Towards a Mediterranean Community for Renewables

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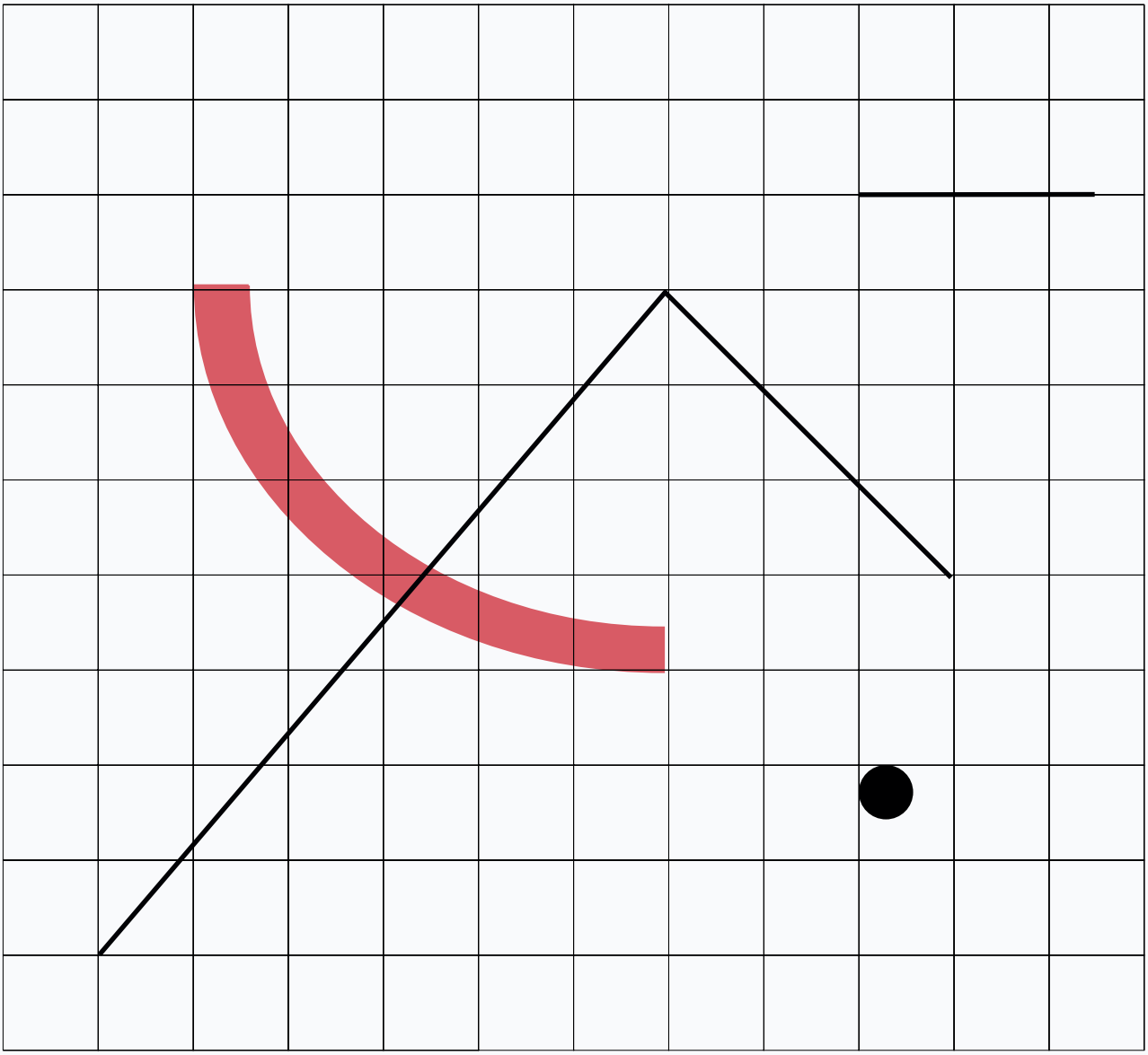

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Towards a Mediterranean Community for Renewables

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INTRODUCTION

The geopolitical situation generated by Russia's invasion of Ukraine has radically changed the geo-energetic context in which the EU will have to position itself in the short, medium and long term[1].

In particular, the EU's dependence on gas markets has made an enfranchisement strategy indispensable. It is worth adding, however, that the real strategic objective is to break free from all energy dependence. This vision has been taken up by the REPowerEU plan, which is the EU's key strategic document on this issue. However, this is only a first step, which needs to be deepened on many levels.

