



OPENING PHOTO: BLADE TRANSPORT WITH INNOVATIVE BLADE LIFTER SYSTEM THROUGH A SMALL VILLAGE IN LIGURIAN REGION TO THE SITE OF INSTALLATION OF ROCHE BIANCHE WIND PLANT .(CREDITS: PHOTOGRAPH MARCO RIMONDI AND COPYRIGHT FERA SRL, [WWW.FERASRL.IT](http://WWW.FERASRL.IT) )

## ITALY

In 2020 Italy was one of the first countries strongly affected by the COVID pandemic and consequent lockdowns. This caused delays in all the sectors, including wind park installations and wind energy related research activities. The new yearly power capacity, around 100 MW, represents the minimum value in the last fifteen years. However, three joint PV wind tenders to access the incentives took place and wind farms won 87% of the whole 1 GW capacity. The renewable penetration registered very relevant peaks.

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### **M**arket Development Targets and Policy

In 2009, Italy set a binding national target of 17% of overall annual energy consumption from renewable energy sources (RES) in 2020, which included a target of 12.68 GW (12.0 GW land-based and 0.680 GW



TABLE 1. KEY NATIONAL STATISTICS 2020: ITALY

Total (net) installed wind power capacity*	10.6 GW
Total offshore capacity	0 GW
New wind power capacity installed	0.1 GW
Decommissioned capacity (in 2020)	0 GW
Total electrical energy output from wind	18.5TWh
Wind-generated electricity as percent of national electricity demand	6.13 %
Average national capacity factor**	19.9 %
Target	19.3 GW installed capacity @2030
National wind energy R&D budget	

\*Installed wind power capacity: Use nameplate power ratings of the installed wind turbines. \*\*Average National Capacity Calculation. Only include turbines in operation the whole year: (MWh production/8,760 hrs) / MW installed capacity MWh total electrical production from wind turbines operating January 1 through December 31 divided by 8,760 hrs divided by the total installed wind capacity (in MW) at the beginning of the year. [You can also use an estimate based on the average installed capacity during the year: (installed 1st Jan + installed 31st Dec)/2. But in that case, state that it is how the estimate is calculated.]

offshore) installed wind power capacity and a target of 20 TWh/yr (18 TWh/yr land-based and 2 TWh/yr offshore) for electricity production. Concerning the percentage of annual energy consumption, Italy already reached the renewable production target in 2015. At the end of 2020, the onshore installed capacity was 1.35 GW lower than the target, and the offshore capacity is 0 GW. However, in 2019, the wind electricity production target was reached.

At the end of 2017, the new National Energy Strategy (SEN 2017) [1] outlining national objectives and policies for Italian energy systems by 2030 was published. SEN 2017 set a target of 40 TWh/yr of wind energy

production (mostly land-based). In line with SEN2017, the final version of the Integrated National Energy and Climate Action Plan (PNIEC) [2] was published in December 2019. This Plan sets a target of 30% of overall annual energy consumption from renewable energy sources (RES). The contribution of the wind energy is fixed in a total installed capacity of 19.3 GW (including 0.9 GW offshore) producing 41.5 TWh/y by 2030. Therefore, a significant increase in wind power capacity is expected in the next years, also fostering the revamping and repowering interventions to minimize the use of virgin soil and better exploit the windy sites of the old plants.

