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Wind Energy, the Next Task

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Despite rapidly changing prices for solar PV energy, new wind power installations remain the most cost-effective source of clean electricity. With production costs (excluding subsidies) varying between \$33 and \$77/MWh, wind is often the most economical of all sources of electricity.



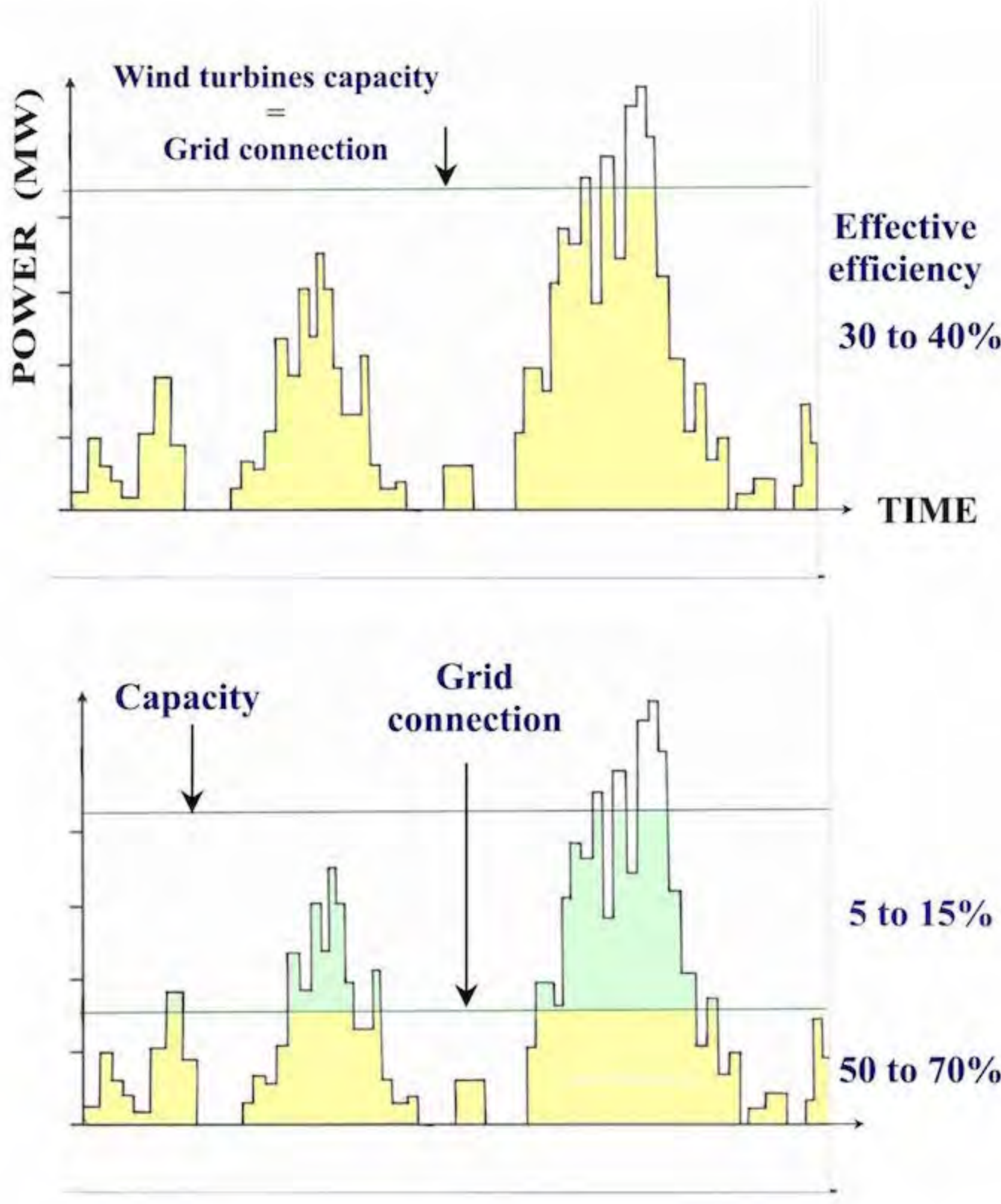
Two Problems Remain

1. The intermittence of wind electricity production.
2. Many other sources of greenhouse gas emissions are inadequately accessible to clean energy. (Air or sea transport, cement production, etc.) The heating of houses and buildings, which is mostly produced by combustion, is an easy target for wind energy.

With Very Economical Wind Energy, Those Two Problems Can Be Worked Out Together

Historically, all the energy produced by wind turbines must be sold at high prices to ensure the profitability of a farm. This business model is represented in the first graph of Figure 1, where we have a wind farm that delivers electricity to the grid with a yield of 30 to 40 percent of its nominal capacity. If the cost of producing electricity is \$40/MWh, a sale price of \$50 is likely.

Figure 1



In the second graph of Figure 1, we reduce the power of the grid connection to deliver only 75 percent of the electricity produced. For example, a wind farm with a nominal power of 100 MW would only have a connection of 40 to 50 MW with the network. In this way, the yield offered could reach 50 to 70 percent.

There Are Three Important Advantages to the Network

1. A connection of 50 MW is less expensive to install, and its utilization rate is doubled, which give a significant reduction in costs of the interconnection.
2. The power density offered is higher; the need for ancillary services and its associated costs is greatly reduced.
3. A larger clean power density will allow network operators to achieve more easily their greenhouse gas reduction targets.

Various Business Models Can Be Associated with This Electricity Generation Structure

1. If the upper part of the electricity production (in green in the graph) is not used, the cost of producing electricity sold to the grid increases from \$40 to \$53/MWh, and the selling price must be around \$63/MWh. It is therefore necessary that the electric operator grants a value of more than \$13/MWh to the three advantages mentioned above.
2. Some of the electricity surplus could be stored in batteries and sold to the grid at peak times. For example, electricity could be available to the system at \$75/MWh at peak hours and at \$57 for the rest of the day. This option provides an interesting alternative for the electric operator that would have an availability of 70 to 90 percent at peak hours. The value of the electricity stored would present a cost-effective business model for the use of batteries.
3. Another solution would be to use locally the electricity that is not delivered to the grid. The easiest way to store these peaks of energy would be to turn them into heat.

We can decide that the value of electricity transformed into heat is \$15/MWh, which would allow, with an efficient heat storage system, to offer heating at \$25/MWh, a very competitive price. If this heating system replaces a gas one, a carbon credit of \$10/T of CO2 would result in a cost reduction of \$6/MWh, and a \$50/T of CO2 credit would result in zero heating costs.

By giving a value of \$15/MWh to electricity surplus, we reduce the increasing of the cost of electricity delivered to the grid. The cost now reaches \$48/MWh and the selling price may be \$58. A win-win solution.

To achieve and eventually exceed our greenhouse gas reduction targets, overcapacity of wind power generation must be achieved, which should lead to the diversification of the use of clean energy.

For the wind, the cost reduction is not finished. Our goals in the fight against climate change are still achievable, and wind power will count for a lot.



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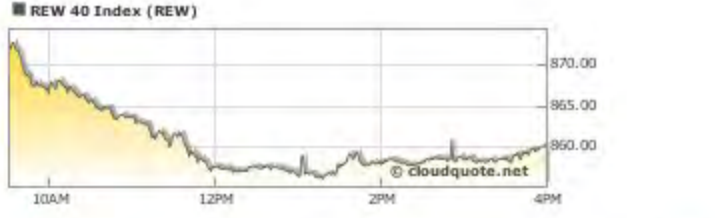
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