

Will renewable electricity be enough?

Back-up may always be required, but analysts disagree over what it should be

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The potential of wind energy is huge. A world full of 2.5-megawatt windmills would meet the global demand for energy if they operated at just 20 percent of their capacity. Altogether, they would produce five times more energy than what the entire planet consumes. The United States alone would generate 16 times more than what it uses. In order for this to be possible, wind generators would need to be installed practically everywhere. The study that these numbers are taken from, *Global Potential for Wind-generated Electricity*, written by Harvard University's Xi Lu, Michael B. McElroy, and Juha Kiviluoma, leaves only cities, frozen areas and forests exempt from the huge blades of these giant mills.

This academic paper shows that, as the chief financial officer of Iberdrola Renovables, José Ángel Marra, said recently, extreme arguments are easy to find in the energy debate. But according to most industry experts, one thing is clear: at this moment in time, all sources of power generation are needed to guarantee supply, maintain costs and reduce carbon dioxide emissions, an argument which environmentalists reject and others call a cliché.

Exclusive dependence on wind — the most prevalent source of renewable energy — on days like August 3 of this year would have been a major problem in Spain. At 2pm that day, when electricity consumption was close to 35,000 megawatts, the country's wind turbines were only producing 1.7 percent of the total required, even though the installed generation capacity is 17 percent. This is typical on the hottest or coldest of Iberian days; when the atmosphere is very stable, the wind doesn't blow.

To make up for the drop in wind production that day, it was necessary to rely on combined cycles (electric power plants that use natural gas). At the peak hour of demand, they supplied more than 45 percent of all electricity being produced, according to data from Red Eléctrica, Spain's grid operator.

Along with this data, climate change and discussions like the one that took place a month ago about the nuclear plant in Garoña (the government finally opted to prolong its working life two years beyond the original 40 it was meant to operate), the debate about what the generation mix should be inevitably resurfaces. "All energy sources are necessary," they say at UNESA, the association that represents companies in the sector. Indeed, this is the opinion held by most experts, including Ignacio Cruz, the deputy managing director of CIEMAT, a public research center for energy, the environment and technology attached to the Industry Ministry: "We could do without, but we'd sacrifice security."

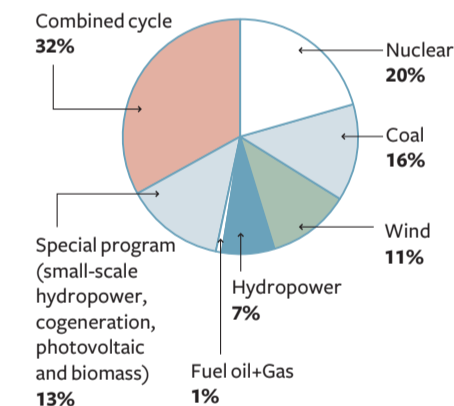
On the side of the ecologists,



Wind energy is a big hitter in Spain — on the right day. / IBERDROLA

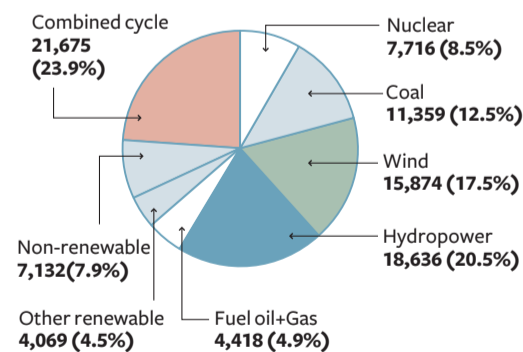
Electric energy production in Spain

BY SOURCE IN 2008



MAXIMUM ELECTRICITY PRODUCTION

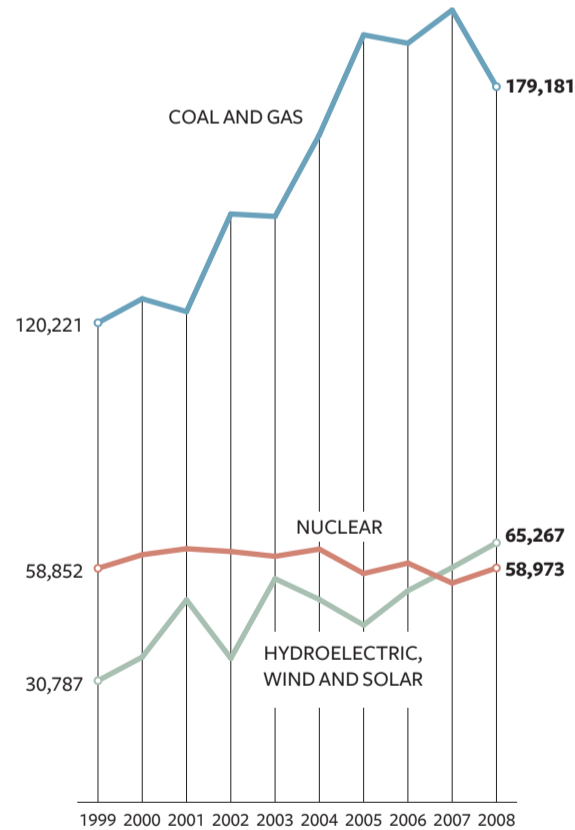
Source, end of 2008. In MW



Sources: OIEA, CSN and in-house.

