

Technical expertise to assess the prospects of LNG markets in the Eastern Partner countries

Update on the Eastern Partnership LNG study

4th workshop of the Eastern Partnership sub-sectoral networking group on LNG Markets

17th December 2019, Świnoujście



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Background and objective of this presentation

Eastern Partner countries' analysis results

Prerequisites and key success factors

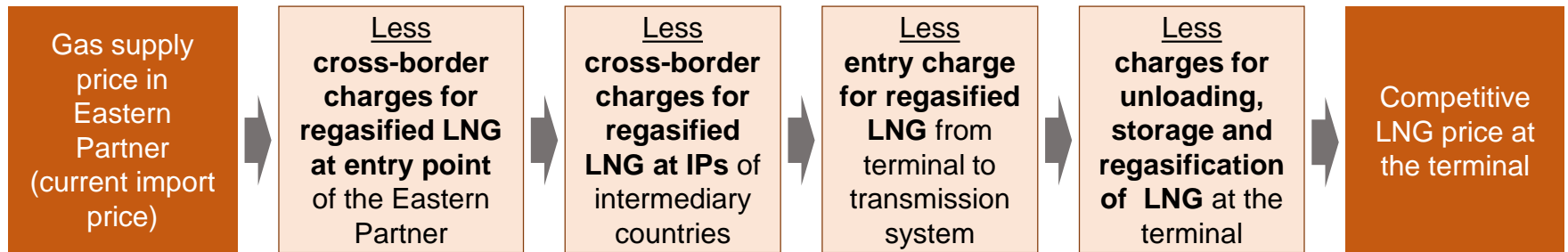
Recommendations and next steps



Work undertaken and objective of this presentation

- Netback analysis was carried out for each of the selected applicable options, to ascertain what should the LNG price at the source be (import terminal, small/mini liquefaction plan etc.) so that the end LNG price in the Eastern Partner country for the intended use is competitive, and the option viable.

Example: Netback analysis for Eastern Partner country import of (regasified) LNG



Work undertaken and objective of this presentation

- The netback analyses carried out in the Study are high-level, based on market demand and price assumptions, as well as on cost and other benchmarks. Dynamic supply-demand conditions were not examined, and there is limited contextualization of infrastructure costs and other parameters.
- In cases where market demand data were not available and netback analysis could not be reasonably performed, the analysis focused on identifying the 'breakeven' demand in the Eastern Partner country, that could render the option viable under assumed price and cost conditions throughout the supply chain.
- The Study results and conclusions are thus preliminary, and highlight options that merit further consideration and detailed analysis to assess their viability.



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Armenia – Applicable LNG Options

Applicable LNG options

Sources of supply

Options for Gas-
to-Gas
Competition

No option identified

Options for Gas-
to-Other Fuels
Competition

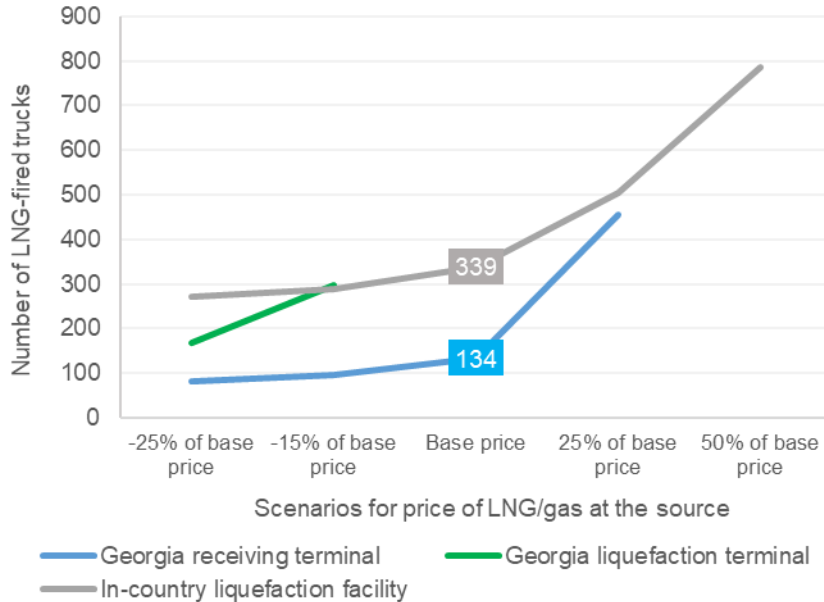
LNG as engine fuel for **trucks**

- Georgia receiving terminal
- Georgia liquefaction terminal
- In-country mini liquefaction facility



