Supply of West Macedonia Distribution Networks through ssLNG Installations

6/7/2022

West Macedonia Projects Proposal – Poria, Aspros and Perdikkas regions

Where	Which Projects	Means of supply
Draft TYDP '22-'31, as set in Public Consultation by DESFA & RAE	• M/R Station in the region of Poria • CNG Station in the region of Poria • M/R Station in the region of Aspros • M/R Station in the region of Perdikkas Eordeas	• Kastoria and Grevena from Poria M/R Station, permanently through TAP connection • Florina, Skydra, Edessa & Naousa temporarily from TAP and then from the HP pipeline to West Macedonia
New Draft TYDP '22-'31, following RAE's request	• **SSLNG installations for the supply of West Macedonia** • M/R Station in the region of Aspros (for connection with HPP to W. Macedonia) • M/R Station in the region of Perdikkas Eordeas (for connection with HPP to W. Macedonia)	• Kastoria and Grevena from Poria M/R Station, permanently through ssLNG solutions • Florina, Skydra, Edessa & Naousa temporarily from ssLNG solutions and then from the HP pipeline to West Macedonia

Submission of draft TYDP to RAE and subsequent approval — July 2022

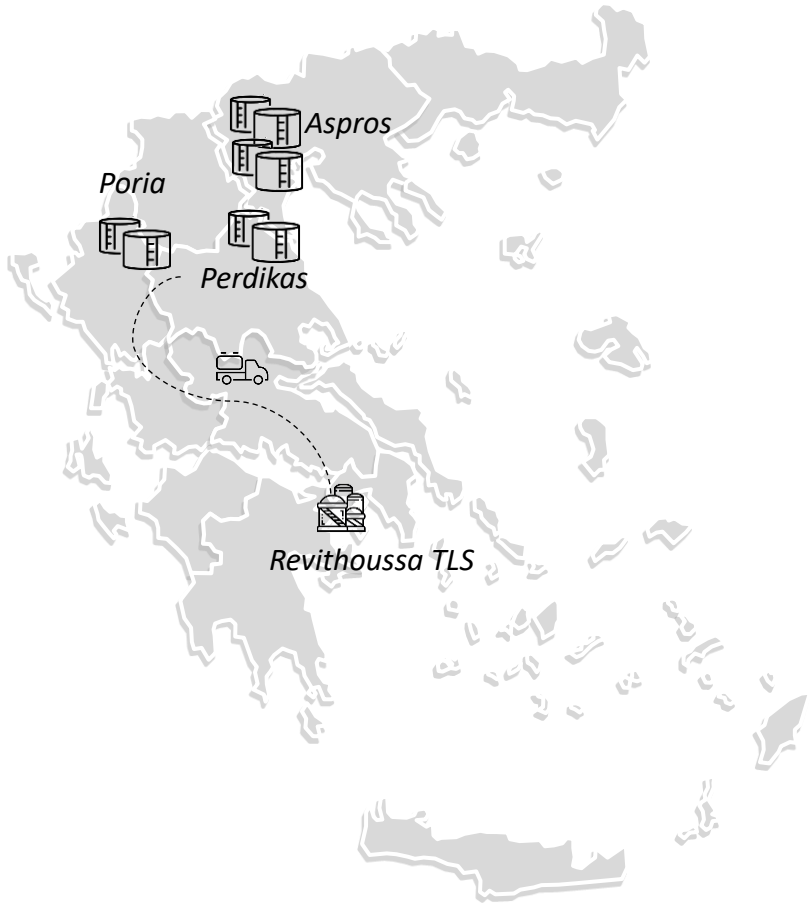
October 2023 — ssLNG Installations are set in operation

