LNG BINNENVAART
Deployment in Inland Waterway Transport

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Breakthrough LNG Deployment in Inland Waterway Transport

3.2 Pilot study on proposed solution for the Capex/Opex paradox

4.3 Development of total cost-of-ownership model and financing constructions

Study on innovative financing for LNG in IWT

Rotterdam; the Netherlands
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Abbreviations

- BAU: Business as usual
- CAPEX: Capital Expenditure
- CO2: Carbon dioxide
- CUM DCF: cumulative discounted cash flow
- CSR: Corporate Social Responsibility
- CCNR: Central Commission for the Navigation of the Rhine
- DCF: Discounted cash flow
- DPF: Diesel particulate filter
- GTL: Gas to liquids
- IWT: Inland Waterway Transport / IWW: Inland Wateray
- LNG: Liquefied Natural Gas
- MGO: Marine gasoil
- MT: metric tonnes
- NOx: Nitrogen Oxide
- OPEX: Operational or Operating Expenditures
- P/H: Power by the hour
- PM: Particulate Matter
- SCR: Selective Catalytic Reduction
- SECA: Sulphur Emission Control Areas
- SOx: Sulphur oxides
- TCO: Total cost of ownership
- WACC: Weighted average cost of capital

1 Introduction

LNG has the potential to improve the already strong environmental performance of the IWT sector. The successful deployment of this relatively clean fuel means an improvement of the competitiveness of IWT as compared to other modalities and will result in environmental benefits as compared to the situation in which traditional fuel (diesel) is being used.

There are a couple of bottlenecks hindering the desired deployment of LNG in the IWT sector, the main bottleneck is financial. The financial bottlenecks can be regarded as the non-availability of capital for investments in greening techniques, in order to lower air pollutants and/or climate change emissions. This is mainly due to a lack of positive business cases, either with or without public funding combined with high risk levels for the ship owner who needs to make the investment.

This study will provide insight into the background of the financial bottlenecks and investigate possible solutions which can lower the financial hurdle and stimulate IWW shipping companies to invest in LNG driven vessels.

2 Approach

This study covers two sub-activities, these are:

- 3.2 Pilot study on proposed solution for the Capex/Opex paradox;
- 4.2 Development of total cost-of-ownership model and financing configuration.

Sub-activity 4.2 includes actually two deliverables, the TCO model and the study on financing configurations. The TCO model is already launched. Given the strong similarities and connection in subject, the pilot study on the Capex/Opex paradox and study on financing configurations will be combined into one study. A possible solution on the Capex/Opex paradox, being a new financing configuration, can actually be seen as a part of the overall study on financing configurations.
The pilot study on proposed solution for the Capex/Opex paradox will be performed by PON Power, whereas the study on financing configurations will be performed by EICB.

The pilot study on the Capex/Opex paradox will be based on desk research and interviews with legal/financial experts in field as well as with ship owners to assess the proposed solution. The study on financing configuration will be based on desk research.

3 The financial bottleneck

Previous research in this project provided insight into the costs and benefits of investments in LNG propulsion for IWW vessels.[1] The additional investment costs for LNG as compared to a conventional diesel propulsion are considerably higher. On the other hand, in most cases there is a lacking business case due to the marginal (and volatile) price spread between the bunkering prices for LNG and diesel in IWT. Due to the marginal price spread the business case is only interesting for ships consuming a relatively large amount of diesel on an annual basis of approximately at least 500/600m^3.

However, despite the presence of a positive business case, the payback period is usually relatively long, for example a payback period of 10 years is not uncommon. In the overall Western European IWT approximately 55% of the assignments of ship owner/operators is traded on the spot market and does not concern longer term relationships with the shipper, broker, cooperative or other shipping companies.[2] As such, the majority of IWW shipping companies can't guarantee positive business prospects over the long-term, which makes it risky and perhaps even irresponsible to make investments with a payback period of ~10 years.

A factor at play is also the reluctance of commercial banks in recent years for providing financing for investments in LNG, since LNG is although cleaner as compared to diesel but is still a fossil fuel.[3]

This multifaceted financial bottleneck can be lowered by addressing one or more aspects of the problem, for example by:

- Taking the risk (partly) away from the IWW shipping company;
- Lowering the investment costs;
- Securing a price spread between LNG and diesel;

[1] Previous research within activity 1.1 'Execution of ex-ante cost/benefit analyses for the best available LNG technologies for vessels' which can be found on https://lngbinnenvaart.eu/downloads/. The TCO model also provides insights as regards the costs and benefits, the model is published on the website https://tcomodel.eu/.

[2] PLATINA II, 2015, Market & Awareness ,D 1.5:Analysis of Possibilities to Enhance Market Transparency and Synergistic Actions.
[3] Based on discussions with experts in field.

- Securing long term contracts with shippers.

These are just a number of aspects which could be integrated in a new financing configuration which can stimulate investments in LNG and eventually contribute towards a more sustainable modality.

4 Possible financing configurations

A lot of the stated financial bottlenecks also apply to investments in other greening techniques. Up till now a number of studies and initiatives have been performed on possible financial solutions to lower the financial bottlenecks for investments in greening techniques, as such also for LNG.

The European H2020 project PROMINENT provided different scenarios to help the entire European fleet towards EU Stage V emission levels.[4] This development would require an investment of at around 1 to 2 billion euro[5] . A promising scenario included a funding and financing mechanism based on pooling of grants, possibly combined with an environmental (differentiated) surcharge on fuel. Based on the revenues from the surcharge and/or additional funds from governments, greening the fleet investments can be funded/financed, possibly backed by EU financial products. This concept has similarities with the Norwegian NOx fund principle.[6]

A relatively new concept is the modular (battery electric) powertrain application for short distance container shuttles by barge. A consortium is developing a concept and business offer to adapt existing vessels to electric powertrains with 'energy as a service' contracts.[7] Energy as a service means that the investment in batteries, maintenance, charging and logistics is taken care of by service providers. Consequently, the ship owner/operator pays for the energy usage itself and not for the batteries. The owner/operator however still needs to invest in the electric platform on the vessel (electric motor, wiring, control systems, etc.). Currently this concept is only economically viable with a minimum number of 50 vessels. A similar concept could also be developed for LNG.