Armenia – LNG as engine fuel for trucks

Netback analysis results for various LNG supply sources*



- LNG sourced from a Georgian terminal if at least 130 LNG-fuelled trucks operate in the market.
- For LNG to be sourced at an in-country mini liquefaction facility, the high cost in required infrastructure necessitate a large (over 340) number of LNG-fuelled trucks for viability.
- Considering that Armenia has a sizeable fleet of trucks involved in local, regional and international transport, a market for LNG could potentially develop, if the prices remain at the assumed base or less.



Azerbaijan – Applicable LNG Options

Applicable LNG options

Sources of supply

Options for Gas-to-Gas Competition

No option identified

Options for Gas-to-Other Fuels Competition

LNG as engine fuel for **trucks**

LNG as engine fuel for **ships** operating in the Caspian Sea

LNG supply to ungasified **off-grid areas**

- In-country mini liquefaction facility



Azerbaijan – LNG as engine fuel for trucks

- Due to the very low, current diesel price in Azerbaijan (0.26 EUR/lt), LNG cannot be competitive in the transport sector.
- Results of the calculations show that the required LNG price at the filling station (285 EUR/1000 m³), after having taken into consideration fuel efficiency gains, is lower than the required switching costs (296 EUR/1000 m³), which include recovery of retrofitting costs and a small price incentive to the truck owner.
- Nevertheless, the Azeri Government have indicated that it may explore this option further for environmental reasons and potentially provide support.



LNG as engine fuel for ships (1/2)

- IMO has set tougher limits for ships' sulphur emissions. In the Black Sea, sulphur limits decrease from to 0.5% from 3.5%, as of 1/1/2020.
- To meet these limits, shipowners have the option to use low sulphur fuel oil or to 'clean' the exhaust gases by using scrubbers, or to change to new cleaner fuels such as LNG.
- Shipowners appear reluctant to invest either in LNG retrofitting or scrubber installation for existing vessels because the costs are high*.
- Use of LNG can be more attractive in newbuild ships provided that they consume large fuel quantities and the price differential between LNG and bunkering fuels is sufficient to cover incremental cost of an LNG-fuelled ship (e.g. 10m \$ for a 50,000 MT Panamax), and that bunkering of LNG is possible along the ship's routes.



LNG as engine fuel for ships (2/2)

- Compliance with environmental requirements is a key factor in catalyzing investment; in the absence of rules and their enforcement, no action is taken by shipowners.
- Suitability and attractiveness of LNG depends on each ship's characteristics, including size and type, age, fuel used, refueling pattern, prices of competing fuels, and technical factors, etc. For this reason, a case-by-case analysis would be required.
- The same applies for use of LNG in waterways, as it depends on financial and technical factors. For small riverboats, technical issues and size limitations are more restrictive.
- In the near future LNG would need to compete with other potential new options, such as the use of hydrogen, green ammonia and electric propulsion systems.



Belarus – Applicable LNG Options

Applicable LNG options

Sources of supply

Options for Gas-to-Gas Competition

No option identified

Options for Gas-to-Other Fuels Competition

LNG as engine fuel for **trucks**

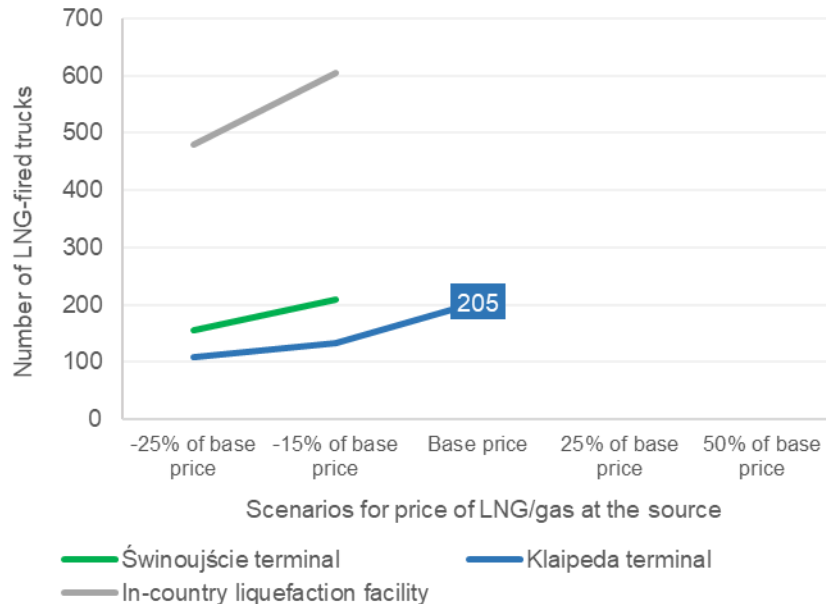
LNG as engine fuel for **ships** operating in the Belarusian inland waterways

