

Intégration du marché européen de l'électricité

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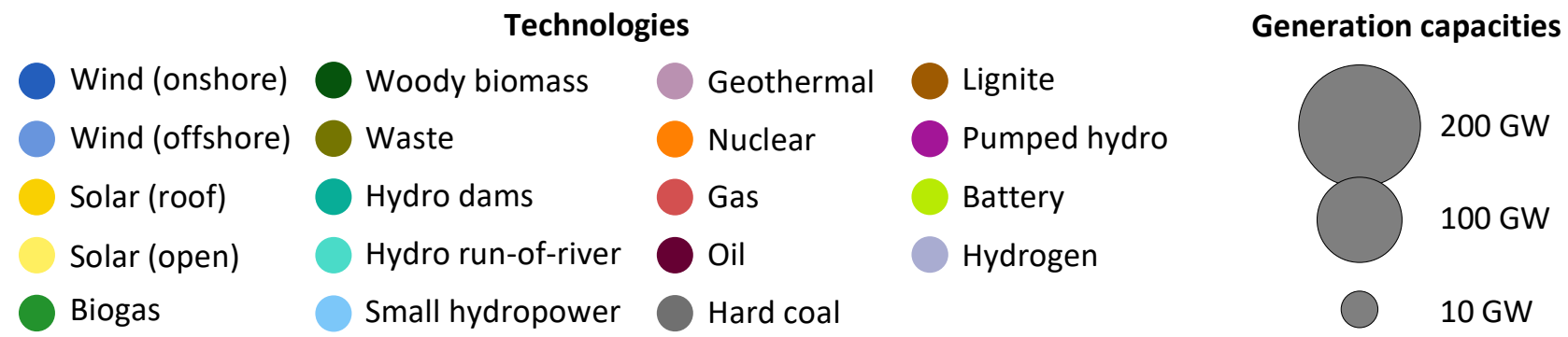
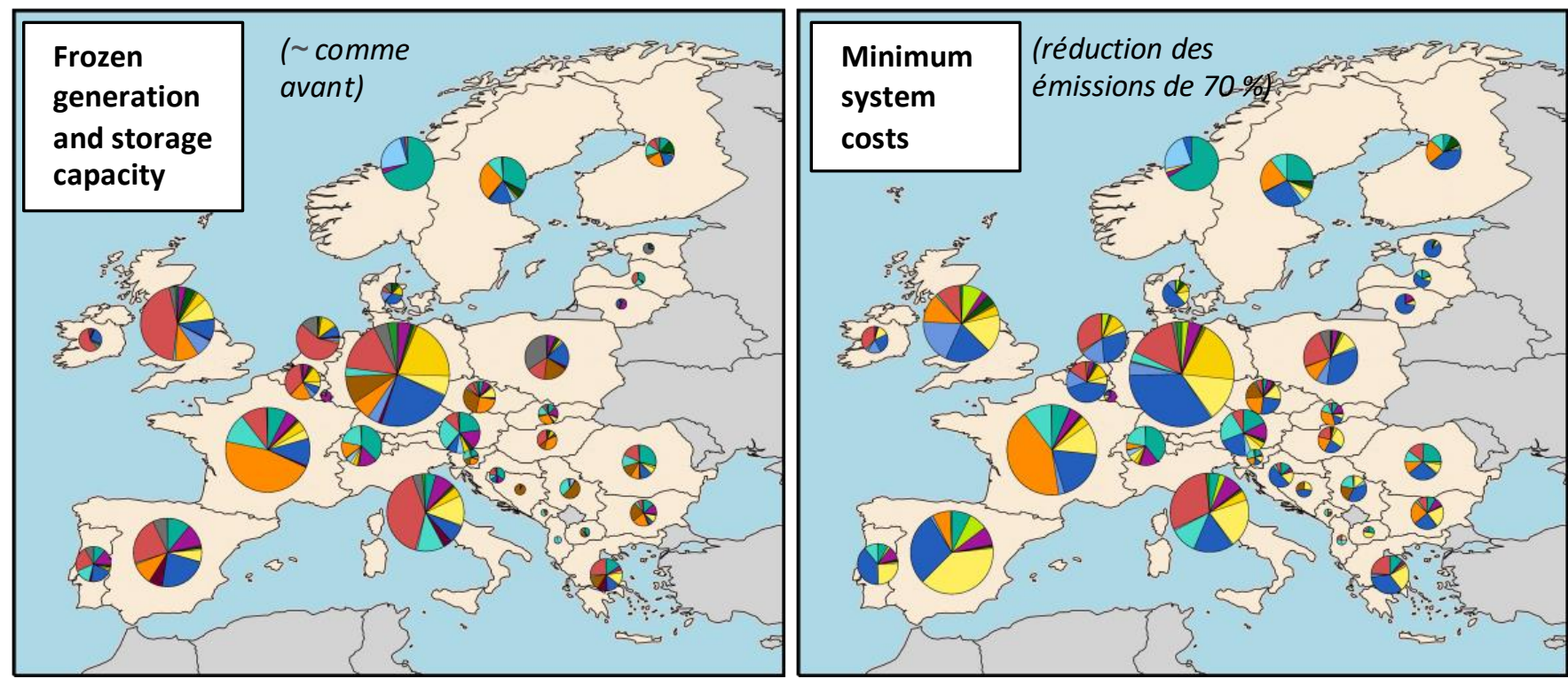
ElCom-Forum, 14 Novembre 2025