'Fonds Verduurzaming Binnenvaart', a Dutch study, conducted a feasibility study on a fund made of public and private contributions, however this appeared not feasible due to a lack of resources to fill a fund and divergent financial interests of participants as well as level playing field issues with neighbouring countries.

[4] http://www.prominent-iwt.eu/wp-content/uploads/2018/07/2018_04_30_PROMINENT_D6.3_D6.5_Combined_Deliverable.pdf
[5] Based on technologies LNG retrofit or after treatment (DPF and SCR), overall investment sum depends on market share of LNG
[6] https://www.nho.no/samarbeid/nox-fondet/the-nox-fund/
[7] Consortium consisting of Heineken, Engie, Eneco, CTT, Wärtsila, ING Bank, Port of Rotterdam

Furthermore, discount on port dues and guarantee programs have been developed and studied for investments in environmentally friendly techniques (e.g. Green Award). However, the financial impact of these incentives is limited. Tax exemption could also be an efficient tool to support the deployment of environmentally friendly techniques. The same goes for a number of other measures such as existing European and national Grant schemes dedicated for IWT and innovative financing instruments (crowdfunding, microfinancing, loans from credit unions, etc.)[8] for the IWT sector.

A specific financing configuration to be analysed in-depth is the configuration which can potentially solve the Capex/Opex paradox. As stated before, the investment in LNG is relatively high, in some cases there is a positive business case but the payback period is relatively long. As such, there is a paradox since the Capex and Opex are not in one hand. The following chapters will dive into the matter.

[8] https://www.eicb.nl/wp-content/uploads/2016/08/EICB001-18_rapporten-LNG_02_dynamisch.pdf

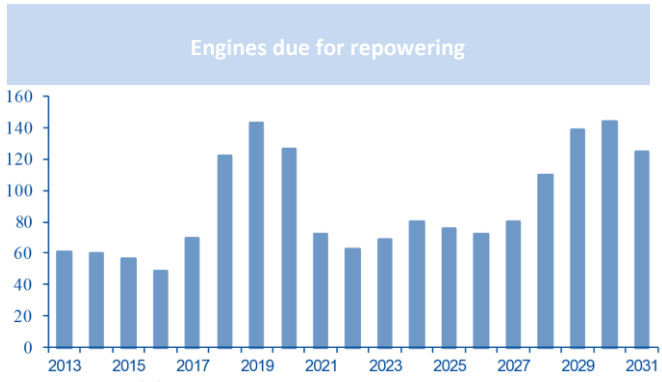
5 The Capex/Opex Paradox

5.1 Introduction

LNG solutions can reduce the total cost of ownership for a selection of heavy duty vessels, making it the most attractive greening solution. Yet, several market barriers exist that need to be addressed. Innovation processes are slow due to long vessel lifetime, low management capacity in the sector, and insufficient incentives. An overall vision within the IWT sector is missing and on contrary there is a focus on the short term. Furthermore, many vessels are highly leveraged and the Capex and Opex related to an LNG investment are not in one hand. Consequently bank financing of LNG solutions is problematic. The proposed solution for this 'Capex/Opex paradox' aims to (indirectly) alleviate the barriers.

PON has the opportunity to utilize a new financing concept to stimulate the further roll-out of LNG in IWT. The company has a large installed base and specific knowledge of the sector due to its maintenance and monitoring program. For example, a peak in repowering demand is expected between 2018 and 2023 which can also be seen in figure 1 below. This time period should be utilized to equip vessels with LNG propulsion systems.

Figure 1: repowering



Source: own elaboration

The installed base of PON consists of more than 3600 CAT engines, an initial analysis indicates 525 existing vessels can be considered similar and suitable for a retrofit solution. An initial selection of 10 vessels will provide a suitable proof of concept.

5.2 The investment proposal

The investment proposal comprises the following innovative financing concept:

- An investment pool (legal entity) that will finance the investment in LNG propulsion for 10 vessels;
- 50% of the required investment will be co-funded with grants[9] (this is currently also required for a positive business case);
- The pooling entity will conduct repayments (including interest) to the investors based on realised fuel cost savings;
- Investing in 10, strictly selected, vessels will strongly reduce investment risk and realise economies of scale;
- Participants in the investment pool might also be able to contribute to the work to be done;
- Participating in the pool will accelerate the transition to a more sustainable IWT sector.

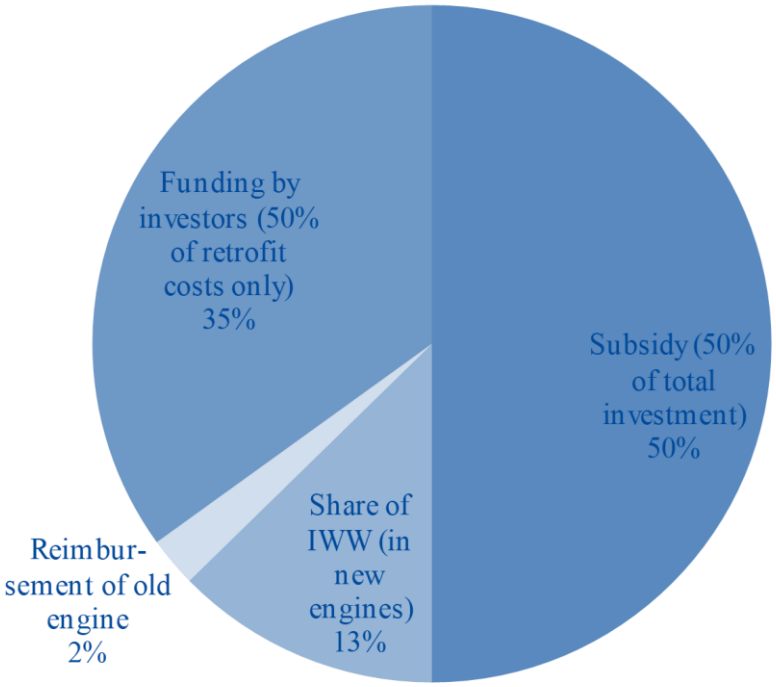
Arrangement per vessel (project):

- Repowering of the vessel (including work done, retrofitted engine(s) and cryogenic equipment);
- Long term fuel contract with an oil major, providing a guaranteed spread with conventional diesel fuel;
- Contract in place with the investment pool, arranging a debt amortization scheme and direct 50% payment of the optional new engine(s) (less reimbursement of old engine);
- Providing cryogenic tank as a securitization.