PROGRESSION BY ENERGY TYPE

In GWh



EL PAÍS

Ladislao Martínez accepts this argument, but he still disagrees that all forms of energy are necessary. To reach this conclusion, he compares Spain's 90,000-megawatt generation capacity with the 44,786 megawatts demanded on the day of historically high consumption: December 17, 2007.

In this considerable production capacity, wind and gas (through the combined cycle) play an important role. Just a few years ago, they were practi-

cally absent from the generation mix; there was not a single combined cycle plant in Spain until 2002. Now, seven years later, wind and gas account for around 40 percent of the installed generation capacity and a similar percentage of consumption. The rest is distributed unevenly between nuclear energy, coal, hydroelectricity, other renewable energies (small-scale hydropower, photovoltaics, biomass) and fuel oil, among others. But the generation mix

is not set in stone. Almost certainly, the use of renewable energies will increase in the future. By 2020, the target is for them to account for 20 percent of the total primary energy supply and 40 percent of electric energy.

This leads us to a series of questions: What is the limit of renewable energies? Are any of them dispensable? Is there such a thing as a perfect generation mix? "The ideal mix doesn't exist," says Jorge Fernández of In-

terMoney Energía analysts. "In reality, it reflects politicians' expectations," he adds, citing the case of France, where nuclear plants produce almost 80 percent of the country's electricity.

"A mix must be capable of guaranteeing supply priorities," argues Miguel Duvisón, operations director of Red Eléctrica Española (REE). And that, as this system manager sees it, is done by relying on thermal generation (combined cycle, fuel oil and nuclear) and large-scale hydropower. These are energies where, broadly speaking, it is easy to make availability and consumer demand coincide.

But in addition to guaranteeing supply priorities, explains Duvisón, a system manager also has other goals to consider: keeping costs down, reducing dependence on foreign energy (around 80 percent in Spain), controlling CO₂ emissions and ensuring long-term supply.

UNESA shares this view. When determining what a country's mix should be, this association thinks that three groups of factors must be taken into account: geostrategic or geopolitical, environmental and economic.

Based on these criteria, re-

"A mix must be able to guarantee supply priorities while keeping prices down"

"If you have more unpredictable sources, you need a bigger cushion"

renewable energies seem like the clear choice. They are abundant and available domestically and they undeniably help fight global warming. But their erratic availability is their Achilles' heel, impeding Duvisón's number-one objective: "guaranteeing supply priorities." Take wind energy, for example. Of the 8,760 hours in a year, a wind generator operates at full capacity an average of 2,200.

Judging from what the experts say, an increased use of renewables — especially wind and solar energies — would require back-up from other sources to cover unpredictability. "If you put more unpredictable sources into the mix, you need a bigger cushion," as they say at REE. And that would include, due to their flexibility, most thermal production (gas, fuel oil and coal) and hydroelectricity.

The spokesman for the platform against thermal plants, Ladislao Martínez, agrees that renewable energies need a back-up, but not that thermal plants are the best cushion. For him, the solution lies in hydropower (a method of electric generation consisting of a current and two

reservoirs that allow water to be raised from one to another and reused). What's more, an additional 3,000 megawatts could be installed in Spain on top of the currently existing capacity.

Gonzalo Sáenz de Miera of Iberdrola Renovables thinks that the current generation mix is "unsustainable," due to environmental reasons and an excessive dependence on fossil fuels. With the increased use of renewable energies, he is convinced that the combined cycle and hydropower will be necessary sources of support.

Always controversial, nuclear power is less likely to play the role of "cushion." Lauded by its proponents as the solution to climate change due to its low level of CO₂ emissions, and criticized by its detractors for the radioactive waste it generates and the large investment it requires, nuclear energy is not characterized by flexibility in Spain, something that is essential in a generation mix where renewables represent a bigger and bigger chunk of the pie. Nuclear plants are designed to always operate at full capacity. This means that, unless they are not running, their contribution to the system is always the same.

All of this brings UNESA to the apparently logical conclusion that all forms of energy are necessary; not just now, but in the future as well. Greenpeace rejects this argument. In a report from April 2007, it attempts to show that by 2050, all

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All this would change if grids were fully interconnected to others abroad

electricity produced in Spain could come from renewable sources.

Paul Isbell of the Elcano Institute think-tank is skeptical about both conclusions. "In an electrical system like the Spanish one, the feasible contribution of renewable energies has a limit, which is agreed to be around 40 percent. And this opens the door to the argument that nuclear energy is irreplaceable," says Isbell. In his opinion, however, all this would change if the Spanish electrical system ceased to be an island. Currently, according to REE, interconnections with France account for only 1,300 megawatts.

