Technical Meeting to Discuss the Concept of an Alternative Energy and Energy Storage Hub for Western Macedonia

Wind Energy in the region around the lignite center of Western Macedonia: Current status, prospects and benefits

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HWEA

Athens, 30 October 2019



- Founded in 1990
- National representative of European wind energy association WindEurope
- Members: Companies and Scientists of wind power sector
- Nonprofit Organization (NPO)

Scope

- Express the well-meant interests of the industry and the market by acting as a think-tank and dialogue forum with scientific documentation and competence
- ✓ Promote the scientific research, technology and applications of wind energy

Total wind capacity connected to the grid (MW) per year



The HWEA Wind Energy Statistics take into account the wind capacity which is in commercial or test operation in Greece and it is based on sources from the market actors.

3



Spatial distribution of operating wind MWs

✓ Total wind capacity in Greece, 6/2019 : 3025MW

out of which....

✓ Wind capacity in Macedonia & Thrace : **599MW** or 20% of total
out of which

 $\checkmark\,$ Wind capacity in Western Macedonia : **61MW** or 2% of total



The end of the lignite era...





...and the beginning of the clean energy era

Korce



Source: Global wind atlas

7

Wind Energy development in Western Macedonia (1)





Projects with:

✓ Operation License : 61MW

Wind Energy development in Western Macedonia (2)





Projects with:

50 km

- ✓ Operation License : 61MW
- ✓ Installation Lic. : 152MW

Wind Energy development in Western Macedonia (3)





Wind Energy development in Western Macedonia (4)





Projects with:

- ✓ Operation License : 61MW
- ✓ Installation Lic. : 152MW
- ✓ EIA Approval : 796MW
- ✓ Production Lic. : 746MW

Wind Energy development in Western Macedonia (5)





✓ Operation License : 61MW

50 km

Projects with:

- ✓ Installation L. : 152MW
- ✓ EIA Approval : 796MW
- ✓ Production L. : 746MW
- ✓ Applications PL : 378MW

Wind Energy development in Western Macedonia (6)



Licensing status	Capacity (MW)
Application for Production License	377,6
Production License	746,5
EIA approval	795,7
Installation License	151,8
Operation License	61,3
Total	2132,9

Source: RAE/geo, downloaded 24/10/2019

Wind Energy development in Western Macedonia (7)





Wind energy projects selected in auctions : 100,95MW

RES LCOE Versus Marginal Cost of Conventional Generation



Certain Alternative Energy generation technologies, which became cost-competitive with conventional generation technologies several years ago, are, in some scenarios, approaching a LCOE that is at or below the marginal cost of existing conventional generation technologies



Comparison of Historical LCOE of Utility-Scale Generation Units



LCOE analysis indicates significant historical cost declines for large scale Alternative Energy generation technologies driven by, among other factors, decreasing supply chain costs, improving technologies and increased competition. Percentages in the graph represent the total decrease in the average LCOE since 2009.



Comparison of Historical LCOE of RES



In light of material declines in the pricing of system components (e.g., panels, inverters, turbines, etc.) and improvements in efficiency, among other factors, wind and large scale solar PV have seen dramatic historical LCOE declines; however, over the past several years the rate of such LCOE declines have started to flatten.







Wind auctions in Greece, RV in €/MWh



The lowest and highest bid and the weighted average of the bids of each RES auction conducted in Greece so far is presented.





The performed sensitivity analysis of the LCOE for various levels of capacity factor, indicates the importance of exploiting the windiest areas.



Key Assumptions	
Capacity (MW)	50
Fixed O&M (€/kW-year)	35
Municipal tax (% of turnover)	3%
Balancing cost (€/MWh)	4
O&M Escalation Rate	1%
Capital Structure	
Debt	70%
Cost of Debt	3,4%
Equity	30%
Cost of Equity	7,0%
Taxes and Tax Incentives:	
Tax Rate	20%
Economic Life (years)	20
Depreciation (years)	10
Loan tenor (years)	15
<u>Capex</u>	
EPC Costs (€/kW)	1.100

Important note: The analysis is based on general assumptions and should not be considered as an advice or a proposed binding policy direction.



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Weighted average of all final bids for wind projects in Western Macedonia, participated in the auctions 7/2018-7/2019: 66,8 €/MWh

At the end of 2017, there were wind farms of total capacity 218.7 MW in south Evia island, which were constructed in the period 1998-2017. On top of that, a capacity of 28.2 MW had been constructed, but not yet put into commercial operation.

Total power of wind farms	218.7 MW
Direct permanent jobs locally	62
Total benefit from operation	16.5 mil. €
Total benefit from the special tax 3%	21.7 mil. €
Total benefit from construction	44.4 mil. €
Total local benefit from the S. Evia W/Fs	82.6 mil. €
Annual average (1998-2017)	4.2 mil. € / year

For comparison reasons, it is mentioned that the first modern-type private gas station of 400MW installed in Greece, created approx. 32 permanent jobs, i.e. 0.08 jobs/MW versus 0.3 local jobs/MW from the wind farms in south Evia (almost 4 times more).

http://eletaen.gr/en/the-local-benefits-from-wind-farms-in-south-evia-greece/







Total power of wind farms	approx. 1,200 MW
Jobs at wind investors/owners (development, construction, operation)	0.49 permanent jobs /MW
Jobs at WTGs manufacturers (sales, O&M)	0.32 permanent jobs /MW
Jobs at towers manufacturing	0.19 permanent jobs /MW
Total	1 permanent job /MW





- ✓ Full implementation of the 100% proven energy resource of Greece.....
- \checkmark which is its wind potential....
- ✓ both onshore and offshore
- Development of a strong local supply chain, especially for wind offshore (incl. floating) incorporating our navalindustry tradition, shipyards, cable industry, OMS infrastructure
- ✓ Large international interconnections
- ✓ Foreign and local investments
- ✓ Producer and exporter of green electricity
- ✓ Strong contributor to the Europe's energy independence
- Geopolitical reinforcement and sustainable economic growth



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