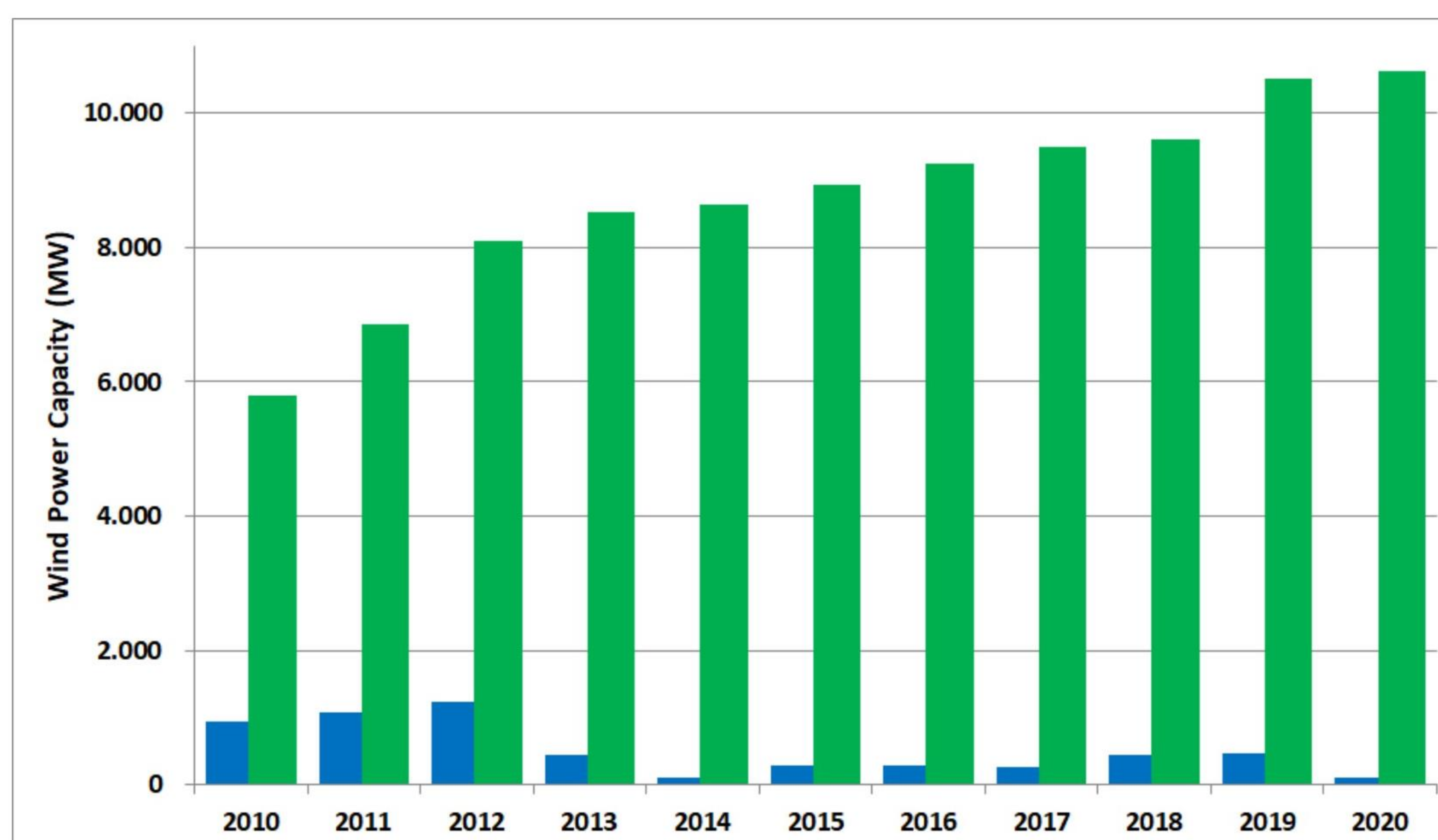


FIGURE 1: 2010-2020 TREND OF ANNUAL (BLUE) AND CUMULATIVE (GREEN) WIND POWER CAPACITY IN ITALY (SOURCE: ELABORATION FROM ANEV DATA).



**Progress and Operational Details**

**Power capacity:** According to the National Wind Energy Association (ANEV), Italy installed a new net wind power capacity of 101.6 MW in 2020. Cumulative installed capacity at the end of 2019 reached 10.6 GW—all land-based, including decommissioning and repowering. The trend of annual and cumulative capacity in the period 2010-2020 is shown in Figure 1. According to the national TSO, TERNA [3], around 240 MW of small wind plants (plant size lower than 200 KW) should be added to the cumulated capacity. The new installed capacity is particularly low (around 1/4 of the value of the last two years!) and it is mainly due to the effects of the COVID-19 pandemic. Unfortunately, Italy was among the first countries with a high number of infected and a lockdown with a full stop of all the activities for two months (March-April 2020) followed by other partial lockdowns in the autumn that delayed many activities, including wind installations.