- Truck loading in Świnoujście and/or Klaipeda terminals
- In-country mini liquefaction facility



Belarus – LNG as engine fuel for trucks

Netback analysis results for various LNG supply sources*



- For supply prices higher than the current ones, the use of LNG in road transport, under the examined assumptions, is non-viable.
- However, considering that Belarus has a sizeable fleet of local and imported international long haulage trucks (over 12,000 in 2013), a market could develop if prices are competitive.
- The potential to manufacture LNG-fuelled trucks locally could lower switching costs, making the market more attractive.



Georgia – Applicable LNG Options

Applicable LNG options

Sources of supply

Options for Gas-to-Gas Competition

Regasified LNG at **in-country LNG receiving terminal** in the Black Sea

Swaps of regasified LNG at terminals in Turkey or SEE with piped gas supplied to Georgia through the Southern Caucasus Pipeline (SCP) offtake

LNG shipments through Bosphorus Straits

LNG receiving terminals in Turkey, Greece, Italy

Options for Gas-to-Other Fuels Competition

LNG as engine fuel for **trucks**

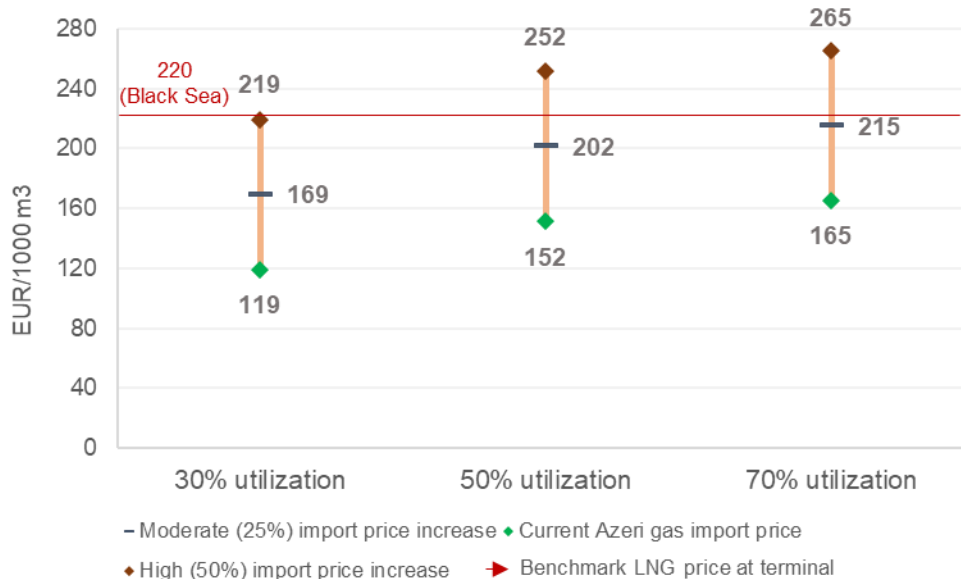
LNG supply to **off-grid consumers and towns**, mainly in mountainous areas

- In-country receiving terminal
- In-country liquefaction terminal
- In-country mini liquefaction facility



Georgia – In-country receiving terminal

Netback analysis results for various terminal utilization rates



- Under the examined assumptions and market conditions, LNG can be competitive only if Azerbaijani import prices are significantly higher than current levels and high utilization of the terminal is secured.
- Expiry of import contracts, post 2026, could potentially trigger the conditions for viability of the terminal, but on the opposite side it could pose a barrier if contracts are extended at favourable prices.