Pour aujourd'hui

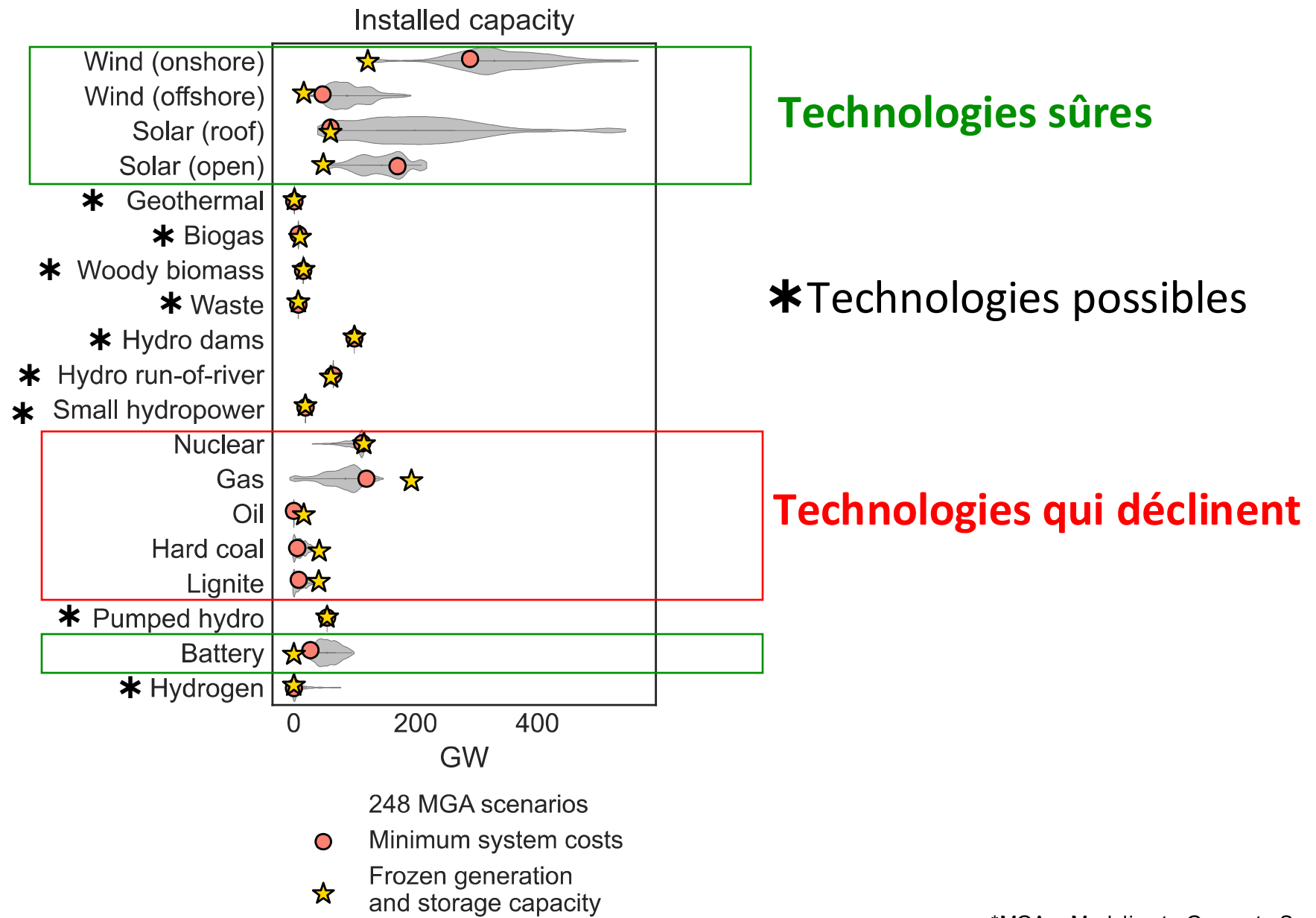
- L'avenir du secteur européen de l'électricité et l'importance de l'intégration des marchés
- L'importance de l'intégration pour la Suisse et le défi non technique