**Electricity production:** The overall wind electricity production in 2020 according to TERNA data [4] was 18.5 TWh, corresponding to 6.1% of Italy’s total electricity demand (total consumption plus grid losses). Wind electricity production decreased both because the wind resource during the year was lower than in 2019 and because the curtailments reached 4.4% (preliminary data). The latter is probably due to the decrease of the overall electricity demand to 302.8 GWh and thus a higher exceed of peak wind energy production. On Sunday 5 April 2020, the low electricity demand typical of a spring holiday combined with the effects of the lockdown brought the renewable and wind energy generation to very high values - 70% and 15% of the total production respectively [5], see Figure 2.

**Capacity factor:** The 2020 average national capacity factor was 19.9%.

**Wind plants and turbines:** In 2020, 10 new wind farms of relatively small size were grid-connected. The maximum plant size was 18 MW. 38 new turbines were installed, bringing the country’s total to more than 7,100 operating units. The wind turbines installed during the year averaged 2.7 MW (maximum 4 MW). The average size of all wind turbines installed in Italy is 1.4 MW, the same as in 2019. Vestas is the first turbine manufacturer with 40% of the new installed capacity, followed by Enercon (37%) and Siemens-Gamesa (16%). Concerning the cumulated capacity, Vestas and Siemens-Gamesa remain the two first turbine manufacturers.

**Geographical distribution:** New wind power capacity was mainly installed in Apulia region (35%), followed by Sicily (20%), Calabria (16%) , Abruzzo (13%) Ligurian