The investment proposal is visualised in figure 2.

[9] The financing construction will, given the scope of this project, also assume the presence of stimulation in the form of grants.

Figure 2: The investment proposal



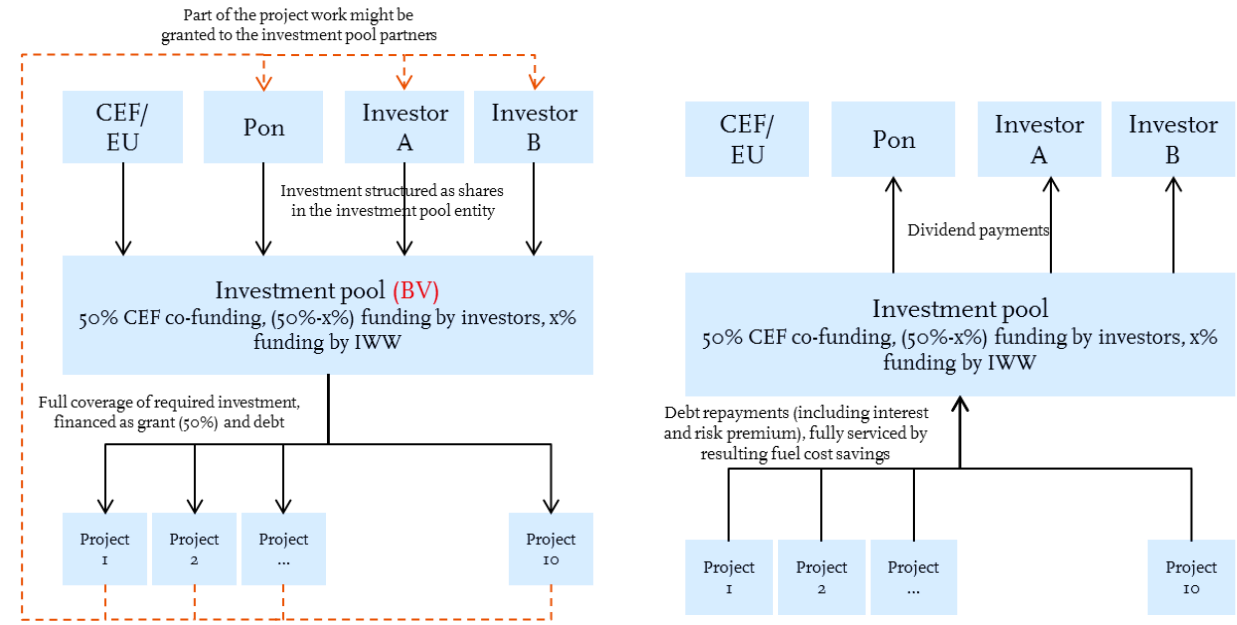
Source: own elaboration

5.2.1 Pooling entity

- The pooling entity is a legal entity (BV) funded by the shareholders;
- The pooling entity will apply for grants;
- The pooling entity will have prior commitment with an oil major, that will commit itself to a fixed fuel cost spread for the 10 selected IWW vessels;
- The pooling entity will contract a main contractor for retrofitting 10 IWW vessels;
- The pooling entity will enter into contract with IWW operators, representing 10 IWW vessels, in which the operator and pooling entity will agree to:
  - repower the vessels to be suitable for LNG;
  - a fixed repayment scheme with interest, based on expected fuel cost savings;
  - securitization of the to be installed cryogenic tank.

The pooling entity and its relation to the other parties in the financing configuration can be visualised as follows:

Figure 3: Position of the investment pool



Source: own elaboration

5.2.2 Investor profile and grant conditions

- Investor profile:
  - (sub)contractor to the pool (e.g. PON, CAT, Shell, Damen, Cryonorm);
  - shipper with strong CSR profile (e.g. Unilever, Ahold, Akzo Nobel, BASF);
  - charterer/large fleet owner (e.g. Danser, Chemgas, Jaegers shipping).

- Investor characteristics:
  - preferably additional benefits from investment (project margin, CSR profile, etc.);
  - investment capabilities.

- Grant conditions:
  - preferably international;
  - part of study with deployment.

5.2.3 Proposition towards IWW: activities and innovative financing concept

- The IWW operator will receive:
  - CAT LNG Engine;
  - Turnkey retrofit of the vessel with pre-selected contractors (e.g. LNG fuel tank and integration);
  - LNG contract with LNG supplier, setting a price (relative to another fuel) and guaranteeing availability under certain conditions;
  - Service contract from PON Power;
  - Training regarding operation of LNG equipment;

- Payment based on a contract with the pooling entity, the duration depends on the payback period based on the calculated fuel cost savings
  - A periodic fee:
    - Amortization;
    - Interest;

- Possibly a percentage of the total investment upfront.

- Providing:
  - Securitization of LNG tank;
  - Guarantee of parent company.