Réduction de 70 % des émissions dans le secteur européen de l'électricité d'ici 2035 (1)

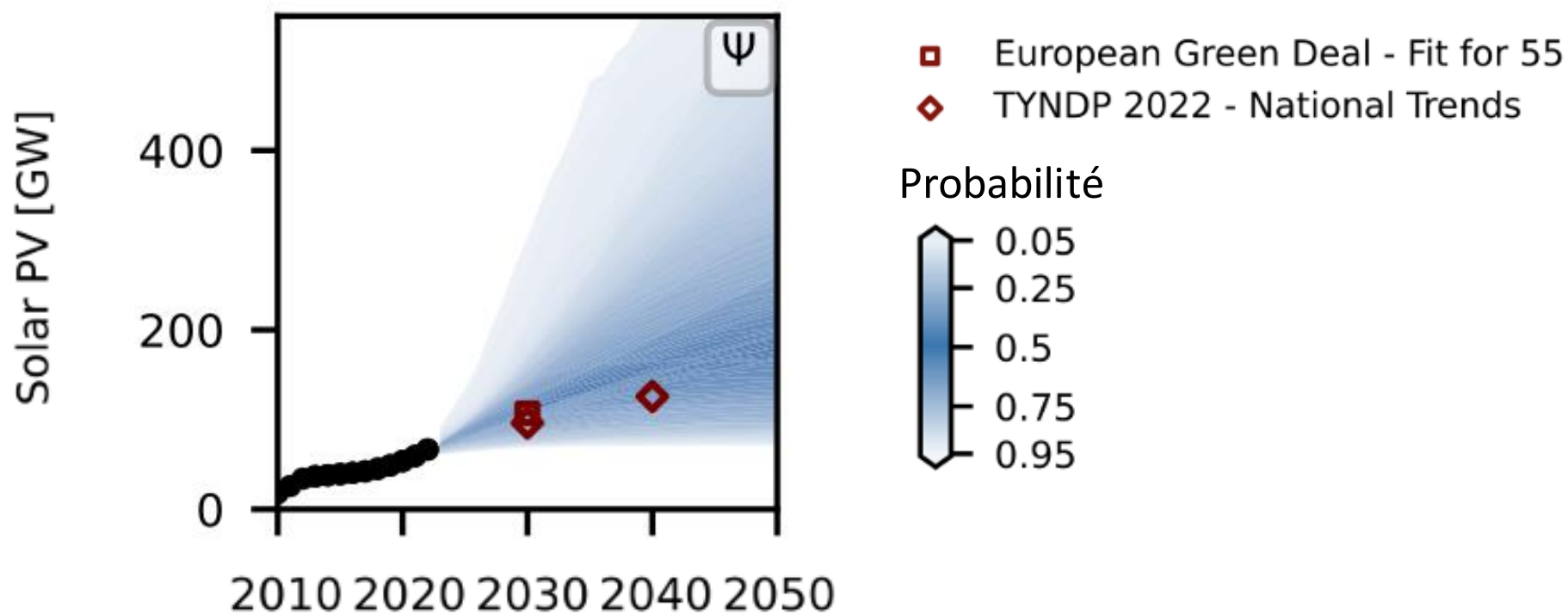


Réduction de 70 % des émissions dans le secteur européen de l'électricité d'ici 2035 (2)

