

Regional prospects for ssLNG

A case study on Romania

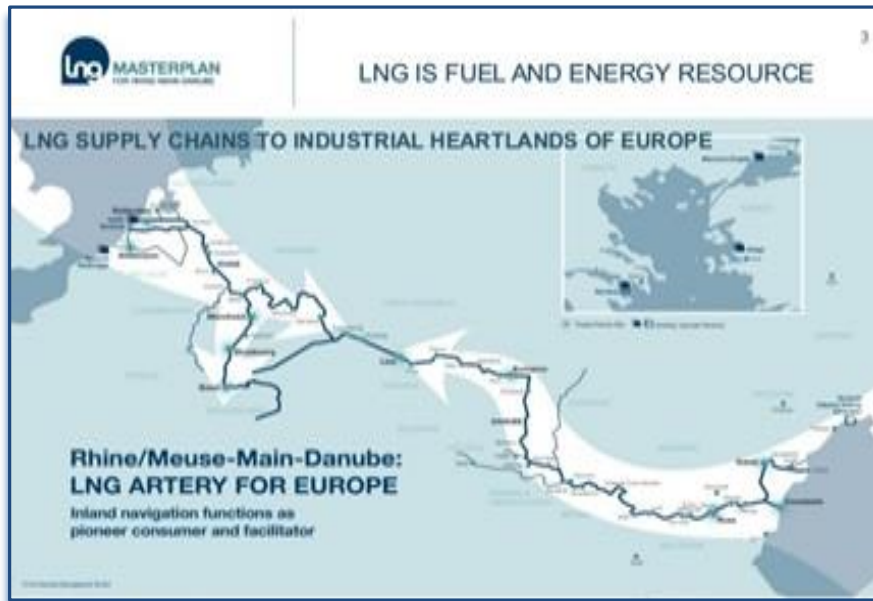
“Energy Transition in SE Europe: Policy and Investment Challenges”

ROEC / IENE, Bucharest, October 16, 2019



LNG in Eastern Europe:

EU promotes LNG as a potential alternative source, improving security of supply and reducing the dependence on a sole import source via classical pipelines.

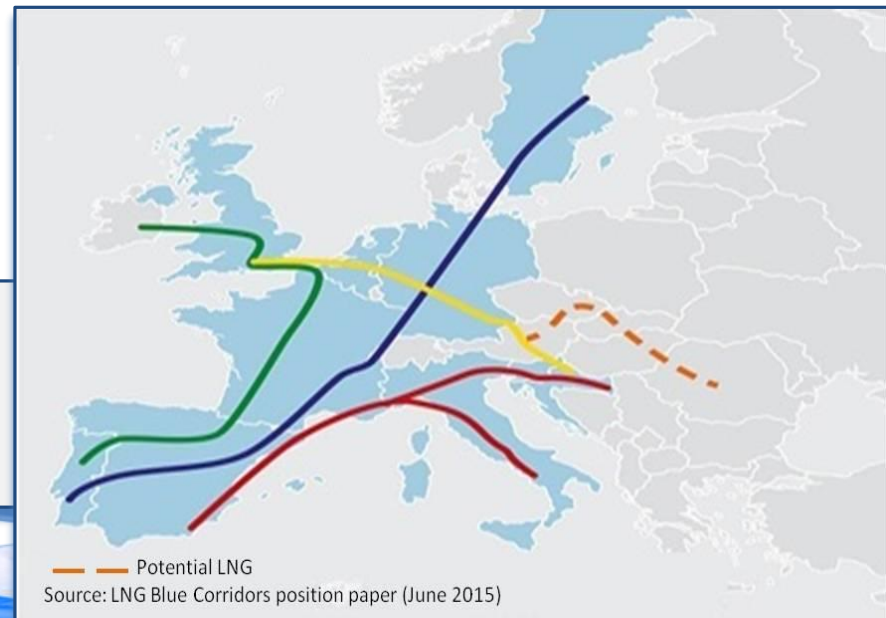


LNG /CNG are alternative fuels in transportation by road, inland waters and railroad

