SUBJECT: 'ONBOARD CO_2 CAPTURING: TURNING EMISSION TO FEEDSTOCK FOR SYNTHETIC FUELS'

Two main strategies can be distinguished to reduce the CO_2-emission of ships as drastically as will be required to fulfil the goals of the IMO and the 'Paris Agreement'. The most 'popular-to-discuss' strategy is on the transition to non-carbon-fuels like hydrogen, ammonia or batteries, which require quite some development before real-life solutions can be implemented and have their effect on limiting climate change. The second strategy is capturing CO_2 from the exhaust gasses from regular combustion engines burning regular carbon-fuels, using proven technology from land-based plants and focus on the development of maritime applications. Big advantage is that existing engines do not need a lot modifications and the technology can be developed within a rather short time.

Capturing CO_2 is a fairly new technology on board vessels, storing it on board in such a way that it can be unloaded in a logistical system in a port is another challenge. In LNG-driven vessels there are interesting possibilities:

- gas-engines on LNG produce rather clean exhaust gasses, reducing emissions of SO_x, NO_x and PM (sooth) to low/acceptable values, requiring a less-complex CO_2-capturing system;
- LNG is bunkered in the vessel at minus 163^0 Celsius and this can be used to cool down the captured CO_2-gasses to the liquid phase, storing liquid CO_2 in regular CO_2-tank-containers on the vessel.

The R&D-project is investigating use-cases/pilot-designs on the heat-balance of cold LNG, hot exhaust-gasses, high and low temperatures required in the capturing process etc., aiming at a percentage of CO_2 that can be captured and stored efficiently between 60 and 90%.

The captured CO_2 can today be re-used in food-industry and greenhouses (to increase the growth-rate of tomatoes for example). For the future of the 'Hydrogen-economy' it is expected that the containerized liquified CO_2 will be a valuable feedstock for the production of synthetic carbon fuels: when large quantities of hydrogen (H_2) will be produced using solar- or (excessive) wind-energy, synthetic fuels can be produced out of H_2 and CO_2 , like methane (CH_4) or methanol (CH_3OH). These synthetic fuels can be the 'hydrogen-carriers' that can be bunkered in a ship (better than liquid or pressurized H_2) and Liquified Synthetic Methane CH_4 is the same molecule as the main content of LNG (abt. 80% CH_4). It is also liquid at minus 163^0 Celcius and can be bunkered in exactly the same tank with the same systems as the actual LNG-systems. The infrastructure on board and on land will stay the same and the actual developing LNG-infrastructure and ships can still be utilized in the 'Hydrogen-economy' of the future, providing the CO_2 is captured and re-used, creating a non-fossile CO_2 cycle.