In this first section, we will present the cornerstones of the plan, particularly with regard to the objectives defined in it, in order to assess their feasibility. In fact, there are three types of constraints to the realisation of the plan's objectives: the first is strictly a feasibility constraint, related to the technological implications of the targets for generation from renewable sources, at competitive costs; the second is related to the current global market structure of panels and batteries; the third to the implications in terms of low energy density, and thus land consumption, of the photovoltaic component of renewable energy generation.

In order to address this challenge, in the age of war ecology[2], the EU should initiate a "new community process" with countries on the southern shore of the Mediterranean, inspired by the community method of the Schuman Declaration.

THE TARGETS

The Commission document is extremely clear. The aim is to phase out, or rather to accelerate the end of European dependence on Russian fossil fuels: "REPowerEU is the European Commission's plan to make Europe independent from Russian oil, gas and coal well before 2030, in light of Russia's invasion of Ukraine."

The current war actually adds to the already firmly elaborated purpose of a green transition: "The REPowerEU plan sets out a series of measures to rapidly reduce dependence on Russian fossil fuels and fast forward the green transition, while increasing the resilience of the EU-wide energy system".

We can therefore say that the environmental motive is closely linked to the motive of energy independence and security, rightly considered one of the essential foundations for a strong and autonomous role of the EU in a dramatically changing global context.

The main strategy is clear: accelerate the transition to renewables: "The new geopolitical and energy market realities require us to dramatically accelerate our clean energy transition and increase Europe's energy independence from unreliable suppliers and volatile fossil fuels." So while the document mentions the need and opportunity to diversify sources of fossil fuel supply, at least in the short to medium term, the long-term target point, i.e. the structural strategy, remains that of renewables.

1 — This working paper is the first one of a series of publications dedicated to the question of European energy security and environmental transition, on which a working group composed of actors from the world of industry, academia and public institutions are currently collaborating. If you want to be part of this conversation, write us : ask[at]geopolitique.eu.

2 — "War Ecology", GREEN. Géopolitique, réseaux, énergie, environnement, nature, n°2, year 2, Paris, Groupe d'études géopolitiques, 2022.

And indeed it is precisely on this plan that the Commission proposes even more ambitious targets than those previously set, with the intention of uniting the issue of green transition with that of energy autonomy: "Renewables are the cheapest and cleanest energy available, and can be generated domestically, reducing our need for energy imports. The Commission is proposing to increase the EU's 2030 target for renewables from the current 40% to 45%. The REPowerEU Plan would bring the total renewable energy generation capacities to 1,236 GW by 2030, in comparison to the 1,067 GW by 2030, envisaged under Fit for 55 for 2030."

The focus is therefore on domestic generation capacity, through sun or wind. For the photovoltaic sector, the target is set very high: 'The EU Solar Energy Strategy will boost the roll-out of photovoltaic energy. As part of the REPowerEU plan, this strategy aims to bring online over 320 GW of newly installed solar photovoltaic by 2025, over twice today's level, and almost 600 GW by 2030'.

The targets are clear: 1,236 GW of renewables, including 600 GW of solar energy. Let us now look at the constraints.

FIRST CONSTRAINT: THE TECHNOLOGY

If, as we will see, the impact of wind and photovoltaics on land consumption is different, they have one element in common: both are generation techniques based on intermittent sources. This characteristic has so far relegated them to an ancillary role, as grid stability had to be ensured by fossil generation. However, the targets now set by REPowerEU shift the problem: the production levels envisioned by the plan could seriously threaten the stability of European grids unless they are matched by a systematic policy of intermittency reduction through increased storage.

It is a matter of proportions, which becomes more pronounced as the renewable component increases its share in the energy mix: each additional yearly unit of electricity from renewables implies (industry experience independence rule of thumb) the safe provision of a 1/600th additional storage capacity. Thus, the target of 1236 GW (given its obvious intermittency) by 2030 would imply a "stable" grid need, met by storage, of more than 6 GWh. To provide with an impressive analog representation, this quantity is equal to roughly 8 times the current world production of batteries, which will also be increasingly contended for by the automotive sector[3].

Here, then, is the first constraint on the plan: we must accompany the growth in generation with a huge growth in safe and economically efficient storage, which is well beyond current global production capacities.