LNG Masterplan Rhine-Main-Danube

Pilot project “Blue LNG Corridors” on 4 transport road corridors over Europe, including East:

- deploys more than 200 LNG filling stations***
- expected 180 additional filling stations for L/CNG.***



LNG in Romania:

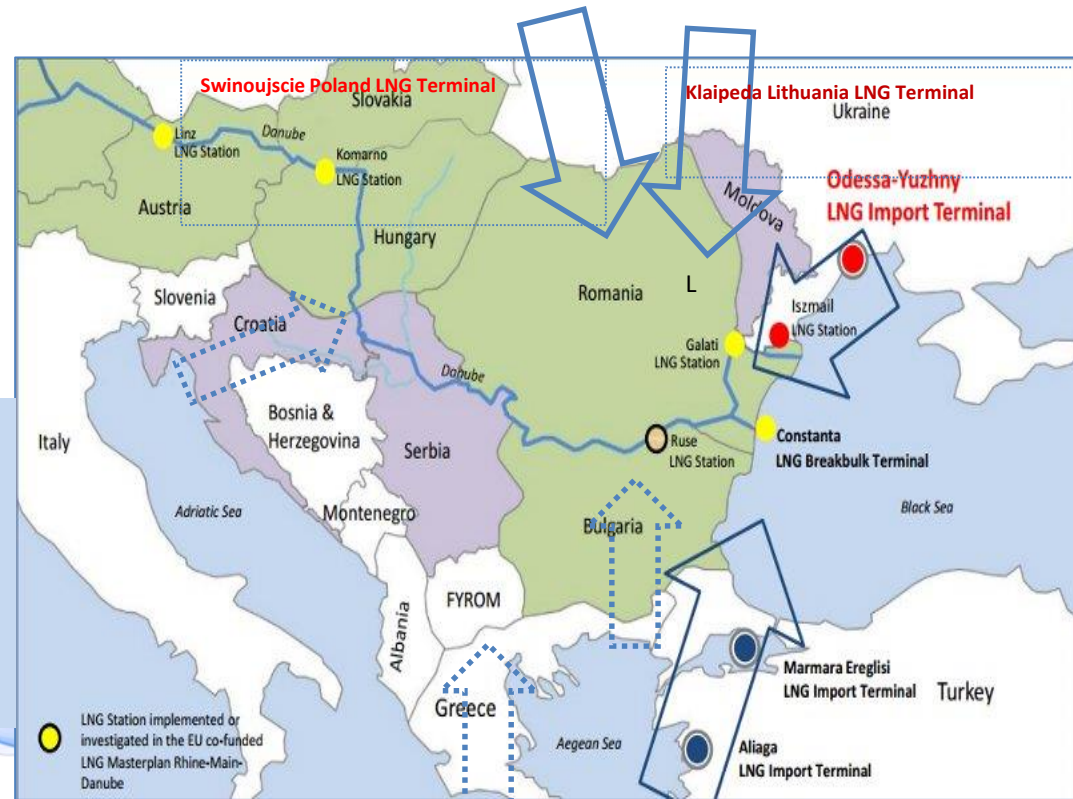
***First planned Romanian LNG project was AGRI-Terminal in Constanta (in stand by),
followed by 2 inland Terminals in Danube ports,
the 2016 announced OMV-Gazprom joint project for a liquefaction terminal and
recently info about Gazprom pre-investment feasibility study for a Black Sea liquefaction plant***

***LNG trading, energy-companies
present in Romania:
OMV, ENEL, E.ON, Engie, SOCAR,
MOL, Lukoil, et.al.***

***LNG import terminals in neighboring
countries***

***Operational : Turkey, Greece, Poland,
Lithuania, Italy***

New planned : Greece, Croatia, Russia.