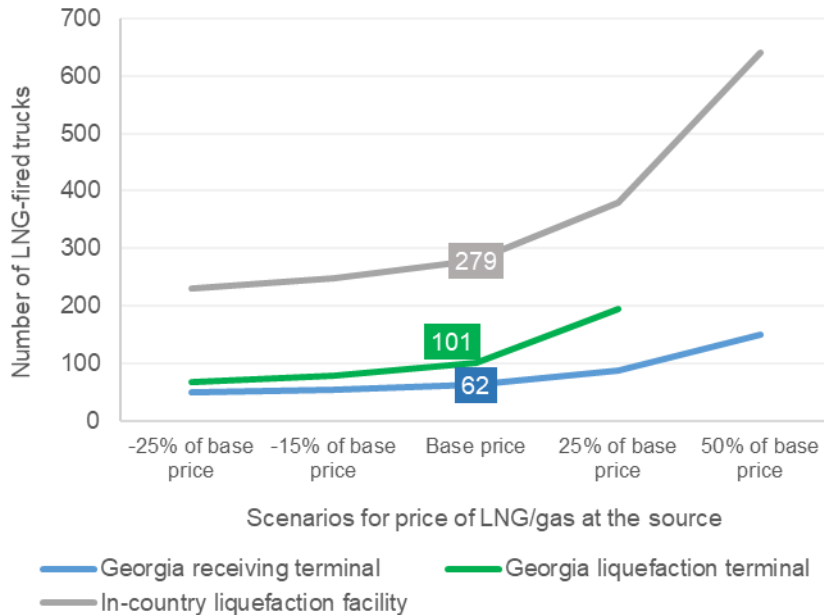
Georgia – Swaps of LNG with piped gas

- Swap of regasified LNG landing at a terminal in Turkey, Greece or Italy with piped gas delivered to Georgia through its offtake of the SCP, would require an agreement between the involved parties, to allow this virtual gas exchange.
- Regardless of the supplier receiving the LNG, BOTAS must agree to deliver gas at the SCP offtake.
- Development of the option is conditional upon:
 - The contractual arrangements between SOCAR and BOTAS for the supply of gas through SCP allow BOTAS to deliver gas at the Georgian offtake gas
 - Price of LNG lower than the price of gas contracted by BOTAS in SCP. If the price of LNG is higher, the price differential would have to be covered by GOGC
 - Import prices of Azerbaijani gas in the Georgian market are higher than the agreed price for the swap



Georgia – LNG as engine fuel for trucks

Netback analysis results for various LNG supply sources*



- The market size requirements for LNG-fuelled trucks in Georgia are low if a receiving or liquefaction terminal is developed (over 60 or 100 trucks respectively).
- In case of an in-country mini liquefaction facility, the high investment costs necessitate a considerably larger (over 280) number of LNG-fuelled trucks for viability.
- The large number of trucks transited through Georgia could provide the critical mass for development of an LNG market, if prices remain at least at current levels.



Moldova – Applicable LNG Options

Applicable LNG options

Sources of supply

Options for Gas-to-Gas Competition

Regasified LNG from **neighbouring EU terminals**

Regasified LNG from **potential terminal in Ukraine**

Regasified LNG sourced from **potential liquefaction terminal in Georgia**, through **receiving terminal in Ukraine**

Świnoujście, Klaipeda, Revythoussa, Krk receiving terminals

LNG shipments through Bosphorus Straits

Potential terminal in Georgia liquefying Caspian gas

Options for Gas-to-Other Fuels Competition

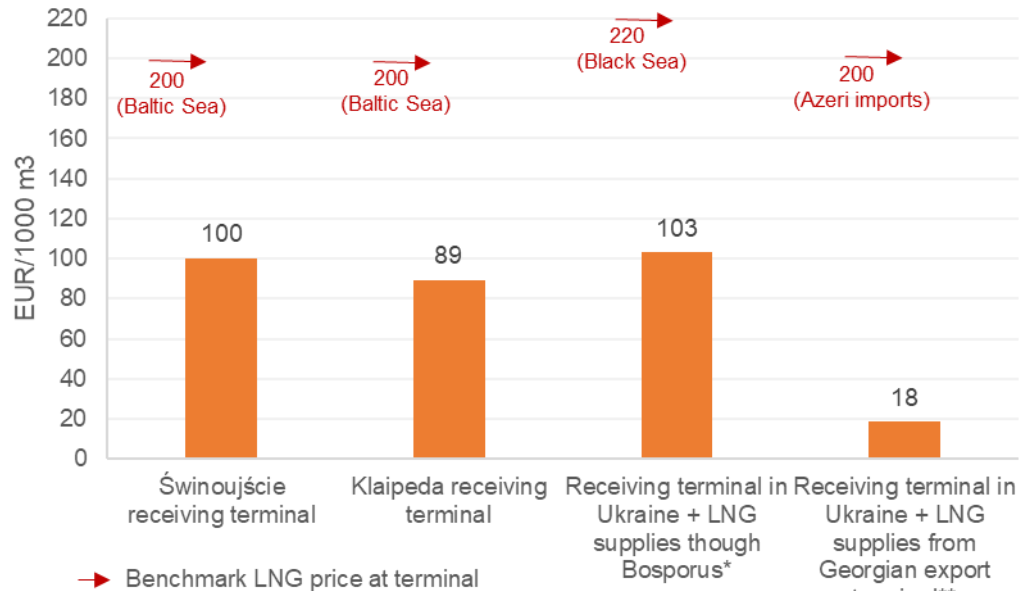
LNG **storage for peak shaving** at the Moldovan CHP stations