SECOND CONSTRAINT: GEOPOLITICS

The technological constraint is necessarily accompanied by a geopolitical one: the concentration of battery production by and large mainly in China, followed by Japan and South Korea manufacturing systems. It is therefore clear that a major increase in storage requirements would not only come up against a physical supply constraint, but also with a dependence on foreign supplies that is just as, if not more, dangerous than the current dependence on gas. In fact, if the downstream technological dependence for current batteries can, albeit with difficulty, be overcome, the upstream dependence would only increase, since China has a near-monopolistic position in some strategic commodity markets for production, particularly for nickel, cobalt and rare earths. Thus, the entire production chain, from mine to battery, is in the hands of China. As Ursula von der Leyen has recently stressed, "Lithium and rare earths will soon be more important than oil and gas".[4]

Lithium-ion batteries manufacturing capacity, by country

	Country	Capacity (GWh)	Share of world total
1	China	558	79.0%
2	United States	44	6.2%
3	Hungary	28	4.0%
4	Poland	22	3.1%
5	South Korea	18	2.5%
6	Japan	17	2.4%
7	Germany	11	1.6%
8	Sweden	4	0.6%
9	United-Kingdom	2	0.3%
10	Australia	1	0.1%
11	Rest of the world	1	0.1%

Data as of February 1, 2021. Chart: Groupe d'études géopolitiques.
Source: S&P Global Market Intelligence.

An independence strategy should hence be accompanied not only by a massive relaunch of storage production, but also by an effort to develop technologies that are not dependent on geopolitically critical raw

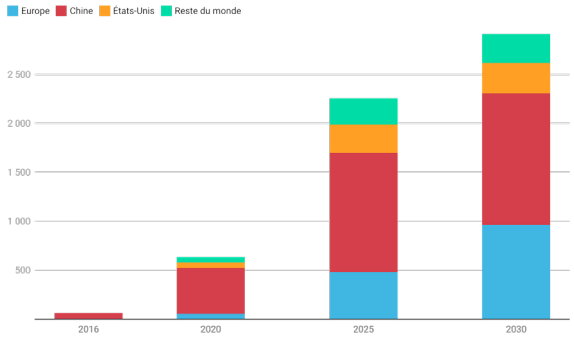
3 — Roland Berger, Battery Monitor 2022. The Value Chain in the Field of Tension between Economy and Ecology.

4 — 2022 State of the Union Address by President von der Leyen.

materials.

In addition, in the case of photovoltaics, there is a strong technological dependence in the panel sector, which currently sees China in a dominant position, with 90% of production concentrated in the top ten tier[5]. Certainly, an import substitution strategy can be put in place, but with the risk of greatly delaying the achievement of objectives, not least because the European panel industry has long since been put out of business by Chinese competition. But photovoltaics brings with it a further, even more stringent constraint.

Battery cell production capacity, GWh annually



Data for 2025 and 2030 are estimates based on announcements of battery cell manufacturers. Chart: Groupe d'études géopolitiques. Source: McKinsey.

THIRD CONSTRAINT: THE LAND

The target of 600 GW photovoltaics must also be evaluated with regard to the impact it would have on land consumption. Theoretically, a photovoltaic field of 1 MW, taking into account the surface area of the panels (given an efficiency of 20%) and the space between them for the maintenance of the field, implies the occupation of 1.5 ha of land.

This proportion gives a result that is difficult not to assess as critical: 600 GW of power would imply an occupation of 9.000 square kilometers of European soil. If we also take into account the additional disadvantage of the loss of generation of photovoltaic fields as one moves northwards, it is likely that the land occupation could be even more pronounced. In a geographical context such as that of the Union, marked by high human and industrial density, this third constraint could prove crucial. The question that arises is then how to bypass this problem, assuming a long-term perspective and putting the REPowerEU plan in an even broader picture. In order to do that, we must assess properly the technological and strategic sea-change implied by the Green Deal.

Share of manufacturing capacity by country or region, in 2021

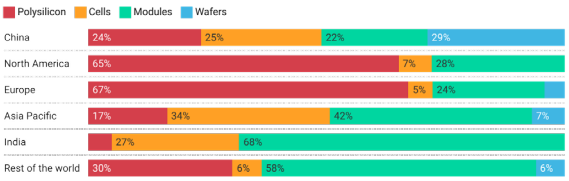


Chart: Groupe d'études géopolitiques. Source: International Energy Agency.

WHO HOLDS THE KNOB?

Thermal fired power plants (regardless of whether they are fueled by coal, oil or gas) have a steep economy to scale. This framework gave birth to the large utility companies and their power (in both meanings of the term). The original pact was simple. Utilities grew big in order to intercept scale economies, and then they passed the improvements to the customers. "Let us grow big, you will buy low". Of course, also a hard and structural engagement came along: whatever it takes, utilities had to commit to deliver all the power needed, whenever needed, literally by the second.