ssLNG from conventional terminals



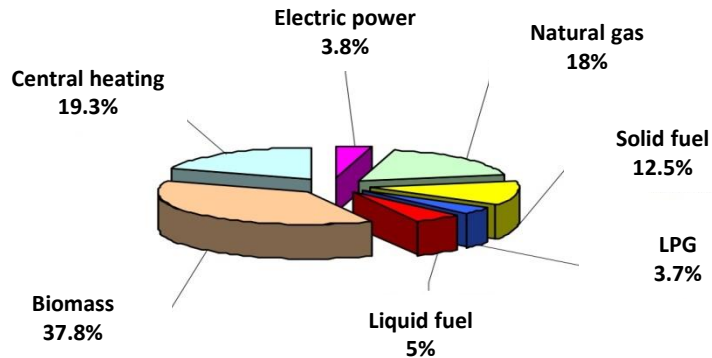
A conventional LNG import terminal needs a “trucks loading facility” to allow ssLNG export for different applications



In Ruse, Bulgaria, there is a small scale LNG importing terminal -1000 cm able to provide bunkering for inland vessels , LNG vehicles re-fuelling and tank trucks loading

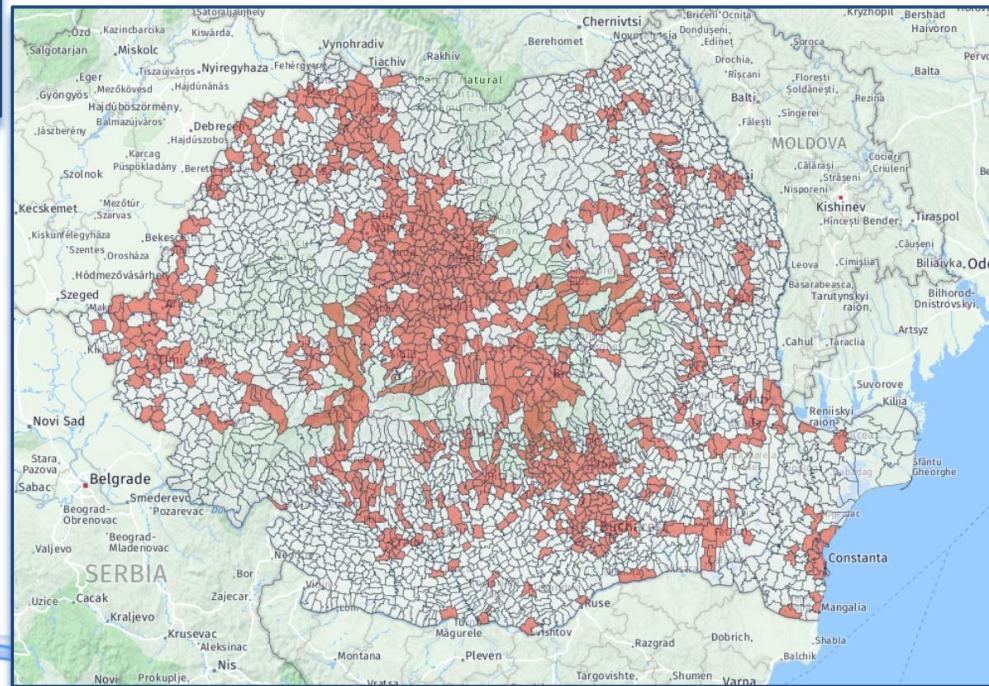


GAS SUPPLY NETWORK IN ROMANIA



Only 35% (red spots) of the communities are connected to the National Gas Transport System (operated by TRANSGAZ). The distribution systems for natural gas are owned by more than 30 private distribution companies.

Structure of household energy consumption indicates biomass as the main fuel. Total household energy consumption is 400,000 TJ.



Slow medium-term growth of gas transport networks.

An opportunity for LNG penetration

Complex interplay of Transport & Distribution Operators with local authorities for financing, licensing, investment and operation.