"If the system was opened up with more interconnections, the outlook for renewable energies would change," adds Isbell, who cites Nordic countries as examples where improving and expanding the network has allowed renewable energies to play a bigger role. As he sees it, even if the use of electric cars increased, thanks to a larger and better electricity grid, Spain's total demand could only be met with renewable energies plus the combined cycle.



Demonstrators outside a nuclear plant in France, where 56 percent of the population thinks the risks of this energy source outweigh the benefits. / AFP

French example has Spain wondering whether to follow its nuclear neighbor

Country leads expansion into third-generation reactors but questions remain

MÓNICA SALOMONE

Deciding whether to follow the example of one's neighbor is not always easy. Take the case of France and its peculiar energy policy. While some think that it's a good idea to cross the Pyrenees to learn and copy, others would rather reinforce borders, in fear of a hypothetical accident. Either way, one thing is clear: France is a nuclear superpower that generates 78 percent of its electricity at its dozens of nuclear plants; 59, to be exact. No other country depends so much on the fission of the uranium atom. In a world with a dwindling supply of oil and an out-of-control climate, many see nuclear power as a cheap, reliable energy source and France as a role model. But is it a really a good idea to emulate our neighbor?

In Europe, where an average of 30 percent of all electricity is nuclear (in Spain, it is around 20 percent), eyes are also on France, and not just as a country that exports electricity to many of its EU neighbors. In Italy, a nuclear-free territory for over two decades, French state company Areva is to build four third-generation plants, which will eventually produce 25 percent of the country's electricity. The first will be up and running by 2020. The United Kingdom also plans to build 10 plants by 2023.

"I wish we could follow the French model here," says María Teresa Domínguez, president of the Spanish lobby group Foro Nuclear. "They've managed to achieve undeniable security of supply. They'll also fulfill the Kyoto Protocol and are promoting na-

tional industry." According to Domínguez, the currently installed capacity in Spain meets demand, but leaving very slim margins. "Right now we're at a balance; sometimes we export and sometimes we import. If demand grows, we'll have to import."

If nuclear energy is so great, why does the debate continue? Because if you take a closer look, dark clouds appear on the horizon. Mycle Schneider, an independent consultant on energy and environmental policy identifies a few. First, it is not completely true that France is energy independent: "Over 70 percent of the energy it consumes comes from oil, gas and coal, just as much as in many other countries." As Schneider points out, nuclear plants make only electricity, and this is not the only kind of energy that a country needs... at least as long as cars aren't electric. And the nuclear industry itself relies on imported uranium: another strike against the independence argument.

What's more, when it is very hot — over 30°C — many French reactors cannot operate because they use rainwater to cool used fuel, and the law prohibits dumping water back into the rivers if it is too warm. On these days, when air conditioners hum across the country, electricity must be imported. This past July, *The Guardian* reported that, with one-third of its reactors not running, France was generating "the lowest levels of electricity in the last six years" and was importing from the United Kingdom.

As for the cost of nuclear energy, is it really so cheap? This is not so clear. Nuclear plants are

very expensive to build, and they are only profitable if they operate for a long time. In the United States, 50 plants have already obtained licenses to operate for 60 years — 20 more than initially planned — and the French nuclear producer EDF wants the life span of its plants to go up from 40 to 60 years.

But the problems don't end there. One of the biggest issues is radioactive waste, which is dangerous for tens of thousands of years. And, as environmental organizations argue, if no proper

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"How many third-generation reactors exist at present? None"

storage facilities have been built yet, how can we know how much it will cost? Estimations range from \$20 to \$90 billion. France has decided to store its waste in an underground facility near the town of Meuse, but before that gets built, a lot of research must still be done. Until it is ready, in 2025 at the earliest, the waste will stay at the plants themselves (in Spain, the delay is even greater: the site for a temporary high-level waste storage facility has not been chosen yet). Schneider points out another

flaw in the argument that France's nuclear program is "the cheapest in the world." No one really knows how much it costs, because "for decades, the civil nuclear program has benefited from direct and indirect subsidies, particularly through the nuclear armament program."

The assertion that third-generation reactors are safer and more efficient is also questionable. "How many third-generation reactors exist at present?" asks Valeriano Ruiz, professor of thermodynamics at the University of Seville and president of the Association for the Promotion of the Thermosolar Industry. The answer is none. That's why, among other reasons, Ruiz thinks it makes much more sense to promote a distributed energy model, based on smaller cogeneration plants close to the consumer, than to speculate on a risky, expensive technology.

Areva started building the first third-generation reactor in 2000 in Olkiluoto (Finland). It was supposed to be producing energy by 2009. The new completion date is 2012, and the initial budget of €3 billion has grown to €4.2 billion. In Flamanville (France), where the second reactor of this kind is under construction, work is also behind schedule.

And what about safety? While environmental associations try to keep the memory of Chernobyl alive, the nuclear industry insists upon ever-stricter safety measures. Even so, the last serious incident — level 3 out of 7 — occurred just four years ago in Sellafeld (United Kingdom), and last year's particle leak in Ascó in Spain was a level 2 event.