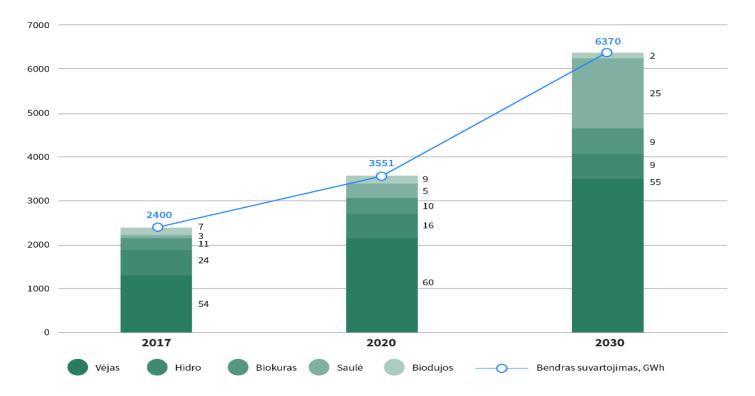
Wind energy potential in Lithuania: opportunities and challenges

Aistis Radavičius Executive director, Lithuanian wind power association



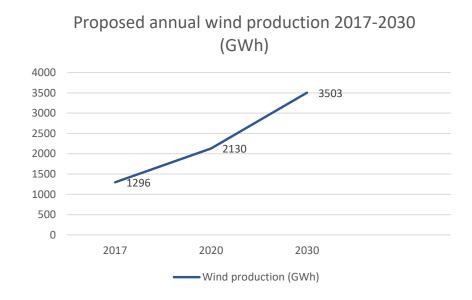
National Energy strategy – 50 % renewable electricity by 2030

Market structure based on the amount of electricity consumed from RES,% and GWh (forecast)

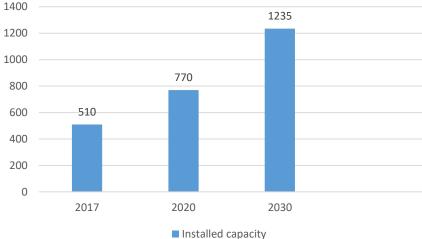




Wind development proposals in National Energy Strategy until 2030









Wind Europe estimation of Lithuanian potential onshore: 1500 MW could be installed by 2030

