



IMPROVING EFFICIENCY OF THE FLOATING ELECTRICITY POWER GENERATION WITH INTERNAL COMBUSTION ENGINES



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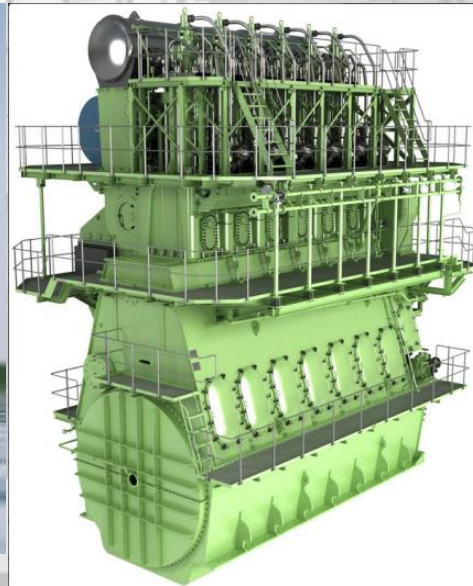


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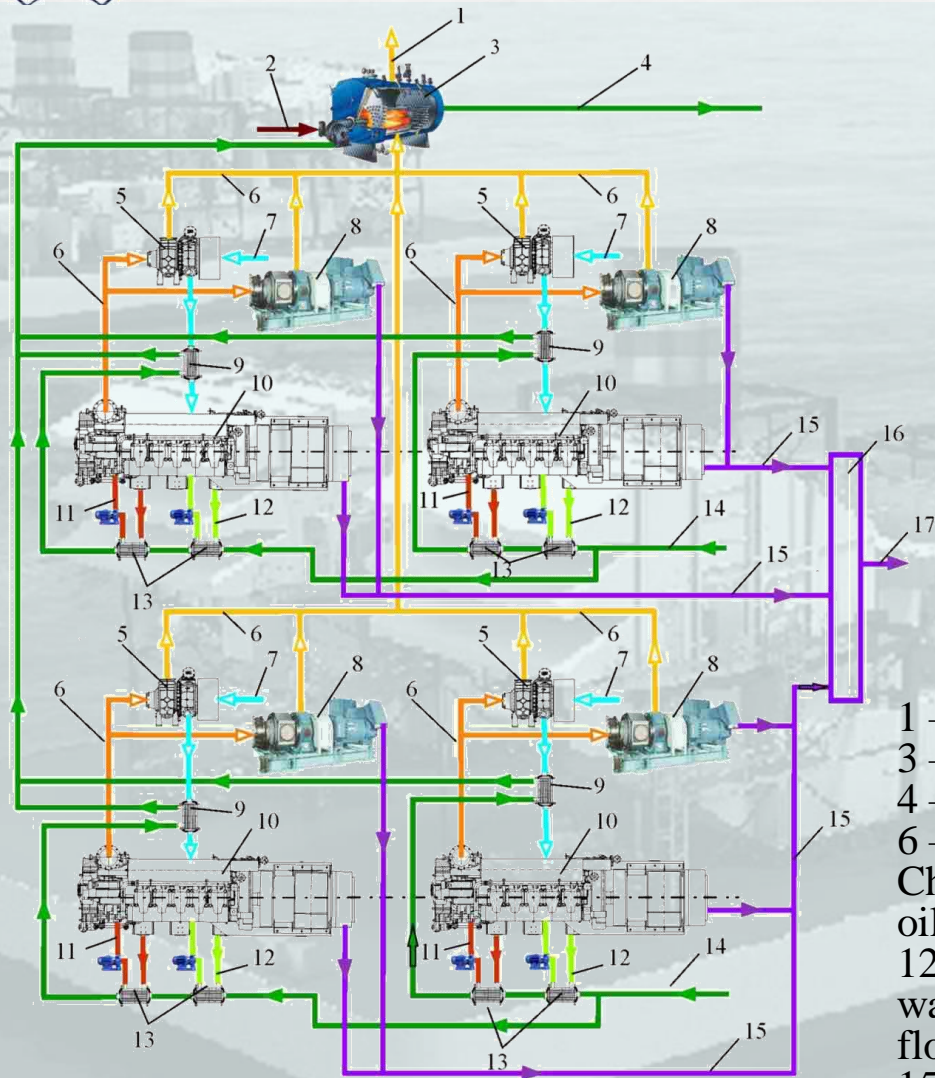
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Floating power plant, which supplies coastal customers with electricity nearly 100 MW. However further efficiency increasing is possible due to power electronic progress and appearance back-to-back power converters. It allows to operate with variable speed diesel-generator.