Economic Feasibility of a new distribution system for a community is limited by:

- **high cost & limited financial resources**
- **difficult connection to TS (long distance, geographical conditions, access rights, conflicting development plans of TSO**
- **Complex build-up of the local distribution**

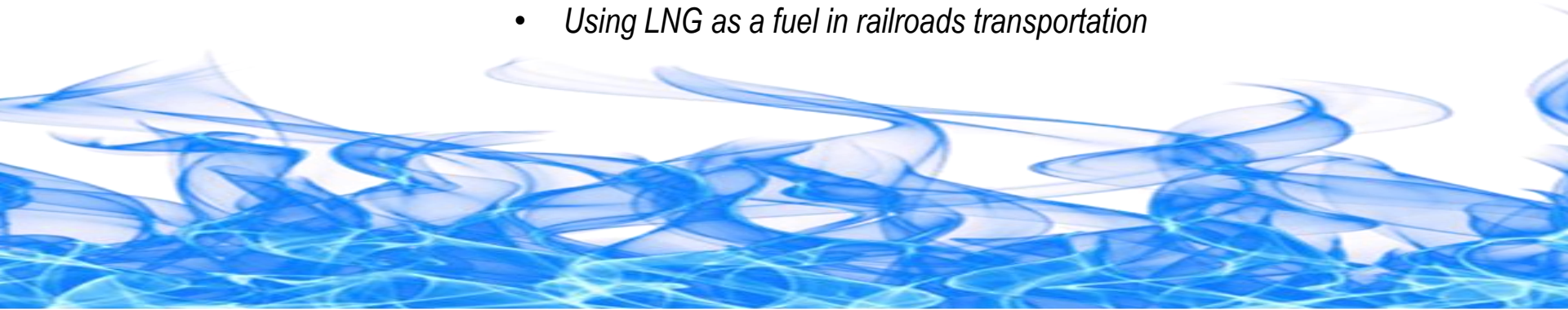
Timing

- **1-2 years for documentation, design and licensing**
- **2-3 years for financing arrangements, detailed design, execution of the connection to TSO network**
- **2-6 years to build up the new Local Gas Distribution Network and start supplying natural gas to final consumers (in stages).**

Difficult financing involving coherent TSO, DSO and local authorities capital contributions, loans, grants.

POTENTIAL SMALL SCALE LNG APPLICATIONS **FOR DOMESTIC MARKET**

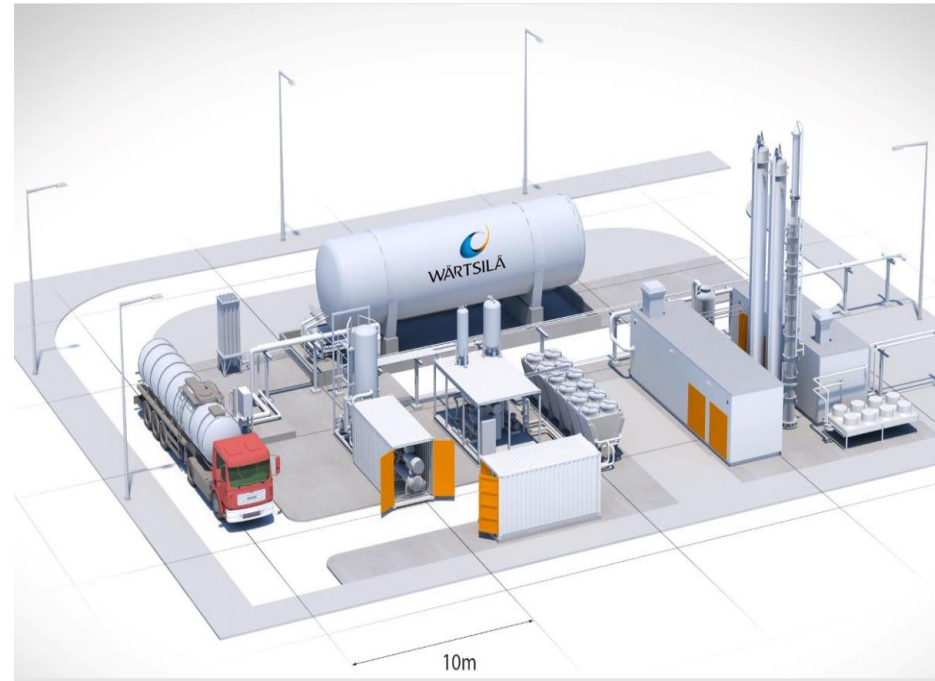
- *Small scale liquefaction plants using domestic gas from remote wells (in the short term) and the Black Sea gas (in the medium term).*
- *Filling Stations for road vehicles fueling with LNG/CNG for long haul truck fleets in transit, medium distance fleets, local logistic services, utilities fleets („LNG Mobility” concept)*
- *Supplying natural gas from LNG to domestic and commercial consumers in new distribution gas networks („virtual pipeline” concept)*
- *Supplying natural gas from LNG to industrial consumers (switch from LPG or fuel oil to natural gas)*
- *Other potential applications:*
 - *Bunkering with LNG fuel for ships on inland or marine waters*
 - *Using LNG as a fuel in railroads transportation*