- LNG truck loading in Świnoujście and/or Klaipeda terminals
- Potential receiving terminal in Ukraine
- In-country mini liquefaction facility



Moldova – Gas-to-Gas competition

Netback analysis results for supply of regasified gas from various sources



- Due to the low gas prices in the Moldovan market, supply of regasified LNG cannot be competitive under the examined assumptions and market conditions.
- Security of supply benefits of importing LNG (at a premium) should be taken into consideration as Moldova is a single-source market.



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* Values for 50% UA terminal utilization

** Values for 70% UA terminal utilization, price of liquefaction terminal at 60% of AGRI project (2 bcma) ²¹

Ukraine – Applicable LNG Options

Applicable LNG options

Sources of supply

Options for Gas-to-Gas Competition

Regasified LNG from **neighbouring EU terminals**

LNG at in-country **LNG receiving terminal**

LNG from **potential liquefaction terminal in Georgia**

Świnoujście, Klaipeda, Revythoussa, Krk receiving terminals

LNG shipments through Bosphorus Straits

Terminal in Georgia liquefying Caspian gas

Options for Gas-to-Other Fuels Competition

LNG as engine fuel for **trucks**

LNG as engine fuel for **ships** operating in Black Sea and Ukrainian waterways

LNG supply to **off-grid consumers**

LNG supply **instead of rehabilitation** of distribution

LNG virtual pipelines to **develop remote fields**

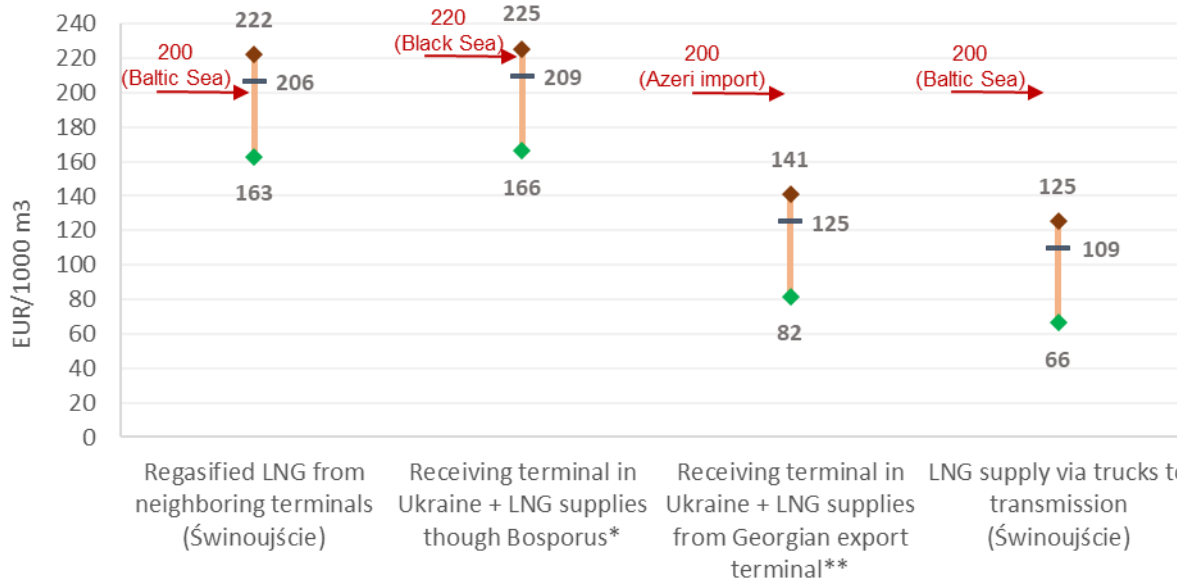
LNG as engine fuel for **locomotives**

- LNG truck loading in Świnoujście and/or Klaipeda terminals
- Potential receiving terminal in Ukraine
- In-country mini liquefaction facility