Simplified general diagram of the floating power facility based on green diesels 4×12G90ME-C10.5-LPSCR

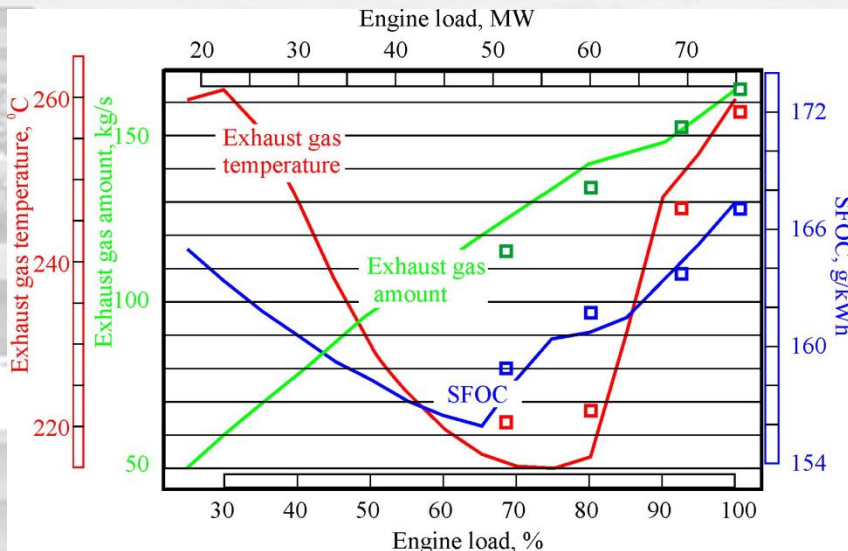


As an example of one of the possible options for a circuit solution for efficient electricity power and heat installation for floating power plant based on a green low-speed two-stroke crosshead reciprocating engines MAN B&W 12G90ME-C10.5-LPSCR with maximum continuous rating MCR power of 74.88 MW, is chosen.

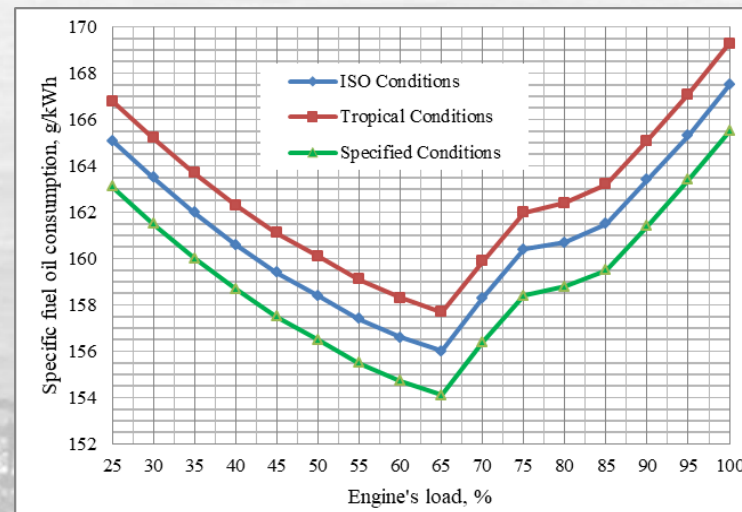
Total facility electricity power is 334.5 MW, including 35.3 MW from gas-turbine generators. Total heat power to customers is 95.7 MW.

- 1 – Exhaust gas into environment, 2 – Additional gas fuel,
- 3 – Combined gas and heat recovery boiler,
- 4 – High Temperature liquid carrier, 5 – Turbocharger,
- 6 – Exhaust gas, 7 – Charge Air, 8 – Turbo-generator, 9 – Charge Air Cooler, 10 –reciprocating engine, 11 – Lubricating oil,
- 12 – Cooling water, 13 – Lubricating oil and fresh cooling water Cooler's, 14 – High temperature liquid carrier reverse flow,
- 15 – Electricity, 16 –Distribution unit, 17 – To Consumers.

Specific fuel oil consumption and exhaust gas output data in dependence of engine's load.



Ambient condition influence on specific fuel consumption at engine load in a range of 25-100%.



Main indexes of the floating power plant equipped with four low speed 12G90ME-C10.5-LPSCR engines

Energy source	Electricity, MW	Heat, MW	Fuel consumption, t/h	Specific fuel consumption, g/kWh	Electricity production efficiency	Total fuel using efficiency
4×12G90ME	299.2	95.7	49.61	165.5	0.508	—
4×Turbo-generator	35.3	0	0	0	—	—
Total	334.5	95.7	49.61	141.4	0.569	0.731

