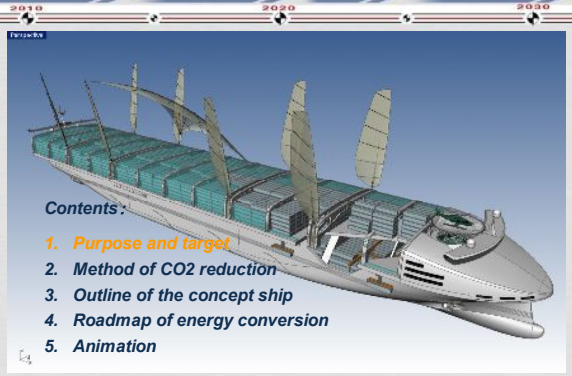
NYK Super Eco Ship 2030
- our concept ship in the future

16th Mar, 2010

NYK Line／MTI

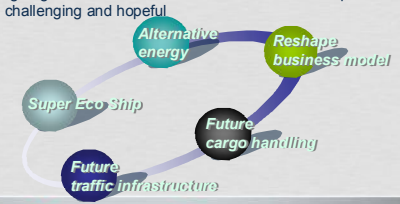


Contents :

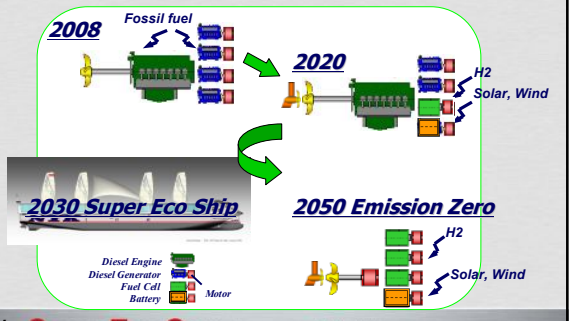
1. Purpose and target
2. Method of CO2 reduction
3. Outline of the concept ship
4. Roadmap of energy conversion
5. Animation

Purpose and Target

- To make it clear what NYK need to technically develop in the long term including alternative energy
- To lead to think future system of shipping, such as cargo handling and traffic infrastructure
- To appeal to young engineers/students in the world that the development of the future ship is challenging and hopeful



Road to "Emission Zero"



1. *Purpose and target*
2. ***Method of CO2 reduction***
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Means to Reduce the Emissions

A. REDUCTION OF POWER

- Reduction of weight
- Reduction of power for ships own use
- Reduction of frictional resistance
- Reduction of wind resistance
- Increase propulsion efficiency
- Increase motor efficiency
- Development of hull form

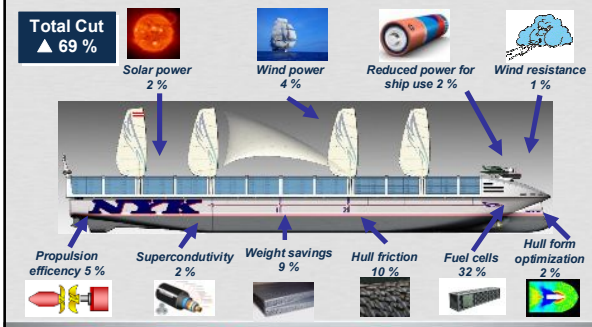
B. USE OF NEW TECHNOLOGY FOR POWER GENERATION

- Fuel cells
- Alternative fuels such as H2 and LNG

C. USE OF RENEWABLE POWER SOURCES

- Solar power
- Wind power

Reduction of CO2 Emissions



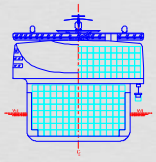
REDUCTION OF WEIGHT

REDUCTION OF SHIP'S WEIGHT

- NEW MATERIALS ▲3,000 ton
  - Extra high tensile steel and alloys
  - Composites
- NEW STRUCTURAL SOLUTIONS ▲5,000 ton
  - Enclosed hull girder
- MACHINERY WEIGHT ▲3,000 ton
  - Fuel cells
- OUTFITTING WEIGHT +/- 0 ton
  - To offset outfitting weight increase (sail, solar panel, self crane, etc.) by hatch cover less

REDUCTION OF DEADWEIGHT

- No ballast ▲6,000 ton
- Less fuel carried ▲2,500 ton
- Lighter containers ▲8,000 ton

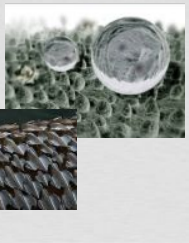


Total reduction of weight	**▲20%**
Reduction of CO2 emission	**▲9%**

Frictional Resistance

Hull Coatings

- Biofouling can increase the frictional resistance up to 15%
- Fouling release paints represent the latest method
- Coatings utilizing nanotechnology adapt ideas from the nature. Promising ones include shark skin and super-hydrophobicity, employed by the lotus leafs

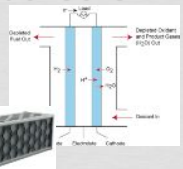


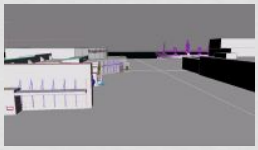
Air lubrication methods

- Friction can be reduced by decreasing the wetted hull surface.