5.2.4 Proposition towards IWW: value proposition

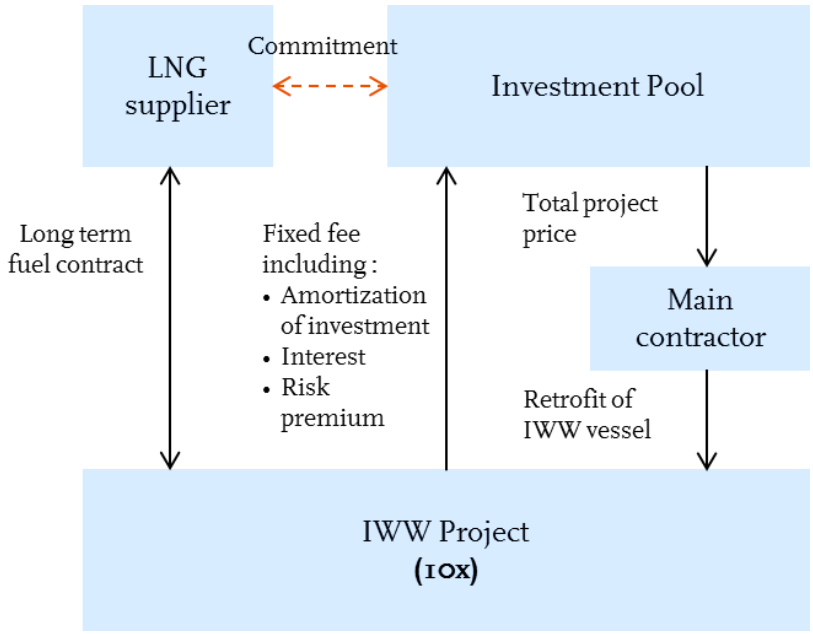
- The IWW operator with an existing vessel will receive the following value proposition that covers liability of newness:
  - Addressing the CAPEX/OPEX paradox by a pooled investment for 10 IWW vessels, backed PON, an LNG supplier and grants;
  - Able to pay back the investment made by the investment pool through the long term fixed fuel cost savings per ton of fuel. Thus, in the end it will not be the IWW operator to invest in the LNG propulsion, however the fuel savings will also not end up with the IWW operator. Therefore, the investment in an LNG installation will eventually have no direct financial impact on the IWW operator. However, the IWW will indirectly reap the benefits, for example from beneficial public exposure, reduced port dues and ability to use both traditional fuel and LNG as a transport fuel.

- To alleviate further barriers the investment pool provides further support through a contractor:
  - Assisting in obtaining a long term time charter with a shipper;
  - Supply adequate regulatory support if requested;
  - Supply an adequate training for the IWW operator;
  - Provide a lease or rental configuration for the cryogenic LNG tank.

5.2.5 Project Structure

The project structure and relationship between the various partners in the configuration can be visualised and summarised as follows:

Figure 4: The project structure



Source: own elaboration

5.2.6 Target Selection

- Target customers are selected based on:
  - Large, financially stable operator (able of providing guarantees);
  - Fuel consumption > 750 ton MGO per year;
  - Predictable demand, suitable 'sailing habit';
  - Cross section of fleet segmentation (based on function) but with best performance in fuel pyramid;
  - Age of vessel;
  - Suitable for retrofit, dominant design.

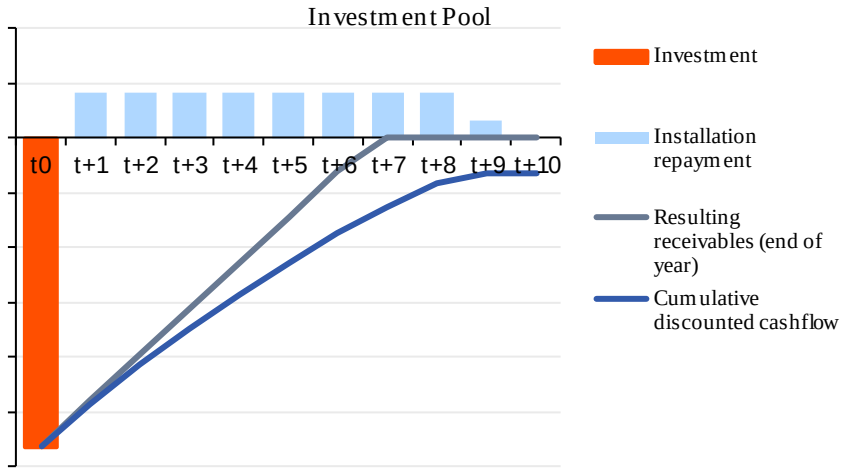
- Out of a preliminary search 5% of the installed base is very suitable for an LNG retrofit with the right characteristics for this proposition:
  - This equates to 26 vessels with a CAT engine out of the selected installed base.

5.3 Business Case

5.3.1 From Investor Perspective

- Investors participate in a pooled, 50% subsidised investment;
- Investors will receive debt repayments and interest payments out of realised fuel cost savings by IWW vessel operators;
- The depicted number indicate the total investment (after subsidy);
- Depending on the interest rate applied, the investors will receive a certain IRR;
- The main risk lies in bankruptcy of IWW operators, no upsides exist;
- The NPV remains negative as the applied base interest rate of 5% is below the applied discounting factor of 8%.

Figure 5: Business perspective from investor perspective



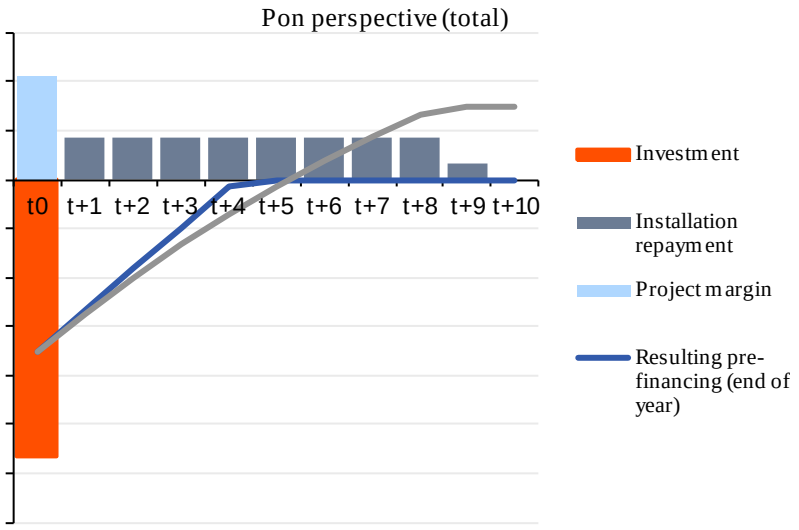
Total Prefinancing	€	5 640 150
Yearly amortization	€	840 000
Years to cash neutral position (no interest)		6.7
NPV (10 year)	€	649 187-
IRR Investor (total)		5.0%

Source: own elaboration

5.3.2 From PON Perspective

- PON will act as an investor in the pooling entity and as a (sub)contractor to the pooling entity;
- The investor role will yield interest, the contractor role will yield project margin;
- In the base case scenario PON will initially fund 50% of the pooling entity (after grant);
- As the project margin, resulting from retrofitting 10 vessels during year t=0, will be a cash in directly, the value at risk will be € 1.7 million;
- Significant sensitivities are:
    - Bankruptcy of IWW operators;
    - If PON has to fund a smaller share of the investment pool, the realised IRR will increase;
    - Higher than anticipated retrofit costs.
- Actual value at risk will be lower if the retrofit installation will not take place simultaneously for all 10 vessels.