Onshore wind power cumulative capacity to 2030

Germany60,00070,00071,000France31,32036,36041,400Spain30,00035,00040,000United Kingdom113,00015,00020,000Italy10,70013,60016,700Sweden9,00012,00013,000Poland7,00010,00013,000Netherlands8,0008,00015,000Portugal6,7507,0007,250Austria5,0006,7008,000Greece3,4006,2007,000Ireland5,0005,6006,700Denmark3,6505,0006,500Finland3,0254,5006,000Belgium6911,2063,000Lithuania7501,1001,500Czech Republic1,4501.9002,450Estonia6007441,000Cyprus158483600Hungary3003001,500Slovenia3300500Slovenia3300500Slovenia3300500Slovenia3300500Litvia635006,48TOTAL EU-28206,913253,087298,548		LOW	CENTRAL	HIGH
Spain30,00035,00040,000United Kingdom13,00015,00020,000Italy10,70013,60016,700Sweden9,00012,00013,000Poland7,00010,50012,000Netherlands8,0008,0008,000Portugal6,7507,0007,250Austria5,0006,7008,000Greece3,4006,2007,000Ireland5,0005,6006,500Finland3,0254,5006,500Belgium3,4004,4004,400Bulgaria6911,2003,000Creec Republic1,4501,9002,450Belgium3,0005,0001,500Bulgaria6911,2003,000Creec Republic1,4501,9002,450Bulgaria6007441,000Creach Republic1,584433600Hungary3003001,500Slovenia3501,000Slovenia3501,000Luxembourg1001002,000Kata5001,5002,000Luxembourg3300500Luxembourg3300500Luxembourg3300500Luxembourg3300500Luxembourg3300500Luxembourg3300500Luxembourg3300	Germany	60,000	70,000	71,000
United Kingdom 13,000 15,000 20,000 Haly 10,700 13,600 16,700 Sweden 9,000 12,000 13,000 Poland 7,000 10,500 12,000 Netherlands 8,000 8,000 15,000 Portugal 6,750 7,000 7,250 Austria 5,000 6,700 8,000 Greece 3,400 6,200 7,000 Ireland 5,000 5,600 6,700 Denmark 3,655 5,000 6,000 Belgium 3,400 4,400 4,400 Bulgaria 691 1,266 3,000 Lithuania 750 1,100 1,500 Czech Republic 1,450 1,900 2,450 Estonia 600 744 1,000 Cyprus 158 483 600 Hungary 300 300 1,500 Slovenia 3 50 100	France	31,320	36,360	41,400
Italy 10,700 13,600 16,700 Sweden 9,000 12,000 13,000 Poland 7,000 10,500 12,000 Netherlands 8,000 8,000 15,000 Portugal 6,750 7,000 7,250 Austria 5,000 6,700 8,000 Greece 3,400 6,200 7,000 Ireland 5,000 5,600 6,700 Denmark 3,650 5,000 6,500 Finland 3,000 5,000 10,000 Romania 3,025 4,500 6,000 Belgium 3,400 4,400 4,400 Bulgaria 691 1,200 3,000 Lithuania 750 1,100 1,500 Czech Republic 1,450 1,900 2,450 Estonia 600 744 1,000 Cyprus 1158 483 600 Hungary 300 300 1,500 S	Spain	30,000	35,000	40,000
Sweden 9,000 12,000 13,000 Poland 7,000 10,500 12,000 Netherlands 8,000 8,000 15,000 Portugal 6,750 7,000 7,250 Austria 5,000 6,700 8,000 Greece 3,400 6,200 7,000 Denmark 3,650 5,000 6,500 Finland 3,000 5,000 6,000 Belgium 3,400 4,400 4,400 Bulgaria 691 1,200 3,000 Czech Republic 1,450 1.900 2,450 Estonia 600 744 1,000 Cyprus 158 483 600 Hungary 300 300 1,500 Slovenia 3 50 100 Slovenia 3 300 500 Slovenia 3 300 500 Slovenia 63 500 6,48	United Kingdom	13,000	15,000	20,000
Poland 7,000 10,500 12,000 Netherlands 8,000 8,000 15,000 Portugal 6,750 7,000 7,250 Austria 5,000 6,700 8,000 Greece 3,400 6,200 7,000 Ireland 5,000 5,600 6,700 Denmark 3,650 5,000 6,500 Finland 3,000 5,000 6,000 Belgium 3,400 4,400 4,400 Bulgaria 691 1,200 3,000 Lthuania 750 1,100 1,500 Cxech Republic 1,450 1900 2,450 Estonia 600 744 1,000 Cyprus 158 483 600 Hungary 300 300 1,500 Slovenia 50 50 100 Slovenia 3 50 100 Slovakia 3 300 500 Groatia	Italy	10,700	13,600	16,700
Netherlands 8,000 8,000 8,000 15,000 Portugal 6,750 7,000 7,250 Austria 5,000 6,700 8,000 Greece 3,400 6,200 7,000 Ireland 5,000 5,600 6,700 Denmark 3,650 5,000 6,500 Finland 3,000 5,000 6,000 Belgium 3,025 4,500 6,000 Bulgaria 691 1,200 3,000 Lithuania 750 1,100 1,500 Czech Republic 1,450 1900 2,450 Estonia 600 744 1,000 Cyprus 158 483 600 Hungary 300 300 1,500 Slovenia 50 50 100 Slovenia 3 50 100 Slovakia 3 300 500 Luxembourg 63 500 1,500	Sweden	9,000	12,000	13,000
Portugal 6,750 7,000 7,250 Austria 5,000 6,700 8,000 Greece 3,400 6,200 7,000 Ireland 5,000 5,600 6,700 Denmark 3,650 5,000 6,500 Finland 3,000 5,000 6,000 Belgium 3,400 4,400 4,400 Bulgaria 691 1,200 3,000 Lithuania 750 1,100 1,500 Czech Republik 1,450 1.900 2,450 Estonia 600 744 1,000 Cyprus 158 483 600 Hungary 300 300 1,500 Luxembourg 100 100 200 Slovenia 3 50 100 Slovakia 3 300 500 Latvia 63 500 6,48	Poland	7,000	10,500	12,000