This commitment in power generation implied regulation, through a strong distributed (thermal) knob. Since thermal power is available on-demand (and via the grid is dispatchable), whenever, by the second, demand ramps up, utilities could turn the knob up or down and transmit across different nodes, to balance the books.
This is indeed a crucial point. In the new horizon depicted by the REPowerEU plan, it must be remembered that renewables are certainly less expensive than any other source, but also intermittent, non-dispatchable and by no means subject to significant economic returns to scale.

Basically then, two issues arise. The first is how to efficiently substitute the thermal knob with storage and electronic command and controls; the second is where to look for the huge spaces needed by a source that surely comes free, but that hits the earth at a low-density and low-capacity rate. This is by no means a lateral adjustment.

5 — IEA (2022), Solar PV Global Supply Chains, IEA, Paris https://www.iea.org/reports/solar-pv-global-supply-chains.

THE TIMES AND THE WAYS OF THE GREEN DEAL

The Green Deal strongly advocated by Europe implies a true technological revolution, which, moreover, has to happen fast. Power is the strongest constraint on autonomy, especially considering the fast-growing wave of electrification of final uses, chiefly in new sectors, from e-mobility to heating.

Because of that, the deepening of 7the electrification of final uses could potentially push a near doubling of existing power demand in 10-15 years, across EU28. The implementation of the goals of REPowerEU will drive the need for anything between an additional 5 TWh to 7 TWh of the unique alternative to the thermal knob, i.e. power storage. Provided with adequate storage, the grid could act as a bank, collecting the deposits of excess generation, to be withdrawn once any deficit happens, i.e. when the sun is not shining and the wind is not blowing. As mentioned before, the amount needed according to REPowerEU is a sheer volume (roughly 7 to 8 times today's world production of batteries) and also implies to be delivered at a minimum level of economic feasibility.

In short to achieve energetic autonomy, EU27 needs to simultaneously achieve three goals:

1. to capitalize inside her walls the production of ten years in a row, each year equivalent to today's world production, of batteries.
2. to produce them without bumping into the constraint of a need of supplies (lithium, cobalt, nickel, rare earths, heavy metals) outcoming, as of today, mostly from unstable, concentrated and uncontrolled areas.
3. the alternative storage supply needs to be (1) efficient (very high round trip), (2) very fast in charge/discharge, (3) long-lasting (aligned to the 20-30 years of a solar power station) (4) environment-friendly in the whole life cycle and (5), last but not least, strategically feasible. And of course, making ends meet for both families and companies.

As a general rule, stored energy must reach the grid at an all-in price in "gas parity", i.e. the sum of renewable generation and the storage thereof should be underselling the price of gas generation and modulation.

THE GAS PARITY RULE

Under the same independence rule, a EU autonomy strategy would need the clean generation of the additional power to be adequately stored and forwarded, which would be roughly equivalent to 8 times today's battery world production. Incidentally, this calls as well for a paced exit from the 100% dependence on the solar cell, silicon-based, industry, mostly Chinese. Just to give an analogic measure, given the low density and low capacity of renewable power, a country like France could need to nearly double in the midterm her 2021 production (468 TWh), to finance both the shift away from thermal production and the electrification of final uses (heating, transport, etc.). This means, in case of solar generation, nearly 300-400 GW of plants, equivalent to some 4.000/5.000 KM2 of dedicated surface (with the same ratio holding true for the rest of the Union).

To be clear, the actual implementation of the vision embodied in the REPowerEU would be the largest industrial policy program ever targeted in the EU and will call for a concentrated effort, financed, State-driven and nudged (with a tight focus, at least as much as the US). And we are yet very far from that.

BACK TO THE CONSTRAINTS

Beyond existing technologies based on lithium and other geopolitically sensitive materials a stream of very promising technological innovations (nanocarbon-based storage, gravimetric storage, flywheels and so on) is coming, bypassing the constraints on rare materials. Some of these technologies, nanocarbon-based, are already available for batteries. The same applies for solar cells, where a wealth of "inside" alternatives (i.e. nanocarbon parts and organic dye cells, again) is getting ripe.

However the land constraint remains: the EU energy independence requires a huge amount of sunny/windy land to be dedicated, which could seriously hinder the implementation of the agreed programs. If we think in terms of strategic cooperation, close to the EU (both geographically and politically), lies a treasure of sunny/windy deserts, where the marginal value of land is nihil.