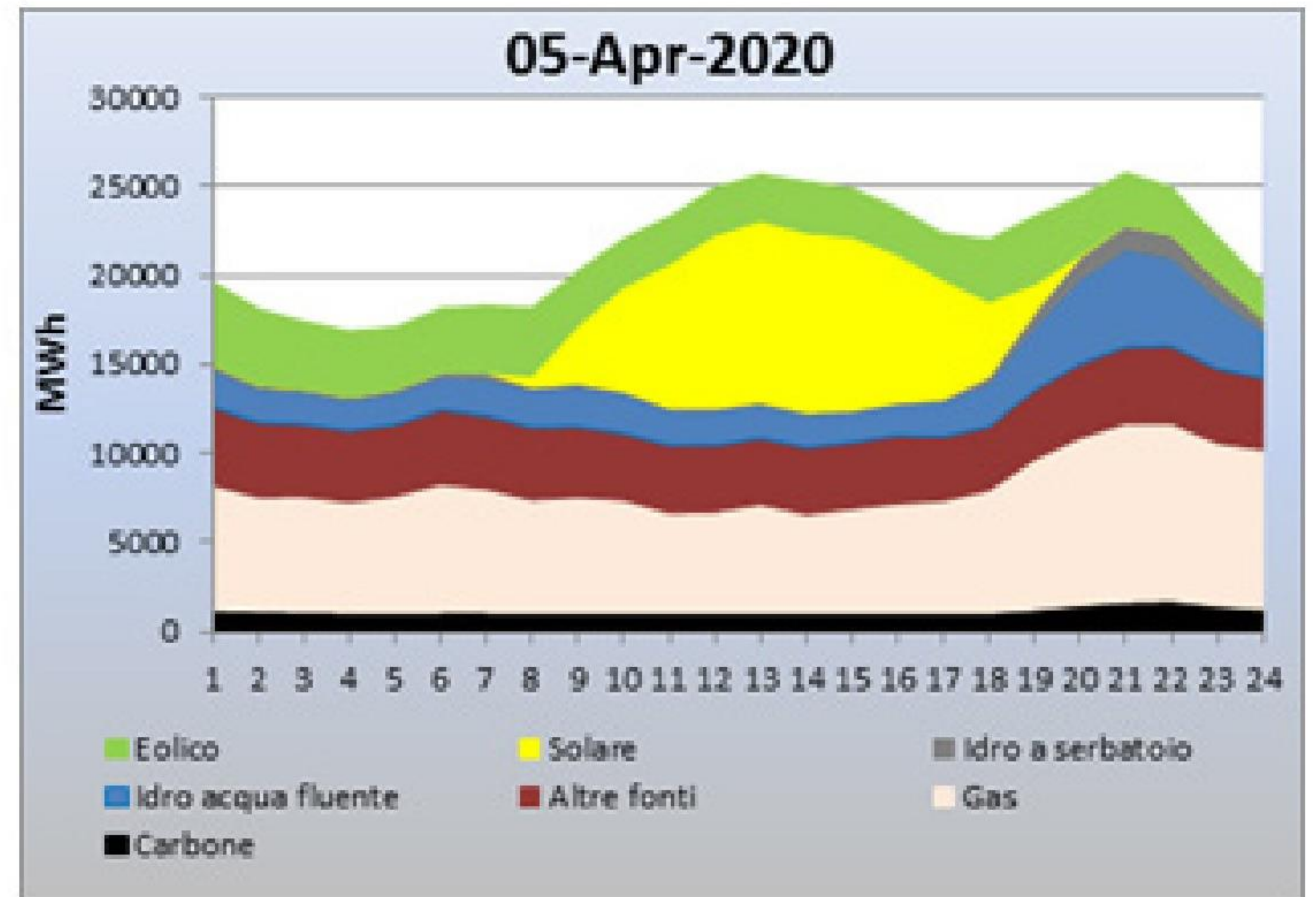


FIGURE 2: ELECTRICITY PRODUCTION BY ENERGY SOURCE [5].