Ukraine – Gas-to-Gas competition (1/2)

Netback analysis results for supply of regasified gas from various sources



* Values for 50% terminal utilization

** Values for 70% UA terminal utilization, price of liquefaction terminal at 60% of AGRI project (2 bcma)

– Average Ukraine import price ♦ Minimum Ukraine import price ◆ Winter average Ukraine import price → Benchmark LNG price at terminal



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Ukraine – Gas-to-Gas competition (2/2)

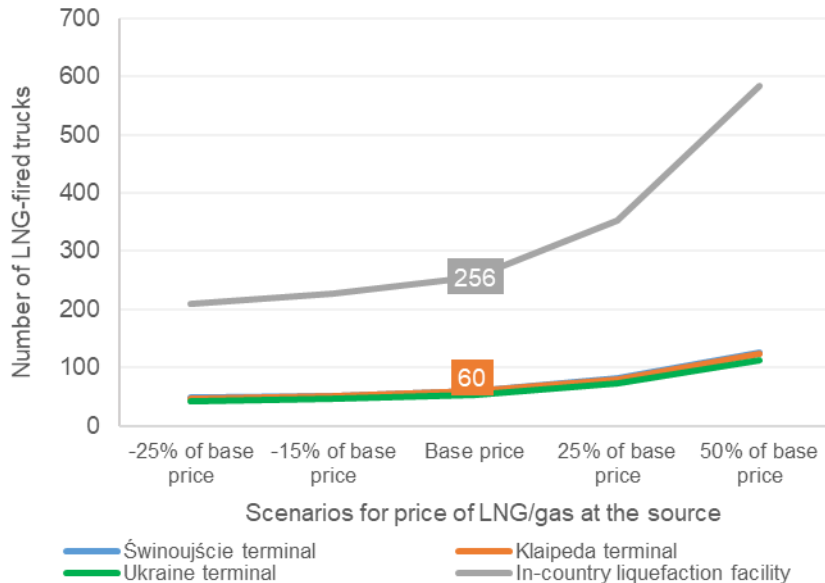
Under examined assumptions and market conditions:

- Supply of regasified LNG from neighbouring terminals is marginally competitive. It does not provide SoS benefits as existing routes are used. It is up to the market players to take advantage of potential opportunities to supply LNG.
- The viability of a Ukrainian LNG terminal is feasible but only if high utilisation of the terminal (over 50%) is ensured.
- Supply of LNG from a Georgian liquefaction and export terminal would be viable only if the price of Caspian gas delivered to the liquefaction terminal is significantly lower than existing prices.
- Use of LNG trucks for supply of regasified gas to transmission consumers is not viable, considering the high costs vis a vis piped gas, and capacity limitations.



Ukraine – LNG as engine fuel for trucks

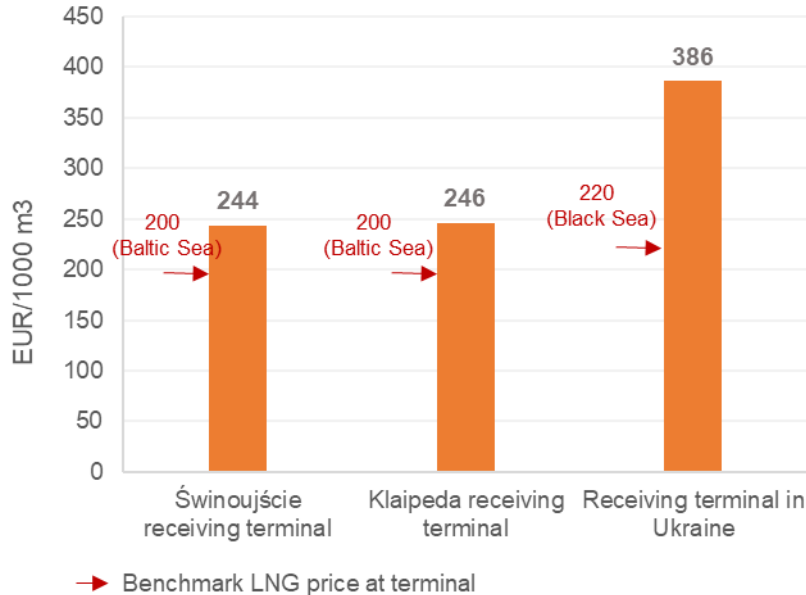
Netback analysis results for various LNG supply sources



