ENEOS Solar Co. Ltd.

R&D of organic solar cell

Third Generation

Establishment of ENEOS Laboratory with Tokyo University

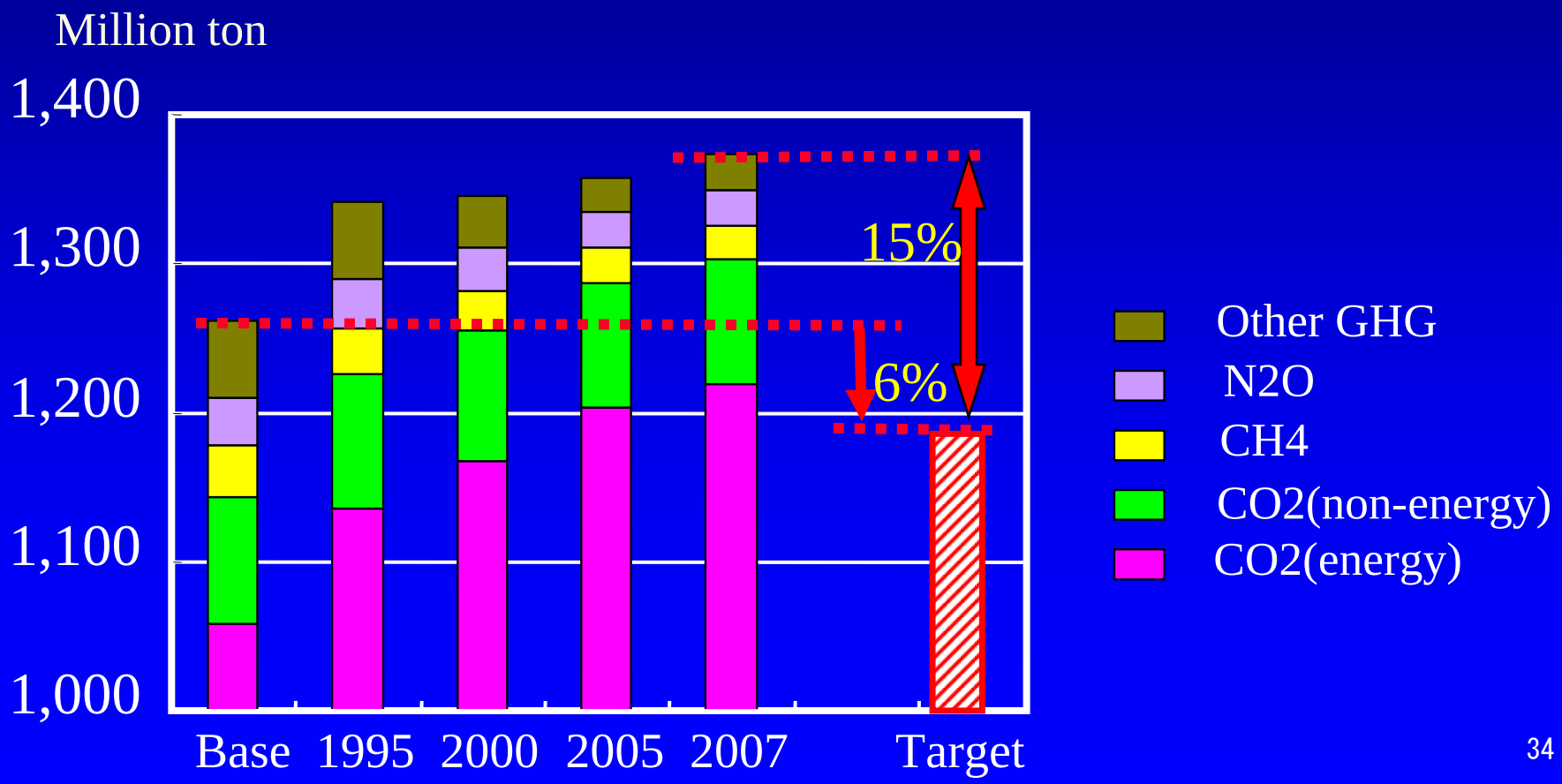
Thank you.

Contact : report@tky.ieej.or.jp

http://www.eneos.co.jp/english/index.html

Emission Reduction Target of Japan

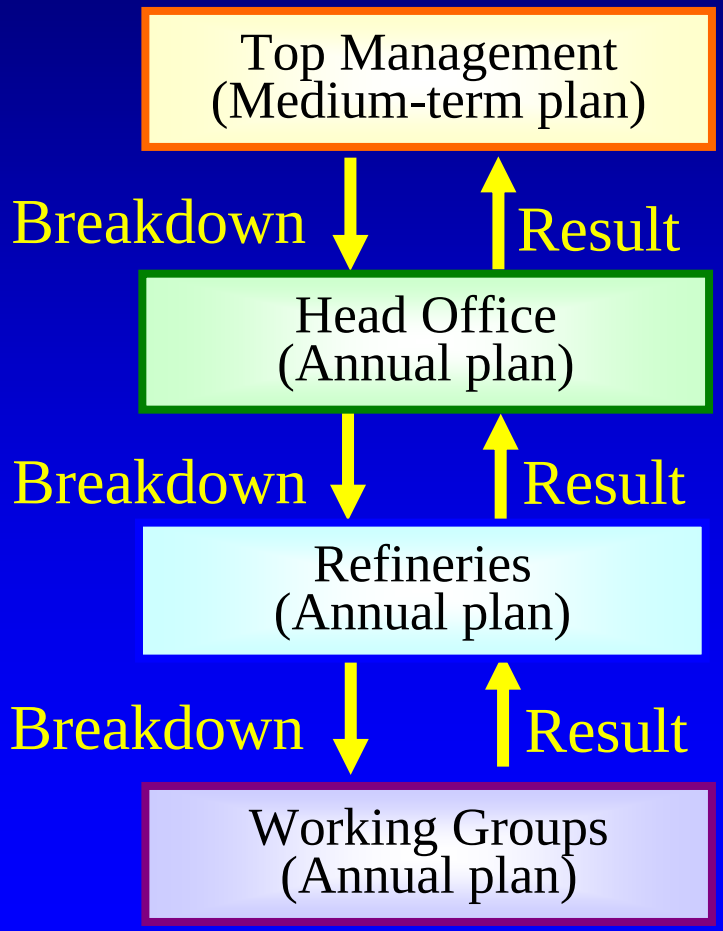
- Emission reduction target of Japan:
  - ▲6% (1990 → 2008-2012)



NEOS Activities by NPRC

<Nippon Petroleum Refining Company (NPRC) is a 100% owned subsidiary of Nippon Oil Corporation>

NPRC Efficient Operation Strategy (NEOS)



Plan (2008): ▲24,000kL
(▲63,000 ton CO2)

Achievement (2008): ▲69,000kL
(▲180,000 ton CO2)

Breakdown

- Optimization of operation: ▲10,000kL
- Heat exchange: ▲8,000kL
- Heat recovery: ▲5,000kL
- Reduction of O_2%: ▲4,000kL
- Reduction of venting of steam: ▲2,000kL
- Reduction of COT: ▲2,000kL

NEOS Activities at Refineries