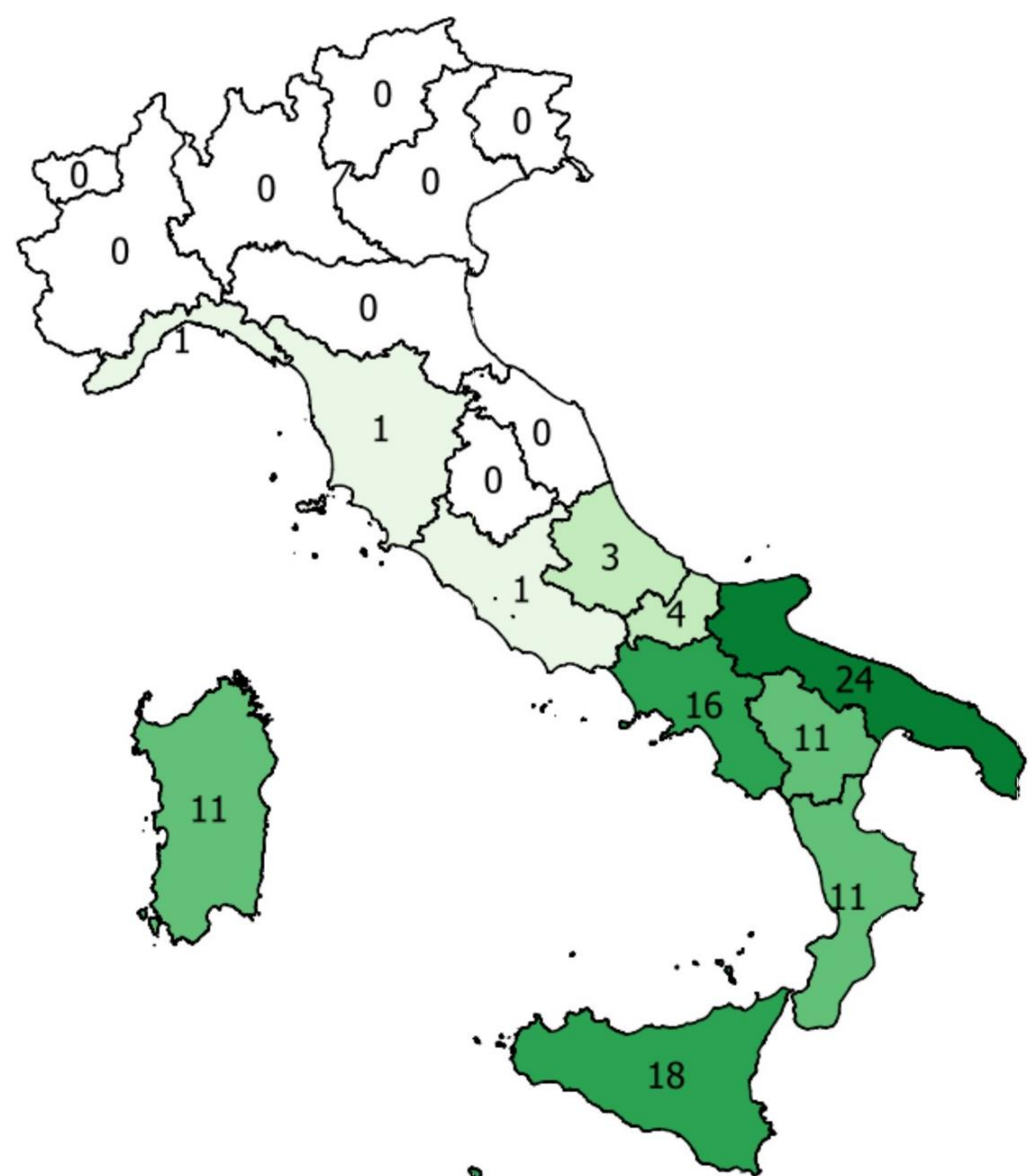


FIGURE 3: REGIONAL DISTRIBUTION OF 2020 CUMULATED WIND POWER CAPACITY (SOURCE: ELABORATION FROM ANEV DATA).

(9%) and Campania (8%). The regional distribution of the cumulated capacity, shown in Figure 3, has remained substantially unchanged compared to 2019.

**Capital cost:** The estimated average capital cost of 2020 new capacity was 1,200 EUR/kW (1,467 USD/kW).

**Matters affecting growth and work to remove barriers**

The main incentive mechanism supporting renewables (6th July 2012 decree) is fixed energy purchase prices



for RES-E plants, depending on technology and size. In general, big plants receive special energy purchase prices through calls for tenders (until the annual quota is reached), which are granted over the average conventional lifetime of plants (20-25 years).

In 2019 a new implementing decree was published (Dlgs 4 July 2019). This decree outlines 7 tenders until the end of 2021 for both PV and wind plants. Only onshore wind plants are allowed to participate in these auctions. The new base incentive tariffs are lower than in the previous decree. These tariffs depend on the plant size: for plant size greater than 1 MW, the tariff is 70 EUR/MWh (86 \$/MWh); for plants size between 100 and 1,000 kW is 90 EUR/MWh (110 \$/MWh) and for plants size between 1 and 100 kW is 150 EUR/MWh (183 \$/MWh). In 2020, three tenders were published: the total amount of capacity admitted in the ranking was 1,019 MW, of which the 87% (884 MW) were wind plants. Moreover, 33 MW of small plants were signed up in the register directly accessing to the incentives.

According to the large wind energy operators, the main issues affecting growth are the long and complex permitting process. Associations, operators, and policy makers are working together to improve it.

### R,D&D activities

Several Italian research institutes and universities actively focus on wind resources, harvesting technologies and wind farms' optimal integration into the grid through participation in national and international projects. The year 2020 was characterized by a transition phase, in which new projects, planned to be concluded by 2021 or later, were in an intermediate phase. Moreover, although the research activities have been carried on during 2020, the COVID-19 situation has affected them to some extent, especially when they required experimental tests. These aspects may form an explanation for the limited number of final research results presented here. The institutions in charge of coordinating, supporting, and promoting R&D and setting the policies on climate change are the Ministry of Economic Development (MiSE), the Ministry of Environment and Protection of Land and Sea (MATTM) and the Ministry of Education, Universities and Research (MIUR).