Austria 5,000 6,700 8,000 Greece 3,400 6,200 7,000 Ireland 5,000 5,600 6,700 Denmark 3,650 5,000 6,500 Finland 3,000 5,000 6,000 Romania 3,025 4,500 6,000 Belgium 3,400 4,400 4,400 Bulgaria 691 1,200 3,000 Lithuania 750 1,100 1,500 Czech Republic 1,450 1900 2,450 Estonia 600 744 1,000 Cyprus 158 483 600 Hungary 300 300 1,500 Luxembourg 100 100 200 Slovakia 3 50 100 Slovakia 3 300 500 Luxembourg 3 300 500 Luxembourg 3 300 500 Luxei 63 <td>Netherlands</td> <td>8,000</td> <td>8,000</td> <td>15,000</td>	Netherlands	8,000	8,000	15,000
Greece 3,400 6,200 7,000 Ireland 5,000 5,600 6,700 Denmark 3,650 5,000 6,500 Finland 3,000 5,000 10,000 Romania 3,025 4,500 6,000 Belgium 3,400 4,400 4,400 Bulgaria 691 1,200 3,000 Lithuania 750 1,100 1,500 Czech Republic 1,450 1900 2,450 Estonia 600 744 1,000 Cyprus 158 483 600 Hungary 300 300 1,500 Luxembourg 100 100 200 Malta 50 50 100 Slovakia 3 300 500 Croatia 500 1,500 2,000 Latvia 63 500 648	Portugal	6,750	7,000	7,250
Ireland 5,000 5,600 6,700 Denmark 3,650 5,000 6,500 Finland 3,000 5,000 10,000 Romania 3,025 4,500 6,000 Belgium 3,400 4,400 4,400 Bulgaria 691 1,209 3,000 Lithuania 750 1,100 1,500 Czech Republic 1,450 1900 2,450 Estonia 600 744 1,000 Cyprus 158 483 600 Hungary 300 300 1,500 Luxembourg 100 100 200 Malta 50 50 100 Slovakia 3 300 500 Latvia 63 500 648	Austria	5,000	6,700	8,000
Denmark 3,650 5,000 6,500 Finland 3,000 5,000 10,000 Romania 3,025 4,500 6,000 Belgium 3,400 4,400 4,400 Bulgaria 691 1,200 3,000 Lithuania 750 1,100 1,500 Czech Republic 1,450 1900 2,450 Estonia 6000 744 1,000 Cyprus 158 483 600 Hungary 300 300 1,500 Luxembourg 100 100 200 Slovenia 3 50 100 Slovakia 3 300 500 Latvia 63 500 648	Greece	3,400	6,200	7,000
Finland 3,000 5,000 10,000 Romania 3,025 4,500 6,000 Belgium 3,400 4,400 4,400 Bulgaria 691 1,200 3,000 Lithuania 750 1,100 1,500 Czech Republic 1,450 1900 2,450 Estonia 600 744 1,000 Cyprus 158 483 600 Hungary 300 300 1,500 Luxembourg 100 100 200 Slovenia 3 50 100 Slovakia 3 300 500 Latvia 63 500 648	Ireland	5,000	5,600	6,700
Romania 3,025 4,500 6,000 Belgium 3,400 4,400 4,400 Bulgaria 691 1,200 3,000 Lithuania 750 1,100 1,500 Czech Republic 1,450 1900 2,450 Estonia 600 744 1,000 Cyprus 158 483 600 Hungary 300 300 1,500 Luxembourg 100 100 200 Slovenia 50 50 100 Slovakia 3 300 500 Latvia 63 500 648	Denmark	3,650	5,000	6,500
Belgium 3,400 4,400 4,400 Bulgaria 691 1,200 3,000 Lithuania 750 1,100 1,500 Czech Republic 1,450 1 900 2,450 Estonia 600 744 1,000 Cyprus 158 483 600 Hungary 300 300 1,500 Luxembourg 100 100 200 Slovenia 50 50 100 Slovakia 3 300 500 Latvia 63 500 648	Finland	3,000	5,000	10,000
Bulgaria 691 1,200 3,000 Lithuania 750 1,100 1,500 Czech Republic 1,450 1.900 2,450 Estonia 600 744 1,000 Cyprus 158 483 600 Hungary 300 300 1,500 Luxembourg 100 100 200 Malta 50 50 100 Slovenia 3 50 100 Slovakia 500 1,500 2,000 Latvia 63 500 648	Romania	3,025	4,500	6,000
Lithuania 750 1,100 1,500 Czech Republic 1,450 1 900 2,450 Estonia 600 744 1,000 Cyprus 158 483 600 Hungary 300 300 1,500 Luxembourg 100 100 200 Malta 50 50 100 Slovenia 3 50 100 Slovakia 500 1,500 2,000 Latvia 63 500 648	Belgium	3,400	4,400	4,400
Czech Republic 1,450 1,900 2,450 Estonia 600 744 1,000 Cyprus 158 483 600 Hungary 300 300 1,500 Luxembourg 100 100 200 Malta 50 50 100 Slovenia 3 50 100 Slovakia 500 1,500 2,000 Latvia 63 500 648	Bulgaria	691	1,200	3,000
Estonia 600 744 1,000 Cyprus 158 483 600 Hungary 300 300 1,500 Luxembourg 100 100 200 Malta 50 50 100 Slovenia 3 50 100 Slovakia 500 1,500 2,000 Latvia 63 500 648	Lithuania	750	1,100	1,500
Cyprus 158 483 600 Hungary 300 300 1,500 Luxembourg 100 100 200 Malta 50 50 100 Slovenia 3 50 100 Slovakia 3 300 500 Croatia 500 1,500 2,000 Latvia 63 500 648	Czech Republic	1,450	1,900	2,450
Hungary 300 300 1,500 Luxembourg 100 100 200 Malta 50 50 100 Slovenia 3 50 100 Slovakia 3 300 500 Croatia 500 1,500 2,000 Latvia 63 500 648	Estonia	600	744	1,000
Luxembourg 100 100 200 Malta 50 50 100 Slovenia 3 50 100 Slovakia 3 300 500 Croatia 500 1,500 2,000 Latvia 63 500 648	Cyprus	158	483	600
Malta 50 50 100 Slovenia 3 50 100 Slovakia 3 50 100 Croatia 500 1,500 2,000 Latvia 63 500 648	Hungary	300	300	1,500
Slovenia 3 50 100 Slovenia 3 50 100 Slovakia 3 300 500 Croatia 500 1,500 2,000 Latvia 63 500 648	Luxembourg	100	100	200
Slovakia 3 300 500 Croatia 500 1,500 2,000 Latvia 63 500 648	Malta	50	50	100
Croatia 500 1,500 2,000 Latvia 63 500 648	Slovenia	3	50	100
Latvia 63 500 648	Slovakia	3	300	500
	Croatia	500	1,500	2,000
TOTAL EU-28 206,913 253,087 298,548	Latvia	63	500	648
	TOTAL EU-28	206,913	253,087	298,548