Liquefaction stations

- **Mini liquefaction plants with a capacity 25 tpd require a CapEx of 5 mil EUR and have limited relocation costs**
- **Major domestic gas producers (i.e. ROMGAZ, OMV PETROM) have an interest to extend their business to the LNG niche as facing a different risk profile and while providing added value.**
- **Due to limited relocation cost and ease of LNG distribution, mini-liquefaction plants can use gas from small/remote wells which are otherwise not viable to connect to the gas transport system.**
- **In the medium term, the Black Sea gas will create a pressure to develop new domestic and export markets. LNG will be definitely one option providing increased added value with relatively less investment and faster implementation.**

Wärtsilä's energy efficient Mixed Refrigerant liquefaction technology for low liquefaction capacities.

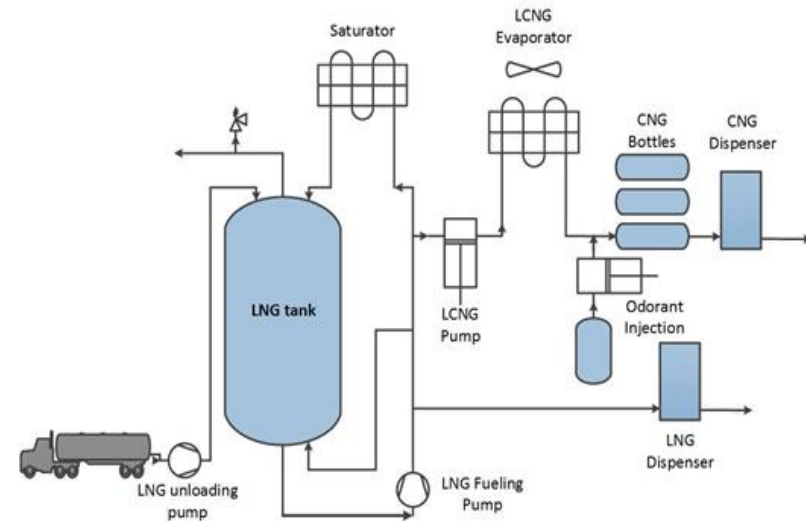


<https://www.wartsila.com/products/marine-oil-gas/gas-solutions/lng-solutions>

FILLING STATIONS LNG/CNG :

Opportunity:

- **Significant long haul traffic on two TEN-T corridors : Rhine – Danube and Orient/East -Med**
- **Existing local branches of important big logistic European companies (some of them with LNG fueling applications in West Europe)**
- **EU is funding a ~27.5 mil EUR project („LNG Motion”), developed by a western consortium, which brings a similar equity share for a total project value ~55 mil EUR**
- **Until 2020 there will be 42 public vehicle filling stations in 9 member states along major corridors (in Romania too) and 200 LNG fuelled trucks with specific project actions**
- **Developing first LNG re-fuelling station in best position, to be used by strong local logistic companies and by transit, with support of major players in trucks industry.**