HP Pipeline to West Macedonia is set in operation — September 2024

Key outcome of the analysis

- ✓ Following RAE's request DESFA has further analyzed the SSLNG option for the supply of the West Macedonia Exit Points (Poria, Perdikas & Aspros) vis-à-vis the alternative of supplying these networks through TAP
- ✓ ssLNG solution will be applied permanently for the region of Poria while for Aspros and Perdikas the ssLNG installations will apply only for the gas year '23-'24. Modular supply solutions have been identified maximizing possible synergies and thus minimizing relevant cost and future expansion
- ✓ *Perdikas & Aspros*: The difference in CapEx between the supply through TAP and SSLNG is more than 50% (in absolute values CapEx cost of TAP solution is 920.000 € higher than the CapEx cost of ssLNG) while OpEx of SSLNG is lower than TAP's OpEx, making the supply of the two areas through ssLNG more cost efficient; It is important to note that the ssLNG installations will be moved to another location when the HP pipeline will start operations
- ✓ *Poria*: The CapEx required for the ssLNG installations is approximately 2 -4 mil. € higher than the CapEx required for the supply through TAP, depending on the final configuration; However, the OpEx through TAP is approximately 2,5 times higher than the OpEx of the ssLNG alternative, making the supply of the region through ssLNG more cost efficient than through TAP
- ✓ **In both cases, either through TAP or through ssLNG supply chain, the timeline for the operation is October 2023, driven from the time required to put the M/R stations in operation**

Modular solutions for the supply of Aspros and Perdikas to cover n.g. demand for '23-'24 thermal year



Main design assumptions

- Aspros and Perdikas will be supplied through ssLNG solution until the HP Pipeline to West Macedonia becomes operational (exp. Sept. 2024)
- Therefore, temporary ssLNG facilities will be installed at Perdikas and Aspros
- The already planned MR Stations are still necessary in order to support the supply of the regions from the HP pipeline to West Macedonia; their operation date will be aligned with the operation of the HP pipeline (i.e. Sept.2024)
- From Sept. 2024 onwards, the ssLNG installations will not be needed further and will be relocated either to the region of Poria or to other areas, depending on the evolution of the market
- To this end, the most efficient solution is to proceed with modular small size tanks and gasifiers, which are easy to be relocated, thus maximizing possible synergies and minimizing relevant cost
- DESFA believes that these installations will sufficiently cover the anticipated demand of the first year of consumption for both areas
- Two extra semi-trailers have been considered for contingency purposes

Aspros	
Trucks per day	3 x 43-48 m^3 net LNG capacity
Storage Tanks	4 x 108 m^3 net LNG capacity (5 days reserve)
Vaporization rate	2.200 -2.400 Nm^3/h (2 VAP+2 PBU unit)
Maximum yearly potential demand to be covered up to 2024	~ 19.272.000 Nm^3/year

Perdikas	
Trucks per day	2 x 43-48 m^3 net LNG capacity
Storage Tanks	2x 108 m^3 net LNG capacity (5 days reserve)
Vaporization rate	1.100 -1.200 Nm^3/h (2 VAP+2 PBU unit)
Maximum yearly potential demand to be covered up to 2024	~ 9.636.000 Nm^3/year

Poria will be permanently supplied though ssLNG infrastructures using the relocated installations of Aspros & Perdikas

Main design assumptions

- The supply of Poria is connected to the supply of Kastoria and Grevena
- Poria is the only region that will not be connected to the HP Pipeline of West Macedonia and in that respect the supply though ssLNG will be permanent
- Based on technical data the following options for the supply of the region have been identified:
  - For the supply of Kastoria : install the ssLNG infrastructure either in the vicinity of Kastoria or in Poria
  - For the supply of Grevena : install the ssLNG infrastructure close to the city of Grevena

Supply of Kastoria	
Trucks per day	1 x 43-48 m^3 net LNG capacity
Storage Tanks	1x 108 m^3 net LNG capacity (5 days reserve)
Vaporization rate	1.100 -1.200 Nm^3/h (2 VAP+2 PBU unit)
Maximum yearly potential demand to be covered up to 2024	~ 9.636.000 Nm^3/year

Supply of Grevena	
Trucks per day	1 x 43-48 m^3 net LNG capacity
Storage Tanks	1x 108 m^3 net LNG capacity (5 days reserve)
Vaporization rate	1.100 -1.200 Nm^3/h (2 VAP+2 PBU unit)
Maximum yearly potential demand to be covered up to 2024	~ 9.636.000 Nm^3/year

Important Points

1. **Coordination is required** with DEDA **under the auspices of RAE,** for the finalization of the supply solution and **the final location of the facilities.**
2. **After 2024** the increased **demand** of the region **will be served using the installations transferred from Aspros and Perdikas**