Proposed in NES: ~ 1235 MW

Proposal is adequate, if we talk about onshore



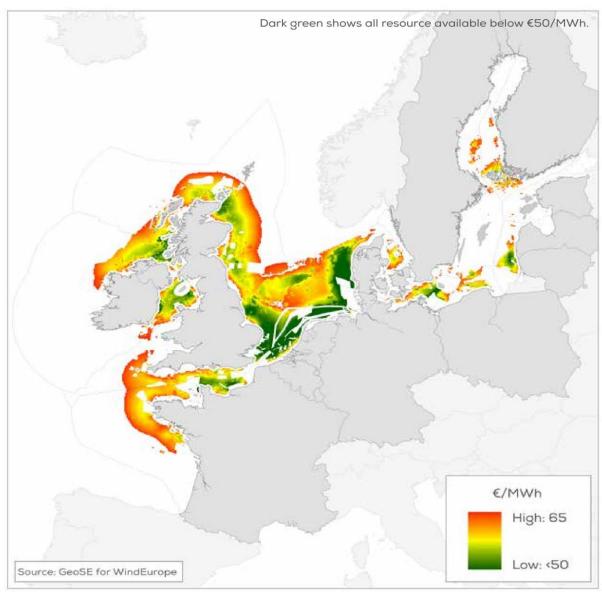
No offshore wind in National Energy Strategy?

- Changes done to Reneable Energy Law in 2017
- Seabed research, cost&benefit evaluations, grid connection cost and other necessary evaluations
- Research results by 2021-2022
- Offshore parks in EEZ not earlier than 2025-2026

Result: no clear vision on offshore = no clear division between onshore and offshore wind



Map of economically attractive resource potential at end of 2030 (upside scenario)



Germany, Latvia and Lithuania have the most economically attractive offshore potential in the Baltic sea region



What are the main constrains/worries/challenges?

From Goverment side:

- Grid stability
- Grid availability
- Cost for grid
- Cost for consumers



What are the main constrains/worries/challenges?