- Under the examined assumptions, LNG from neighbouring terminals can be competitive to diesel with a market of less than 100 LNG-fired trucks, even if LNG import prices increase.
- Supplies from a mini liquefaction facility would require a considerably larger market, at least around 250 trucks.
- Ukraine has sizable international long-haul traffic (export/imports and transit), thus a market for LNG in road transport of 100 or more trucks could potentially develop.

Ukraine – LNG supply to off-grid consumers

Netback analysis results for supply to agriculture site



- For the case study examined (off-grid agricultural consumer in South Ukraine), LNG is competitive to LPG.
- Each particular off-grid consumer should be examined individually, as the parameters affecting the analysis (e.g. distance from the terminal, consumption profile, type of fuel, size of required regasification terminal) are unique for each case.
- Switching to LNG is each consumer's decision if they deem this option financially viable.



Background and objective of this presentation

Eastern Partner countries' analysis results

Prerequisites and key success factors

Recommendations and next steps



LNG receiving terminal in the Black Sea

Key prerequisites

- LNG vessels passage through the Bosphorus Straits
- Binding market tests securing interest to use terminal services
- Securing adequate financing for terminal investments
- Regulations and standards for development and operation of the terminal

Key success factors

- Strong project promoter
- Strategic partners (financial, operating and market expertise strengths)
- Conducive legal, contractual and regulatory framework
- Supportive Government



LNG liquefaction & export terminal in the Black Sea

Key prerequisites

- Long term contracts of Caspian gas supply to the Terminal
- No constraints for LNG vessels to reach and off-take from the Terminal
- Securing long-term LNG sales contracts
- Securing adequate financing for terminal investments
- Regulations and standards for development and operation of the terminal

Key success factors

- Strong project promoter
- Buyers of LNG to participate as investment partners in the Terminal
- Conducive legal, contractual and regulatory framework
- Supportive Governments



LNG as engine fuel for trucks

Key prerequisites

- Regulations and standards for LNG fueled trucks, filling stations, truck loading facilities, liquefaction facility
- Road regulations for LNG fueled trucks and trucks carrying LNG
- TPA and pricing regulations at liquefaction facility and/or truck loading at terminal

Key success factors

- Fiscal incentives for trucks and infrastructure
- Imposing restrictions on older trucks with higher emissions engines
- Reducing subsidies and favourite tax treatment of fuels competing with LNG
- Awareness and promotion campaigns for LNG
- 'National champion' to support market development and act as investor one-stop-shop



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Proposed actions for regional cooperation

- Creation of technical & standards, regulatory, market sub-committees under the EaP LNG working group, to facilitate coordination and action on key initiatives.
- Joint Georgia – Ukraine initiatives for addressing the Bosphorus Straits' constraints.
- Harmonization of rules, regulations and standards on a regional or sub-regional level, for LNG-fuelled trucks, and for trucks transporting LNG.
- Assess the potential for Eastern Partners to jointly develop a small-scale liquefaction terminal for regional supply of LNG for trucks.
- Formulation of a regional development plan for the establishment of LNG filling stations in the Eastern Partner countries.



Proposed EaP joint actions

- Knowledge transfer from EU counterparts (from the whole LNG industry) to Eastern Partners, on LNG technologies and benchmark costs.
- Sharing of the experience gained through the Blue Corridor initiative, as a model case to develop the use of LNG in the transport sectors of Eastern Partners.
- Provision of know-how and technical assistance for the development of the legislative and regulatory framework, technical rules and standards.
- Development of a common IT platform for knowledge sharing of materials relevant to LNG markets.
- Assess possibilities for co-financing of selected projects of common interest through the European Network Instrument, or other financing mechanisms.



Next Steps

- Drafting of the Final Report, to include Cost - Benefit Analysis of selected options, and for each Eastern Partner country prerequisites and key success factors, priorities and policy directions, and proposed actions.
- The Final report will also include Regional Perspectives for LNG market development, and relevant regional cooperation actions.
- Next year there will be a presentation of the final report within an upcoming event planned by DG Energy.