### National R,D&D priorities and budget

The main national priorities for the energy system are described in the Integrated National Energy and Climate Action Plan (PNIEC), published in 2019. They include: i) the acceleration of the decarbonization process towards 2030-2050; ii) the increase of renewable sources contribution to the energy mix and iii) the coordination of the R&D activities for the

evolution of the Italian energy system. Specific priorities are described for offshore wind R&D: i) technological solutions for floating offshore wind turbines for the Mediterranean Sea; ii) innovative high strength materials for platform mooring lines; iii) multi-purpose platforms combining different production processes (e.g. energy harvesting from wind and waves, water desalination and aquaculture); iv) grid architecture and management systems taking into account the impact of renewable and non-programmable energy sources. Finally, the PNIEC has confirmed the Italian participation to Mission Innovation and to the Strategic Energy Technology (SET Plan) and the process to align national R&D priorities to the EU strategies. Within Mission Innovation, Italy is committed to double the budget for public research on clean energy starting from 2021.

“ Record low new power capacity due to the COVID pandemic.

Great efforts in the coordination of research activities and in the communication with the industry have been recently spent by the Italian wind community. The participation in many of the IEA WIND Tasks has facilitated this synergy at different levels and has brought to academia/industry joint participations within national and international research projects. In September 2020, a joint meeting of all the Italian participants to the IEA WIND Tasks was organized to share research activities and results. Anyhow, most of the organizations involved in wind energy R&D activities set their own budgets for wind energy R&D and, in many cases, the activities are funded in a bigger umbrella concerning the whole renewables. For these reasons, it is difficult to give a representative value for the national wind energy R&D budget or to evaluate trends.

The most important R&D support programme is the 'National Fund for Electric System Research' (RdS) promoted by MiSE. It aims at the scientific and technological innovation for the electricity system to enhance competitiveness, security, and environmental compatibility, as well as ensure conditions for sustainable development. RdS projects are implemented by public R&D institutions, namely Ricerca sul Sistema Energetico (RSE SpA), the National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA), and the National Research Council (CNR). The year 2020 represent the mid-term phase of the present 2019-21 term, thus many research activities are fully under development and will be concluded by the end of 2021. Wind energy research activities are included in different projects totaling a budget of around 3.5 MEUR over 3 years. RSE



is working on the update of the Italian Wind Atlas, on developing methodologies for forecasting and on the evaluation of the actual production of offshore wind farms in Italian marine areas. CNR is coordinating the construction of a laboratory at sea for the integration of different energy harvesting systems, among which a floating wind turbine prototype (scale factor 1:5 with respect to a 2 MW machine). At the end of 2020, the floating machine and the platform have been selected, and all the instrumentation for monitoring has been designed. The turbine is planned to be deployed in the sea lab in early 2021.

Within the 2015-2020 Italian Research Program, MIUR supports the coordination between national research and industry by 12 National Technological Clusters (CTN).

### National research initiatives and results

- Using the results of a long-term monitoring campaign on a vertical axis wind turbine (VAWT), the Genoa University carried out an extensive analysis of the dynamic properties considering a wide selection of representative time-histories of the turbine response. The rotor has 4.3 m radius, 5 blades 5.8 m long and 20kW target power. The steel support pole is 11 m high. Natural frequencies, modal damping coefficients and their variations over time are investigated under different wind and operating conditions, also considering non-stationary thunderstorm events, paying special attention to damping ratios and including higher modes [6]. In operating conditions, damping ratio increases considerably due to the combined effect of rotation and aerodynamic contribution. However, for the investigated VAWT typology, damping is much lower than the values usually found for large-sized horizontal axis WTs.
- During 2020, RSE carried out a preliminary techno-economic assessment of floating wind plants in Italian marine areas in a medium (2030) and long-term (2060) scenario. In 2030, the resulting Levelized Cost of Energy (LCoE) values range from 70 to 156 EUR/MWh and are comparable to the ones expected for the sector at this date. In 2060, possible wind resource variations due to climate change and cost reductions due to large diffusion of the technology were considered in three case studies: possible wind production decreases are abundantly compensated by expected cost reductions even in the more pessimistic scenario [7].