From Investor side:

Increasing complexity of development process:

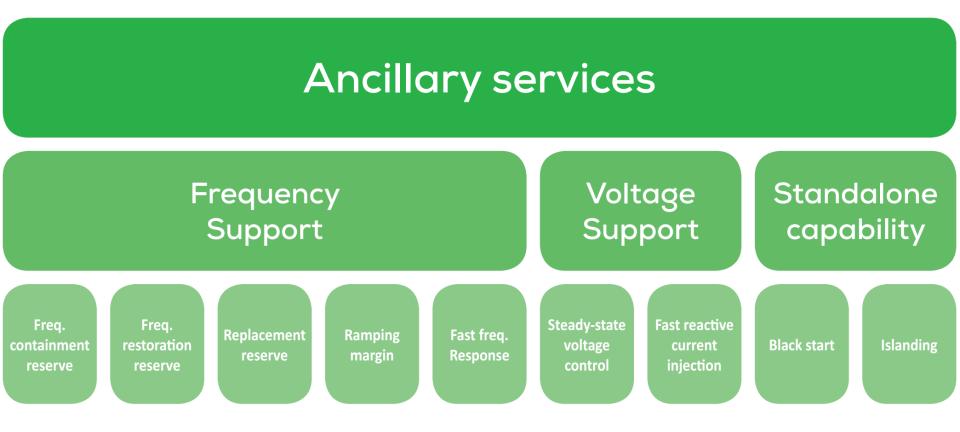
- Radars
- Spatial planning/sanitary zones
- Growing noise requirements
- Increasing enviromental requirements for birds and bats
- Increasing price pressure from landowners
- Increasing taxation from municipalities

Political uncertainty

Low market prices



Grid stability: Wind turbines can provide grid stability services





Grid availability and cost for grid: Up to 500 MW of wind can be integrated without significant cost

According to Lithuanian TSO "LITGRID":

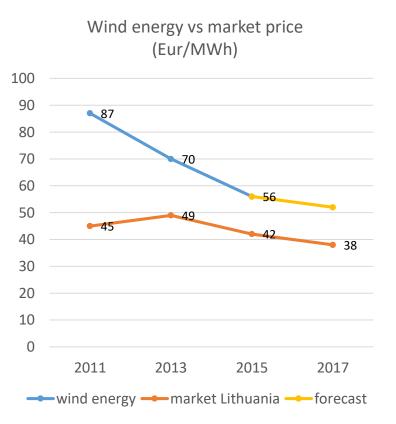
- Up to 500 MW of additional wind (above the current 510 MW) can be integrated without reconstructing the grid (minor costs up to 4,8 MEUR for substations)
- Integration of higher volumes requires investment upgrading the grid: additional 1000 MW (above the current 510 MW) – 90 MEUR
- For debate: does integrating 1000 MW really requires building 400 MW of new reserve capacity??
- Common Baltic balancing market starting in 2018



Cost for consumers: further onshore development possible without additional burden to consumers

Further development possible without additional burden to consumers

- Wind is already the cheapest option for new installations
- New 350 MW onshore 11 MEUR/y
- 2019 2023, 8 wind parks (139 MW) out of subsidy (18 MEUR/y)

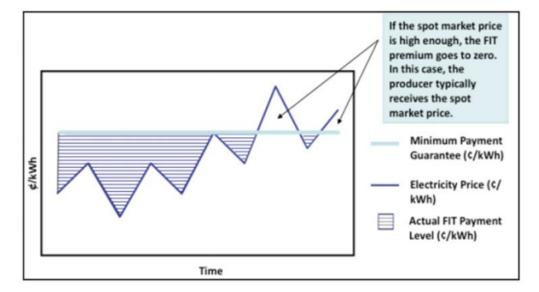




Choosing the most suitable support scheme

Sliding feed-in premium (sFIP) support scheme

- Producer trades electricity in the market
- Producer is responsible for balacing
- A sliding premium above the market price is paid to the producer
- Optimized financial burden for consumers; revenue stability for producers provided





To sum up:

- The proposed development of wind in National Energy Strategy is adequate if to be allocated only to onshore
- Offshore development is postponed for almost a decade, so the main focus should be on onshore
- Wind can contribute to lower prices in the market and grid stability
- Wind is the cheapest form of electricity generation and up to 500 MW additional onshore does not cost to connect



Proposals:

- Make a clear distinction between onshore and offshore development
- Set a clear five year framework for additional 350 MW onshore
- Conduct a study on grid availability after 2022
- Increase RES targets, if offshore is included



Thank you!

Lietuvos vėjo elektrinių asociacija M.K.Čiurlionio 4, LT-03104, Vilnius +370 650 23232, <u>lvea@lvea.lt</u> <u>www.lvea.lt</u>