Figure 6: Business perspective from PON perspective



Total Prefinancing	€	2 820 075
Project margin	€	1 068 323
Yearly amortization	€	420 000
Years to cash neutral position (no interest)		4.2
NPV (10 year)	€	743 729
IRR Pon (total)		18.0%

Source: own elaboration

6 Power by the hour

The proposed financial configuration for the Capex/Opex paradox could be further strengthened by applying the 'power by the hour' principle. An important and rather radical prerequisite of this principle is the modular configuration of an IWW vessel, easily adaptable as regards installed power and type of fuel per trip. Consequently, technically only newbuild vessels would fit for the application of this principle in its purest form, since adjusting existing vessels to this concept would be simply not feasible (both from a technical and financial perspective).

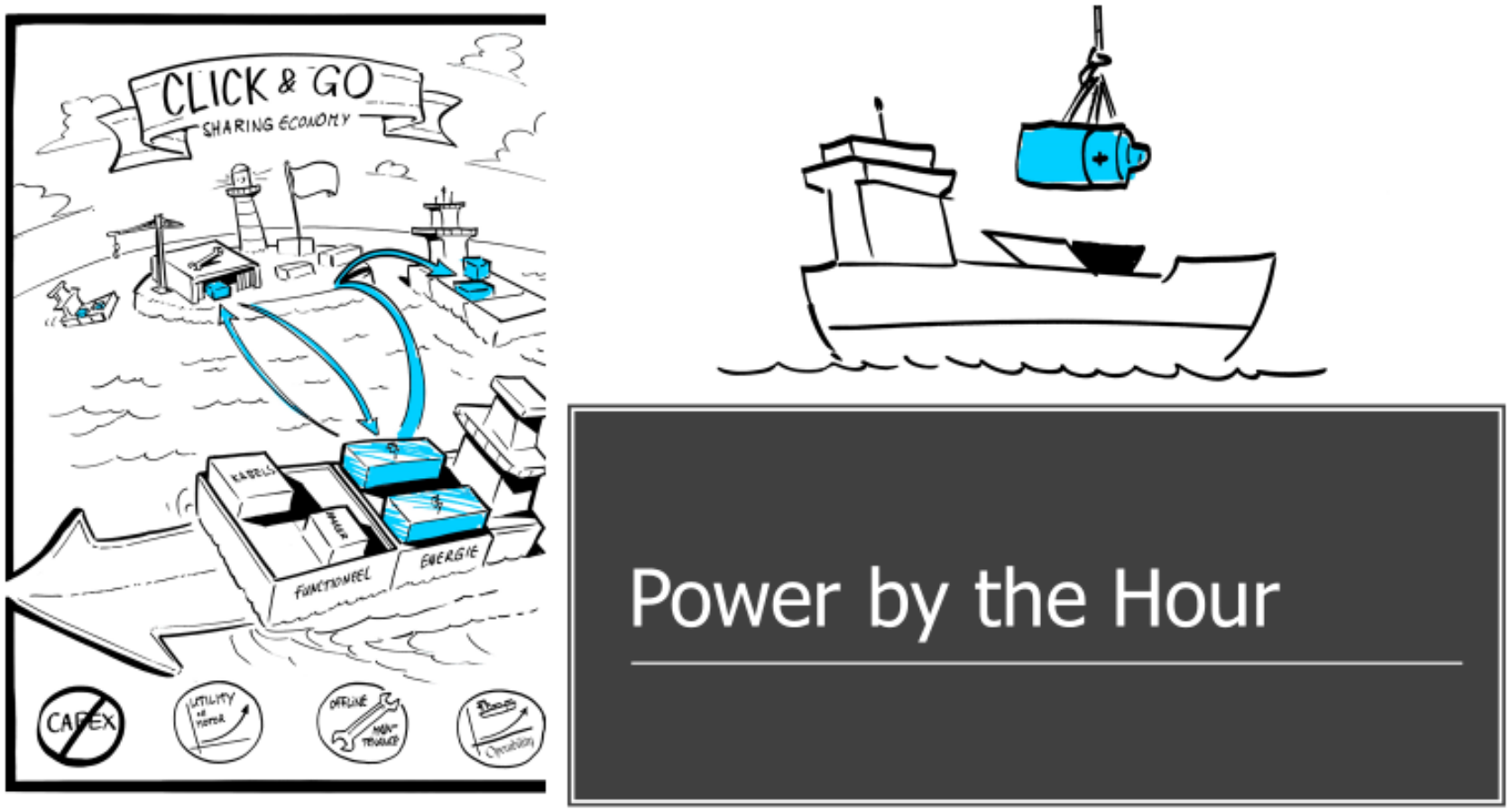
The advantages of a power by the hour concept is that IWW would can easily adapt their vessel to the specific trip with its specific power requirement, and perhaps later on also fuel requirements due to (local) environmental regulations. This will considerably improve the efficiency of the vessels, since most vessels have currently too much power installed on board of the vessel. The required propulsion power is being determined by the characteristics of the vessel and even more by the boundary conditions of the waterway. For most vessels more than 50 % of the installed power is only utilised during upstream trajectories on free flowing river sections with sufficient high water depth and such power is also required for manoeuvring. However, on smaller channels or downstream sections only a limited amount of power is applied. Where the keel clearance is small, excessive power use results in increased squat and consequently may cause grounding.[10]

Another major advantage for the IWW operator would be that maintenance and monitoring of the equipment will be taken care of and is consequently part of the service contract.

The power by the hour principle concept is being visualised on the next pages with a number of drawings.