Comparison of costs for the two alternative solutions for Aspros and Perdikas

CAPEX Requirements | Supply of Aspros, Perdikas

#	Scenario	CAPEX Elements	Installations' cost, €	Total Cost, €	Estimated OPEX, €
1	**Via TAP** (1)	Pipeline cost for the connection to TAP	400.000	1,3 mil.	3,2 mil.(2) + energy cost
		Connection cost requested by TAP	870.000		
2	**Via truck loading station in Revithousa**	Leasing cost for LNG semi-trailers(4)	300.000 (6)	0,38 mil. (5)	3 mil. (3)
		Tanks/regasification incl. installation equipment	3.330.000		

(1) TAP imposes a **minimum measurement threshold of 400 Nm³/hr** for gas flows; so, flow interruptions may occur for lower flows

(2) In the case of supply via TAP, the annual OpEx (capacity booking in TAP Exit Points as well as in Nea Mesimvria) for Aspros is estimated approximately at €3.000.000 and for Perdikkas at €120.000, based on the data provided from the corresponding Distribution Companies. An extra cost of approx. €100.000 is included and refers to TAP's OpEx passed through to DESFA; additional energy costs (electricity and gas self-consumption) apply ex-post

(3) In the ssLNG case OpEx includes the cost for the use of the Truck Loading Station in Revithoussa as well as cost related to the road transport of the semi-trailers (i.e. trucks and drivers and fuel costs) and of the regasifier (electricity cost etc). More detailed analysis of logistics of the supply chain will be required prior to operations

(4) The cost of LNG semi-trailers refers to their leasing cost; DESFA has also examined the possibility of purchasing LNG semi-trailer or ISO Containers, however it is proposed to proceed as a first step with the leasing option

(5) The cost attributed to Aspros and Perdikas includes the leasing of the LNG semi-trailers and the 1/40 of the tanks and gasifiers' capex, assuming a 40 years' useful life of these installations (depreciation period)

(6) The yearly leasing cost per trailer is considered to be €60.000

The cost for the M/R Stations in Aspros and Perdikas has not been included as it remains the same for both supply alternatives (TAP and ssLNG)

Comparison of costs for the supply of Kastoria and Grevena

CAPEX & OPEX Requirements for a 15 yrs period

#	CAPEX elements, €	Via TAP	Via truck loading station in Revithousa
	CAPEX ELEMENTS		
1	**Poria M/R station**	3.500.000(1)	-
2	**Connection cost requested by TAP**	435.000(2)	
3	**Pipeline for the connection to TAP**	200.000	-
4	**Poria CNG Station**	1.000.000	-
5	**LNG Semi-trailers**	-	2.600.000 - 6.000.000(3)
6	**Tanks/Regas Cost incl. installation cost**	-	1.400.000 + 3.250.000(4)
	TOTAL	**5.135.000**	**7.250.000 - 10.650.000**
	OPEX ELEMENTS (sum 15 yrs) 2023- 2037		
7	**TAP capacity booking**	42.638.247	-
8	**Transportation from Revithoussa**	-	12.300.000 (5)
9	**Cost for the use of the truck loading station**		4.700.000 (6)
	TOTAL	**42.638.247**	**17.000.000**

Main assumptions

(1) The cost is updated according to latest available data

(2) Amount provided from TAP

(3) The main assumption is that the LNG semi-trailers will be leased; such include 2 trailers until 2024 and 7 trailers from 2024 onwards; However, since this leads to the upper limit of the range and the estimated cost of purchase of each semi-trailer is ca €350.000, we have also considered the option to buy the trailers from the 2nd year onward, which leads to the lower limit of the range. More detailed analysis of logistics of the supply chain will be required prior to operations

(4) Includes the capex of the initial tanks and regasifiers (slide 5), plus the non-depreciated capex of the relevant facilities of Aspros and Perdikkas, when relocated after 2024

(5) Is the cost related to the road transport the semi-trailers (i.e. trucks and drivers and fuel costs) and of the regasifier (electricity cost etc). Further decrease of the OPEX may occur if synergies with the possible ssLNG installations in Igoumenitsa/Ioannina are considered, since then trucks can load from the truck loading station in the area of Igoumenitsa. More detailed analysis of logistics of the supply chain will be required prior to operations

(6) €650 per truck loading