Growing power (with new cells) in the desert, funneled by modern HVDC up to the South Mediterranean coast, dispatched by submarine cables and stored by innovative solutions, onto the EU shores, is today economically feasible. A recent non-peer-reviewed study shows the potential to deliver, all-in, desert-to-grid, on a continuous service base, power at 50-60€/MWh, satisfying

therefore the gas parity constraint.[6]

BACK TO BASICS: SCHUMAN, MONNET AND THE COMMUNITY METHOD

After the pandemic, Putin's war triggers a change in the way we understand the world. Where we once had consumers, trade and horizontal flows, we are now challenged by the emergence of brutal forms of conflict over the definition of borders, while the fragility of stocks and supply threatens the stability of our societies. War ecology has become a key dimension of the EU Commission's approach, a new paradigm–which Dani Rodrik calls "productivist"–is taking shape[7].

In the face of this upheaval, the emphasis in Brussels is sometimes a kind of imitation of the vocabulary of American power. However, we must not fall into the trap of a civilisational turn or of a vulgar Machiavellianism leading to the glorification of raw power. In a fragmented and brutal world, the Union's interest is to remain a cooperative force while succeeding in its geopolitical transition–in this sense, the EU must "change course, while keeping it".[8]

Faced with this macro-crisis, to avoid losing our way, it is therefore necessary to go back to basics. As emphasised, the tragic dilemma of energy supply has an immediate way out: we need access to a large area with three characteristics: 1) human density approximately equal to 0 ; 2) optimal sun exposure ; 3) since such a space does not seem to exist in Europe, in a proximity to our continent.

However, it goes without saying that an extra-European land grab, even of desert spaces such as those located in the Sahara, even within the framework of essentially redistributive intergovernmental agreements, would be rightly seen as a post-colonial initiative. It would therefore only produce large-scale contestation and instability. Moreover, most of our partners in the South repeatedly emphasised that they will no longer accept any purely extractive logic. This implies the creation of a solidarity of production and technology –as a lever for integration and political dialogue–and not a simple dynamic of exploitation or extraction.

In order to address this challenge, we must turn to the community method and the construction of 'de facto solidarity' of which Schuman spoke in his Declaration of May 1950. In concrete terms, this means proposing a free and lasting association around a common project. To do this, we must return to the sources of Monnet's proposals[9]. If this association wants to last, it cannot depend solely on the goodwill of the leaders of the moment. If it wants to be strong, it must protect itself from any temptation of domination, or free-riding by one nation over the others. If it is to look to the future, it must be based on a principle of equality and technology sharing, for mutual recognition is the condition for the success of any joint work.

If it wants to succeed, it must be guided by a pragmatic concern for efficiency, because its main reason for existence is to do better together than alone. Finally, if it is to be effective, it must be agreed, and therefore democratic. To this day, the European Coal and Steel Community (ECSC) remains the 'purest' implementation of the Community method of action: six States, all very different and with extremely harsh historical relations, but with the political will to look beyond their differences to pool their interests. In order to solve the current tragic energy dilemma, the Union can propose a similar framework. The logic could be to initiate a process of reflection on the constitution of a supranational institution whose purpose would be to jointly manage the space, the energy and the financial and technological resources produced within such a framework - let us call it provisionally "Mediterranean Community for Renewables".

In addition to the geopolitical recomposition effort on the horizontal axis of the European Political Community[10], the EU would tremendously benefit today from structuring an initiative on the vertical north-south axis, leading to potential political convergence. We have the possibility - and if we want to be effective in our energy plans,

6 — "Desert Tech 2.0" [Confidential Study], Semperampere, August-September 2022.

7 — L'émergence du paradigme productiviste, une conversation avec Dani Rodrik "It's a kind of a reorientation away from neoliberalism in the sense that it has much less faith in market forces, much less confidence in private firms and put much more confidence in the ability of the State and non-state actors, collective action in general, to be a transformative force".

8 — Florian Louis, "La transition géopolitique européenne", le Grand Continent, 1er septembre 2022.

9 — Institut Jean Monnet, Pour une redécouverte de notre méthode d'action, la méthode communautaire, 15 juillet 2022.

10 — Franz C. Mayer, Jean Pisani-Ferry, Daniela Schwarzer, Shahin Vallée, "Une feuille de route pour la Communauté politique européenne", le Grand Continent, 22 septembre 2022. Daniela Schwarzer, "What can the European political community achieve?", Groupe d'études géopolitiques, October 2022.

the necessity - of reinstalling a profoundly constructive logic in a deeply worrying context: this is a perspective that deserves to be explored– the community method can lead to building peace in a world in ecological war.

To achieve this, we should launch a multi-actor new process inspired by the community method.