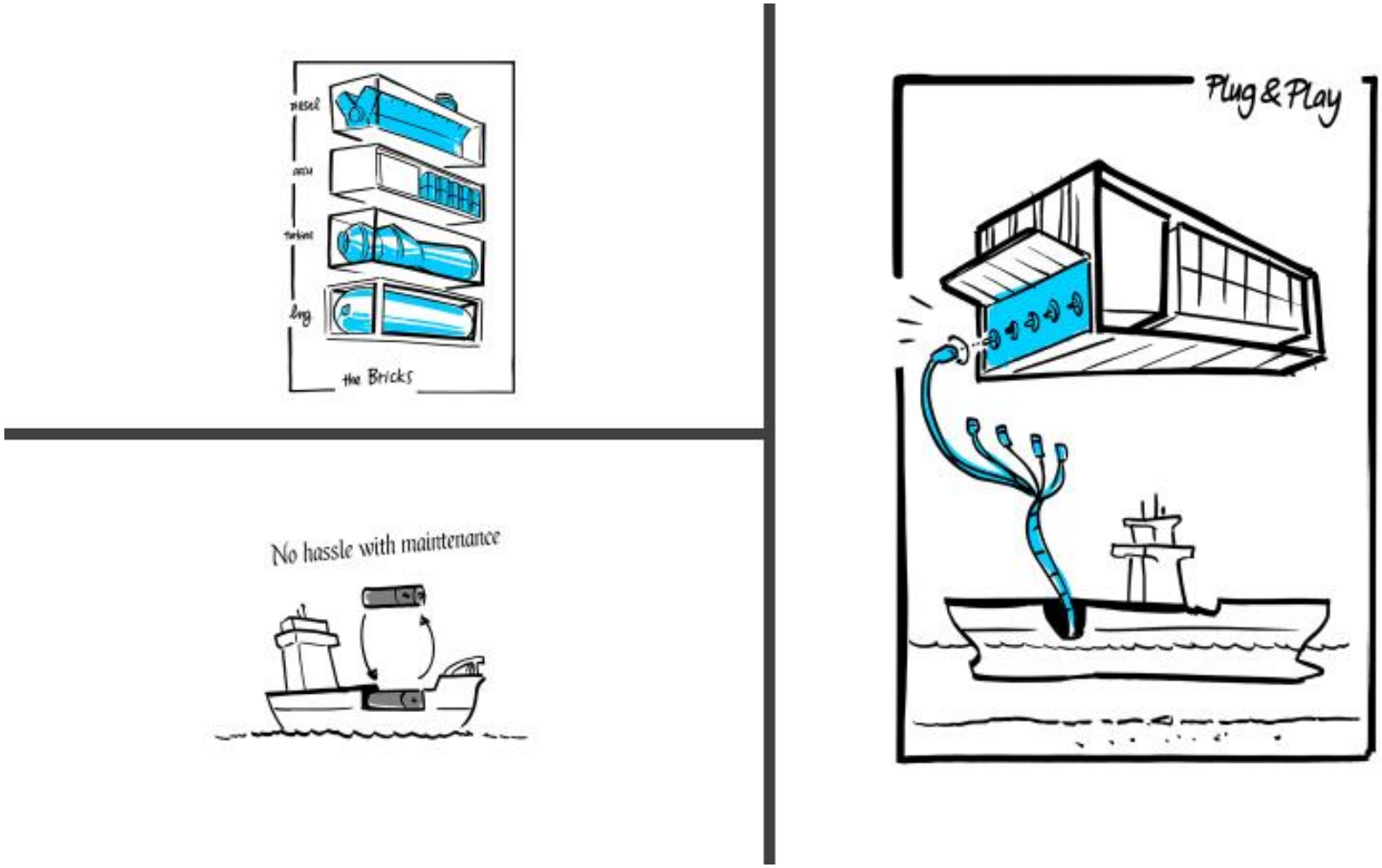
[10] http://www.prominent-iwt.eu/wp-content/uploads/2015/06/2015_09_23_PROMINENT_D1.1-List-of-operational-profiles-and-fleet-families-V2.pdf (p.53)

Figure 7: Power by the hour concept 1/2



Source: own elaboration

Figure 8: Power by the hour concept 2/2



Source: own elaboration

7 Potential of proposed financing configuration

The proposed configuration in chapter 5 is being presented to legal experts and IWW operators, and as such tested on feasibility in practice. The overall conclusion is negative, since the deployment of the proposed financing configuration is economically and legally not feasible.

The economic feasibility is discussed with two major IWW operators, Plouvier Transport and Danser Group. Both companies already have experience with LNG, given the presence of LNG driven vessels in their fleet.

Both interviewees still believe in LNG as a greening solution on the long term, despite the major uptake in popularity for zero-emission technologies as battery-electric and hydrogen-electric propulsion for IWW vessels. They state that LNG remains the best transition fuel for the shipping industry available today. The mentioned zero-emission alternatives have a period of implementation of 10 to 20 years. It took several years to have LNG approved by the CCNR to use as a transport fuel, and the IWT sector has just started using it as a transport fuel. It is therefore too early to abandon LNG and already follow the next trend. However, it is being stated that further investments in LNG would also require a strong governmental support for the further roll-out of the infrastructure for LNG as transport fuel.

Both interviewees are sceptic though as regards the economic feasibility of the proposed financing configuration. Especially from an investor point of perspective, since the IRR related to the investment is relatively low and results in major opportunity costs.

The soft benefits of LNG are not believed to add value in the IWT. The idea behind the financial configuration is appealing at first sight, however the financial assumptions need to be sound and compensate the risk. For example the cost of personnel is higher as expected due to the complexity of the LNG system on board of the vessel, furthermore also the additional costs for the

LNG installation itself were eventually higher as anticipated. Given their previous experience with LNG projects both interviewees question if a leasing structure is viable in the IWT sector. A leasing structure based on a power by the hour principle will not alter the situation.

In addition to the economic feasibility, the legal feasibility is being reviewed by maritime lawyers.[11] There is one major bottleneck in applying the proposed financing configuration, specifically as regards leasing the LNG installation, either through the pooling entity or directly from the equipment supplier, to the IWW vessel owner. According to the laws for vessels sailing under the Dutch flag state there are risks for the lessor as regards property right. The lessor can loose its property right in case the vessel owner goes bankrupt. Most vessels are financed through mortgage loans. Vessels with an ongoing mortgage, being the majority of the fleet, will become property of the loan holder (mostly a bank in the IWT sector) in case of a bankruptcy. This concerns the vessel including its equipment such as the powertrain (LNG engine, corresponding equipment, fixed LNG tank, tank connection space, etc.), since a vessel without powertrain is not complete from a legal point of perspective. The situation and as such the potential risks for the lessor, will probably not differ much in other popular flag states.