Power Generation with Fuel Cells

- Converting chemical energy directly to electricity.
- Fuel cells are located inside container units.
- Enables power optimizing for each voyage and shifts all maintenance to shore.





Efficiency enhancement through WHR

- Waste Heat Recovery of low and high temperature cooling waters is implemented in order to maximize the efficiency.

Solar Power

Particulars

- 31,000 m2 on covers and sails
- Soft and clear solar panel

Irradiation

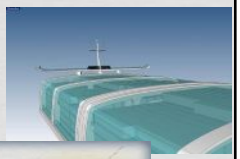
- Average 250W/m2 (Peak 1,400W/m2)

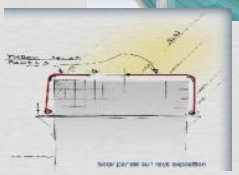
Conversion factor

- 2030 - 30% (current 16% for ship)

Energy

- Average 1～2MW

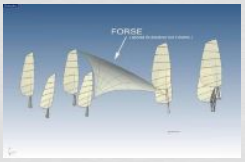




Sails

Specifics

- Air foil with high aspect ratio, rounded tip is most efficient.
- Solar cells on foils
- Foils can be taken down when the wind conditions are not favorable in order to avoid wind resistance.



Driving Force

- 8 foils x 500 m2
- Driving force corresponding average 2.5 MW

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4. *Roadmap of energy conversion*
5. *Moving image*

July 09 Super Eco Ship

Ship's Particulars

8,000 TEU / 25 knots Basis	MV "NYK VEGA" (built in 2006)	Super Eco 2030
Length	338m	353m
Width	45.8m	54.6m
Design Draft	13.0m	11.5m
Required Power	Diesel Engine (HFO)	Fuel Cell (LNG)
	64MW	40MW
Renewable Energy	None	Solar : 1-2MW
		Wind : 1-3MW
CO2 Emission	195g/TEU-mile (100)	62g/TEU-mile (31)

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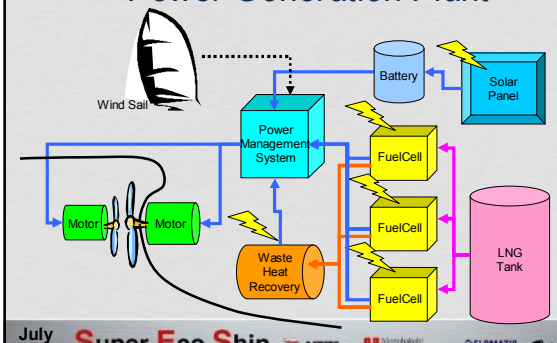
Power Generation Plant



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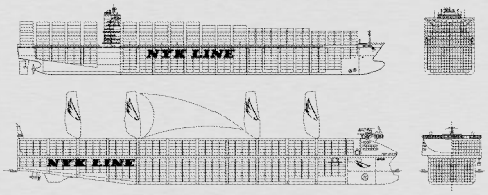
Increase of Max Loadable Capacity



- By switching fuel cells from a diesel engine, loadable space increases from current 91% to 97%

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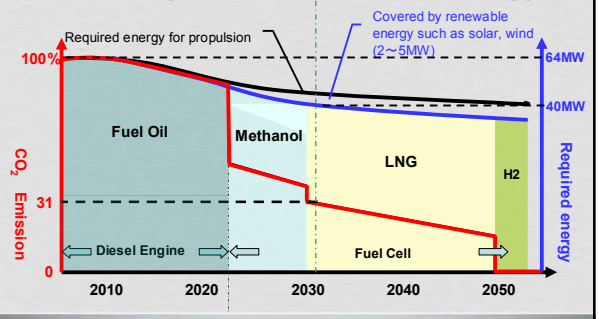
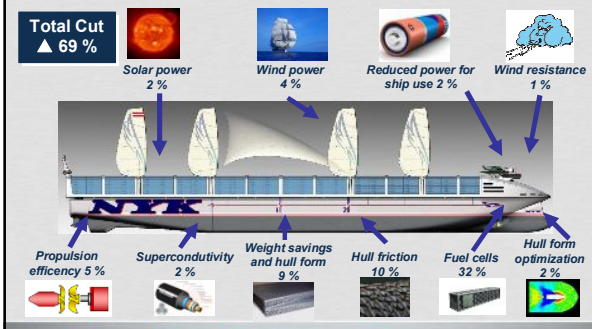
Road Map of Fuel Cell Technology



Reduction of CO2 Emissions



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Thank you
NYK COOL EARTH PROJECT
The Earth is Our Home