-a study case-

***Different alternatives were considered ,
involving local and institutional partners***

Virtual pipeline distribution

Independent source of Natural Gas for a new Local Community Distribution Network

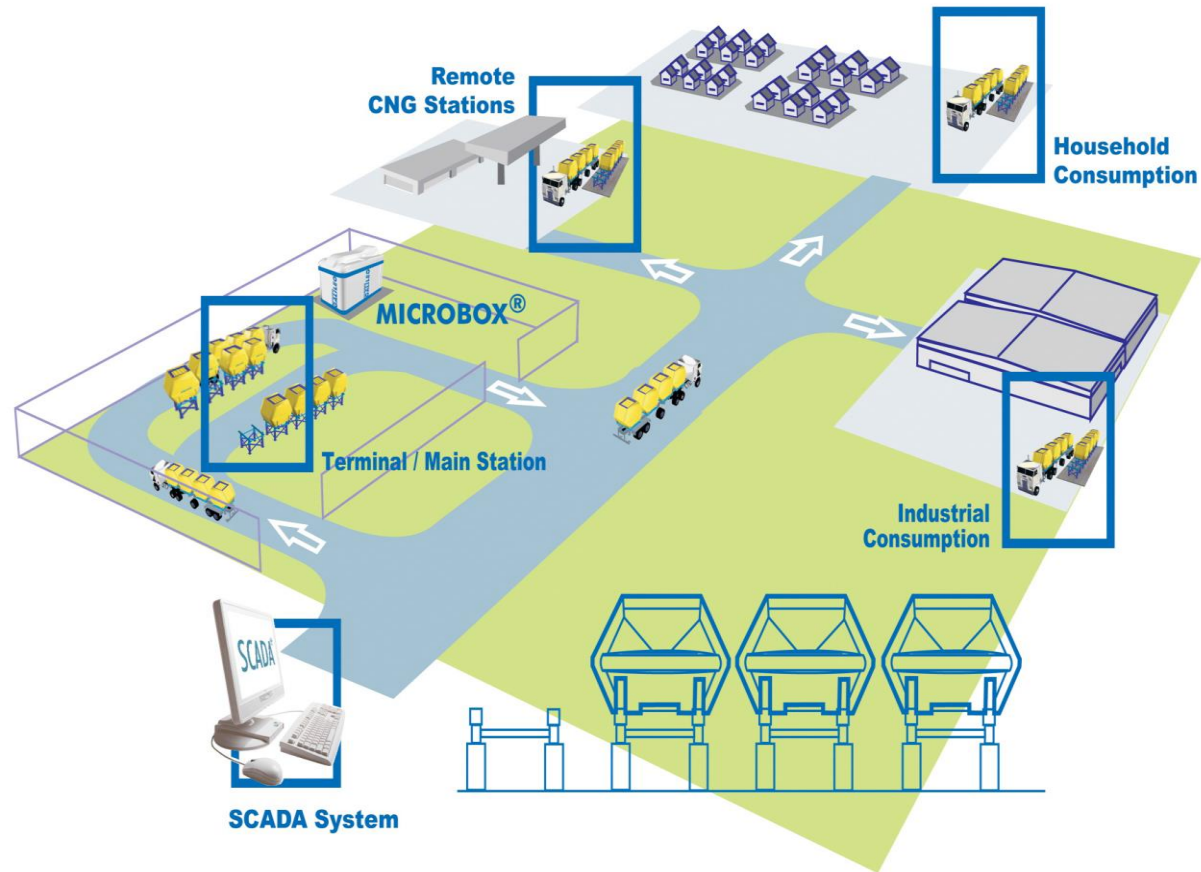
- ***Satellite Plant, consisting of storage tank(s) and vaporizers.***
- ***LNG is transported with tank trucks from import terminals or from domestic liquefaction plants***
- ***The local facility provides for unloading, storage, regasification and continuous supply to a classic Distribution Network for domestic, commercial or industrial consumers.***
- ***Modern and reliable distributed supply concept is implemented where the classic pipelines are ineffective (high cost, geographical conditions, inaccessible land, restricted access rights, long leadtime)***
- ***The facility could be linked with LNG supply for a re-fueling station for road vehicles.***