[11] Van Steenderen MainportLawyers conducted a review on behalf of PON.

8 Conclusion

This study conducted an in-depth analysis on the financial bottleneck currently preventing a major uptake of LNG in the European IWT sector. The stated financial bottlenecks are not specifically related to LNG and do, more or less, also apply to other greening techniques. The financial bottlenecks can be regarded as the non-availability of capital for investments in greening techniques, in order to lower air pollutants and/or climate change emissions. This is mainly due to a lack of positive business cases, either with or without public funding combined with high risk levels for the ship owner who needs to make the investment.

Up till now a number of studies and initiatives have been performed on possible financial solutions to lower the financial bottlenecks for investments in greening techniques, as such also for LNG.

A promising financing configuration is a funding and financing mechanism based on pooling of grants, possibly combined with an environmental (differentiated) surcharge on fuel. Based on the revenues from the surcharge and/or additional funds from governments, greening investments can be funded/financed, possibly backed by EU financial products. This concept has similarities with the Norwegian NOx fund principle.[12]

A specific financing configuration tested in practice for this study aims to solve the Capex/Opex paradox. The investment proposal comprises the following innovative financing configuration:

- An investment pool (legal entity) that will finance the investment in LNG propulsion for 10 vessels;
- 50% of the required investment will be co-funded with grants[13] (this is currently also required for a positive business case);
- The pooling entity will conduct repayments (including interest) to the investors based on realised fuel cost savings;

[12] https://www.nho.no/samarbeid/nox-fondet/the-nox-fund/
[13] The financing construction will, given the scope of this project, also assume the presence of stimulation in the form of grants.

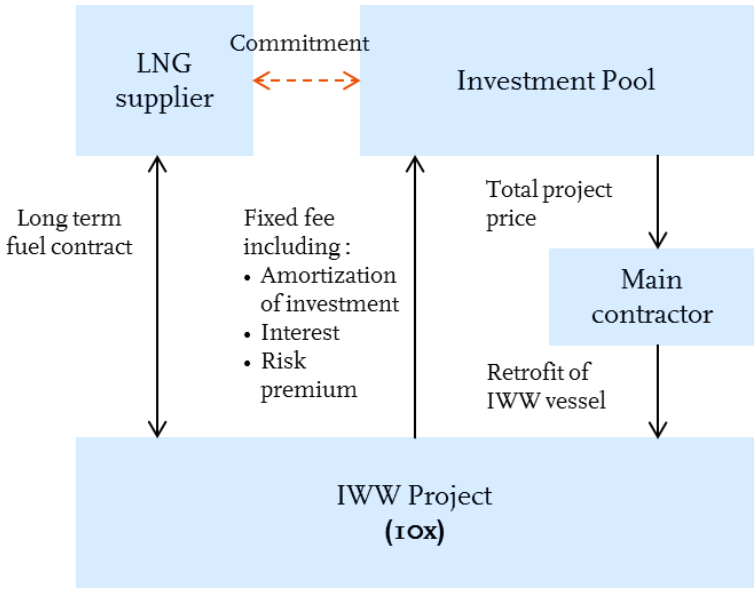
- Investing in 10, strictly selected, vessels will strongly reduce investment risk and realise economies of scale;
- Participants in the investment pool might also be able to contribute to the work to be done;
- Participating in the pool will accelerate the transition to a more sustainable IWT sector.

Arrangement per vessel (project):

- Repowering of the vessel (including work done, retrofitted engine(s) and cryogenic equipment);
- Long term fuel contract with an oil major, providing a guaranteed spread with conventional diesel fuel;
- Contract in place with the investment pool, arranging a debt amortization scheme and direct 50% payment of the optional new engine(s) (less reimbursement of old engine);
- Providing cryogenic tank as a securitization.

The structure and connection between the involved parties throughout the project, i.e. retrofitting vessels towards LNG, can be visualised as follows:

Figure 9: The project structure



Source: own elaboration

The proposed financing configuration in response to the Capex/Opex paradox appeared not feasible though, both from the investor's financial point of perspective and the lessor's (either pooling entity, bank or equipment supplier) legal point of perspective. The business case from an investor's point of perspective is relatively unattractive and results in opportunity costs. As regards the lessor of the LNG installation there are significant risks involved concerning the property rights in case of a possible bankruptcy of the vessel owner.

Moreover, the analysis assumed the presence of 50% grants as this is also the scope of this project, which is a favourable financial situation. However, despite the presence of grants the proposed financing configuration is financially not feasible for all of the involved parties. Consequently, the deployment of the proposed financing configuration is not achievable.

9 Recommendations

Financing the greening objective in IWT is an overall challenge and not only relevant for investments in LNG. Most of the stated bottlenecks also apply to other greening techniques such as aftertreatment techniques, battery-electric and hydrogen-electric techniques, methanol, etc. An innovative financing configuration can indeed be a solution, however some conditions need to be met since an financing configuration on its own will not be able to stimulate greening on its own.

A financing configuration needs to be technological neutral and to be deployed on a European scale in order to guarantee a proper level playing field. Furthermore, the configuration needs to be widely accepted in the IWT sector in order to be successful, therefore the sector needs to be involved strongly throughout the process of developing a new financing configuration. The carrot and stick principle needs to be applied in order to reach the greening objective, a principle which could be integrated in the new financing configuration. An example is the polluter pays principle applied in the NOx fund. The financing configuration includes an environmental (differentiated) surcharge on fuel. Based on the revenues from the surcharge greening investments can be financed.[14]

Further research on this topic will be carried out in 2019/2020 on a larger European scale involving all relevant stakeholders on this subject (EU bodies, member states, IWW owners and operators, banks, shippers, associations, etc.). This research will be backed by under which the CCNR. Abovementioned aspects and lessons learned from this study will be taken into account for further research on new financing configurations. A possible successful deployment of a new financing configuration will stimulate the overall greening of the IWT sector, and as such stimulate the further deployment of LNG in the sector.