### Collaborative research

- ENEA and EcoAzioni are the Italian partners in the WinWind project and coordinators of the National Desk. This project, which ended in 2020, was aimed

at enhancing social acceptance fostering a continued dialogue via regional thematic workshops, and policy roundtables. The project has managed to engage multiple stakeholders who contribute to understand the causes of lack of acceptance and the lack of information on wind energy. In order to access the outcomes of WinWind activities the open access tool PocketWinWind (<https://www.pocketwinwind.eu/>) was designed to promote socially inclusive wind energy development providing useful information to citizens, public administrators and market actors.

Results of joint PV-wind tenders: 87% of the plants in the ranking (884 MW) were wind plants.

- The Department of Aerospace Science and Technology of Politecnico di Milano is partner of the FLOating Wind Energy netwoRk (FLOAWER), an Innovative Training Network funded by EU within the framework of Marie Skłodowska-Curie Actions (H2020 ITN-MSCA). This 4-years project brings together academic and industry partners working on floating wind turbines with the goal of training early-stage researchers to strengthen the leadership and competitiveness of the offshore wind industry in Europe. The Aerospace Department, with its two positions, is working on aerodynamic modelling and on cost of energy minimization of the next generation of floating wind turbines. Within this context, the Institute of Marine Engineering of the National Research Council (CNR-INM) is associate partner of Politecnico di Milano.
- Politecnico di Milano is also a full participant in EERA's joint programme on wind energy, while CNR and RSE are associate participants. Finally, Italy continues to participate in IEA WIND Task 11, 25, 26, 29, 41 and in 2020 joined task 34.

## Impact of wind energy

### Environmental impact

According to the Gestore dei Servizi Energetici (GSE), substituting one MWh produced by fossil fuels with one produced by wind energy avoids 536 kg in CO<sub>2</sub> emissions [8]. In 2020, Italy's wind-generated electricity avoided around 9.9 million tons of CO<sub>2</sub> emissions.

### Economic benefits and industry development

In 2020, the economic impact of wind energy in Italy was estimated around 3.3 billion EUR (3.6 billion USD). This value represents the overall contribution of three different business areas, estimated as follows:



new installations (122 million EUR – 149 million USD), operation and maintenance of the online plants (501 million EUR – 612 million USD) and energy production and commercialization (2.6 billion EUR – 3.2 billion USD). The number of jobs in the wind energy sector was estimated to be 16,000 units, including direct and indirect involvement.

Leitwind, the only Italian manufacturer of large-sized wind turbines accounted for around 1% of the overall installed capacity and for one new 1 MW wind turbine installed in 2020. Vestas has two production facilities in Taranto. During 2020 no relevant news for the other industries operating in the wind energy sector in Italy. First consented offshore wind farm in Italy, Beleolico park, is under construction in Taranto Harbour by RENEXIA. Ten 3 MW wind turbines are going to be installed on monopiles. Some delays mainly due to Senvion bankruptcy, but also to COVID-pandemic. The start of monopile installation is expected in the second half of 2021.

### Next term

New targets for 2030, doubling wind power in Italy, calls for increased deployment rates over the next years. The auction results from 2020 give a positive outlook. In 2020, new steps to make offshore wind technology effective in Italy have been achieved. Apart from the already mentioned near-shore Beleolico Park, RENEXIA has also started the authorization process for a 2.9 GW floating wind farm, MeDWos [9], in the South of Sicily, whilst the company Agnes S.r.l. in cooperation with SAIPEM S.p.A. is designing several bottom-fixed and floating wind turbine farms to be installed in the Adriatic Sea [10]. Finally, in 2020 the Preliminary Guidelines for the H2 Italian Strategy have been released. Within this plan, aimed at reaching about 2% of hydrogen supplied energy by 2030, renewable

energies in general, and wind energy in particular, play a primary role because H2 storage and transport will definitely alleviate grid integration issues related to inherently intermittent energy sources.

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