Independent source for a new Local Gas Distribution Network

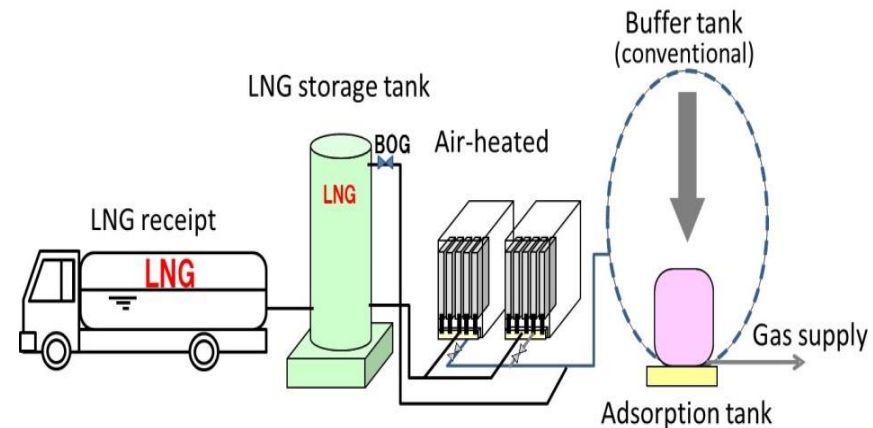
-a similar practical case-

- In Bulgaria, CNG Maritza Ltd implemented the Galileo technology for supply and transportation of compressed natural gas under “Virtual Pipeline” concept
- The project consist in implementing regasification technology for one municipality and 9 other small communities, each having independent gas source from CNG



Natural Gas supply for Industrial Consumers

- **Efficient, local and independent source of Natural Gas obtained through regasification of LNG for an Industrial Consumer , the „Satellite plant”.**
- **Natural Gas supply for a new small Industrial Consumer from National Transport System is inefficient, time-consuming and bureaucratic**
- **An LNG Satellite plant is more flexible and faster in terms of licensing and construction .**
- **The LNG Satellite plant provides better security of supply, brings supplementary financial savings and is safer than a traditional LPG supply.**
- **Linked development of a new Gas Distribution Network for the local community**



Comparision of LPG, NG and LNG use for an Industrial Consumer

Case study: small industrial consumer of 10,000 MWh/year, B4 gas tariff

Characteristics	LPG	Natural Gas	LNG	Comments
HHV (MJ/kg)	45.00	53.60	56.34	High Heat Value
HHV (MWh/kg)	0.0125	0.0149	0.0157	
Acquisition price	3.5 RON/kg	161.42 RON/MWh	220 RON/MWh	3.5 RON/kg ⇔ 280RON/MWh
Acquisition price (EUR/MWh)	59	34	46,2	@ 4.76 RON/EUR
Quantity for 10GWh/year (t)	800	672	639	
Cost of 10 GWh/year (EUR)	588,235	339,117	462,184	
Annual savings to LPG (EUR)		249,118	126,050	21,4% savings LNG to LPG

Feasibility of a Romanian startup in ssLNG market niche

Key success factors

- ***Absence of LNG market in Romania allows a gradual increase of business at market development pace. Cherry-picking the best ssLNG projects should insure profitability and risk limitation***
 - ***Start up ssLNG business as a substitute for LPG and heavy liquid fuel, considering price advantage and ease of upgrading existing facilities for industrial clients***
 - ***Expand to local communities of neighboring industrial clients***
 - ***Develop filling stations along EU transport corridors***
 - ***Invest in mini-liquefaction plants to benefit from lower cost and availability of Black Sea gas, while expanding to other markets (export)***
 - ***Based on demonstrated demand and accounting for risk limitation, a business could start with 2-3 Filling Stations , 2-3 Satellite Plants for local communities users and 2-3 Satellite Plants for industrial users; these will be selected from a large number of investigated potential clients (x10)***
 - ***The start up will require an investment of ~ 10.5 mil Eur over 6 years. Expected IRR is in the range of 15 - 25 % not considering potential EU grants.***
 - ***For the firsts ~ 2 years, LNG will be imported from neighboring terminals, while in the medium term, investment in domestic mini-liquefaction plants would boost profits.***
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***Thank you !
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