[14] https://www.nho.no/samarbeid/nox-fondet/the-nox-fund/

10 Annex I Interviews

10.1 Interview participants

Interviews are being conducted with:

- Ben Maelissa (director) of the Danser Group
- Antoine Struyf (manager) of Plouvier Transport

10.2 Interview reports

10.2.1 Interview with the Danser Group

1. What is the vision of LNG for the Inland Waterway?

It is the vision of Danser Group that LNG has a pivoting role in the energy transition. It is an available, recognized fuel that addresses air quality as well as the climate targets agreed in Paris with the COP21. Danser Group will consider further investments in LNG if it is supported strongly in a long term vision by the infrastructure like the governmental bodies, especially in the Netherlands. Other countries are more open to the opportunities of LNG in the energy transition and don't abandon this without viable alternatives.

2. What are the barriers for LNG, what are the lessons learned and it retro-perspective what would you have done differently?

It is extremely sad to observe that the political focus is completely lost due to the fact that LNG is still a fossil fuel and the potential of decarbonisation of LNG is being ignored. That doesn't help to overcome the barrier of the substantial CAPEX. Especially the requirements of the CCR caused delay and a strain on the budget. In retro perspective what we would have done differently relates to the human interface of the installation. Time was spent to educate the crew on gas, but it was challenging to close the gap between theory and reality. Day to day challenges have to be solved and require a different mindset of the crew. We questioned ourselves if the required mindset is harder to develop with the crew of a container vessel compared to the crew of a tanker vessel which are trained and more used to work with dangerous goods. For Danser to

consider a second LNG project the technology must be matured and easier to adapt by being more comparable to the current level of technology.

3. What can be done to close the 'Chasm' and get the majority on LNG?

In order to close the chasm the role of the parties financing the vessels is crucial. Since the crisis, that started in 2009, the industry is still recovering their balance sheet. The individual ship owners should be encouraged to broaden their perspective to the long term rather than short term survival. The banks should be open to accept a higher risk and support the long term goals and should be supported by a long term governmental vision. The company charters as well approximately 80 vessels. As a charter company we can outline our perspective and demonstrate leadership by example, but operate in an competitive environment as well. To close the chasm should come from the industry not the charterer.

4. What can be done on the financing part to lower the risk of LNG?

The risk can be lowered if more 'of the shelf' products are made available. Innovation is needed to develop standard products at a lower costs base. Only if the costs can be lowered combined with a high degree of certainty can the financing risk be limited. This creates a more predictable and positive business case.

5. Can the business case be made taking the CAPEX into account and the OPEX? What is your feeling with off balance assets?

The business case to convert one of the vessels of Danser was based on a fuel spread of 25% compared to EN590. With the calculated CAPEX the business case the decision to invest was made with a pay back period of 7 years. Due to additional requirements, liability of newness the investment became substantial higher although a EU grant was obtained.

6.In the CAPEX OPEX paradox the risk is at the investor and the IRR is low with 5% possible. Would that from investment perspective make sense due to other benefits?

It would be great if the fuel supply can be arranged in such a manner. In the vessel that Danser has sailing the fuel tank is too big since the bunker locations are limited. This effects the space for payload negatively. If the fuel tanks can be exchanged it saves bunkertime and payload. The

vessel stops regularly to swap containers, the fuel containers can easily be exchanged. If we can buy the LNG and pay a deposit for the tank that would help the industry, like the 'Camping Gas' system. This is an ambition that we have had but the viability is challenged by to the risk assessment. Innovation that touches the CAPEX and societal challenges with a multi-year support from policymakers and banks is needed before the decision to invest in LNG can be taken.

10.2.2 Interview with Plouvier Transport

1. What is the vision of LNG for the Inland Waterway at Plouvier?

LNG remains the best transition fuel for the shipping industry available today. The alternatives discussed most today have a period of implementation of 10 to 20 years. It took several years to have LNG approved by the CCNR to use as a fuel, we are just starting with it. It is too early to abandon and follow the next trend. The challenge will be with the transition to NRMM EU Stage V. For the uptake of LNG this comes a bit too early. Plouvier sincerely believes in LNG.

2. What are the barriers for LNG, what are the lessons learned and it retro-perspective what would you have done differently?

The barrier is that there is no 'off the shelf' solution that fits the IWW-needs. The LNG engine for the Plouvier vessels is intended for sea-going vessels, manned with an engineer in the engine room. The inland waterway is exempted from this. The lesson learned quickly is that the organisation has to select the crew of the vessel carefully. The downside of this is that people are a scarcity, let alone good people. The crew has to deal with a very complex installation with new challenges. Plouvier hopes that autonomous sailing sets in quickly and that will alleviate the shortage of personnel. The regulation and legal framework has to facilitate this type of progress as well for the sake of more complex future proof vessels.

3. What can be done to close the 'Chasm' and get the majority on LNG?

To reach the majority legislation has to force the industry to take the future seriously and to change the short term perspective. Creating an ambitious level playing field could accelerate the change towards the inevitable transition to alternatives. The parallel is drawn with the single walled tankers. There industry rapidly phased out the older vessels due to changes in the legislation.

4. What can be done on the financing part to lower the risk of LNG?

The risk for Plouvier was acceptable due to the long term charter of Shell. Due to this commitment no grant was needed to meet the financial targets. It would help that grants remain available to reach an attractive volume. A strong long term political support should help as well to lower the financing risk for manufacturers. The potential in the market is limited due to the small numbers.

5. Can the business case be made taking the CAPEX into account and the OPEX? What is your feeling with off balance assets?

It is challenging to close the business case. The cost of personnel is higher as expected due to the complexity and the additional costs are higher as anticipated. Taking this into account the business is still there for Plouvier, but the savings in OPEX are compensated in the charter. It is unknown if the compensated charter rate for Shell has a positive business case as well. Leasing is not a common practice in the industry and not considered desirable by Plouvier.

6.In the CAPEX OPEX paradox the risk is at the investor and the IRR is low with 5% possible. Would that from investment perspective make sense due to other benefits?

No. If this project had an IRR of 5% or less the request for investment was rejected by the shareholders. The soft benefits of LNG are not believed to add value in the tanker transport market. The idea behind the financial structure is appealing but the financial assumptions has to be sound and compensate the risk. With the experience from this project Plouvier questions if a leasing structure is viable in the IWW industry.