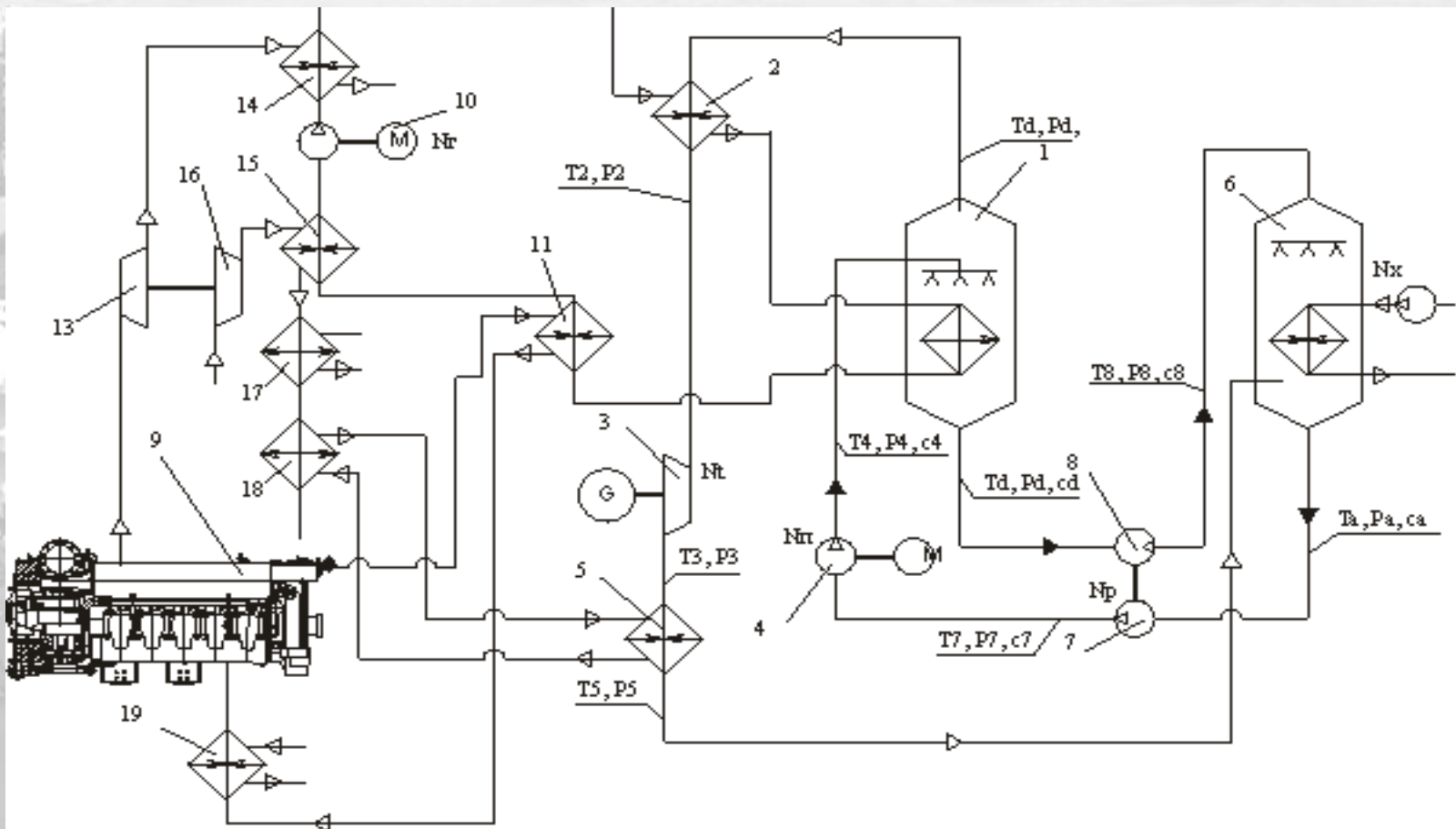
Powerful low-speed engines implementation is possible for vessels with grate displacement tonnage and draft more than 10 m. The most preferred areas of application for such facilities are deep-water ports and other similar locations.

Middle power low-speed dual fuel engines as electro-generator's drivers will be effective for floating power plant which may operate at shallow sea depths and river's areas due to less engine's mass, dimensions and vessel's draft.

Dual fuel low-speed diesel engines **X62DF** series are efficient for regions with some deep-water restrictions. These engines have significant advantages due to possibility to operate with gas fuels, as well as heavy liquid one.

Energy source	Electricity, MW	Heat, MW	Fuel consumption, t/h	Specific fuel consumption, g/kWh	Electricity production efficiency	Total fuel using efficiency
4×12G90ME	84.4	33.8	14.40	180	0.468	–
4×Turbo-generator	9.3	0	0	0	–	–
Total	93.7	33.8	14.40	154	0.495	0.722

The simplified diagram of low-grade heat recovery on thermochemical base with metal-hydride energy converting



1 – Desorber, 2 – Super-heater, 3 – Expansion machine, 4 – Slurry pump, 5 – Heat exchanger, 6 – Adsorber, 7 – Recuperative pumping section, 8 – Turbo-pump unit.



Conclusions

The usage of the low-speed internal combustion engines of high and medium power as the main drives of an electric generator for floating power plants seems to be an effective solution in the way of reducing electricity cost. Low-speed engines implementation become possible due to high efficient multi-pole generators, which was elaborated at last time. Specific fuel consumption is in a range of 0.155...0.165 kg/kWh for low-speed engines with maximum continuous rating power 40...100 MW.

These engines have significant advantages among conventional middle-speed engines: less specific fuel consumption, possibility operation with low-cost heavy fuel and gas and friendly to environment.

The way is implementation of developed low-grade waste heat recovery system, which includes electro-turbo-generator for additional electricity production. It allow to increased total electricity production efficiency up to 12% for powerful low-speed engines and up to 11% for middle power engines.

Implementation of the metal-hydride facility for extra low-grade heat recovery allows to increase the efficiency of floating power plant on 2...5% depending on heat potential and equipment content.

THANK YOU