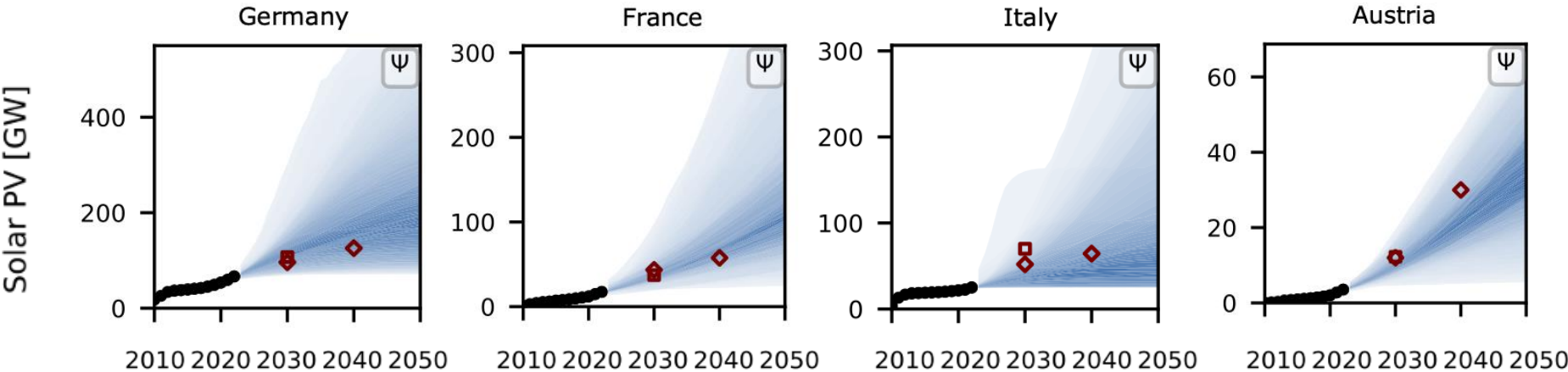


Progrès attendus en Europe

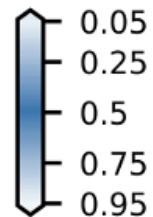
Électricité solaire photovoltaïque en Allemagne



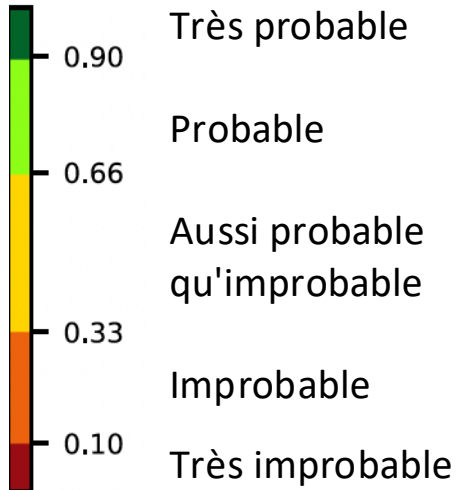
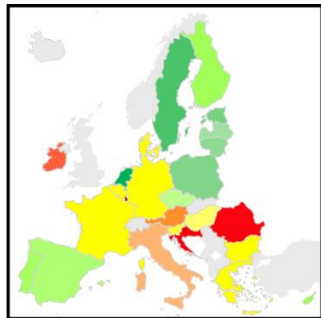
Progrès attendus en Europe: solaire photovoltaïque



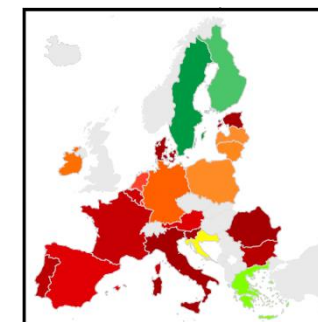
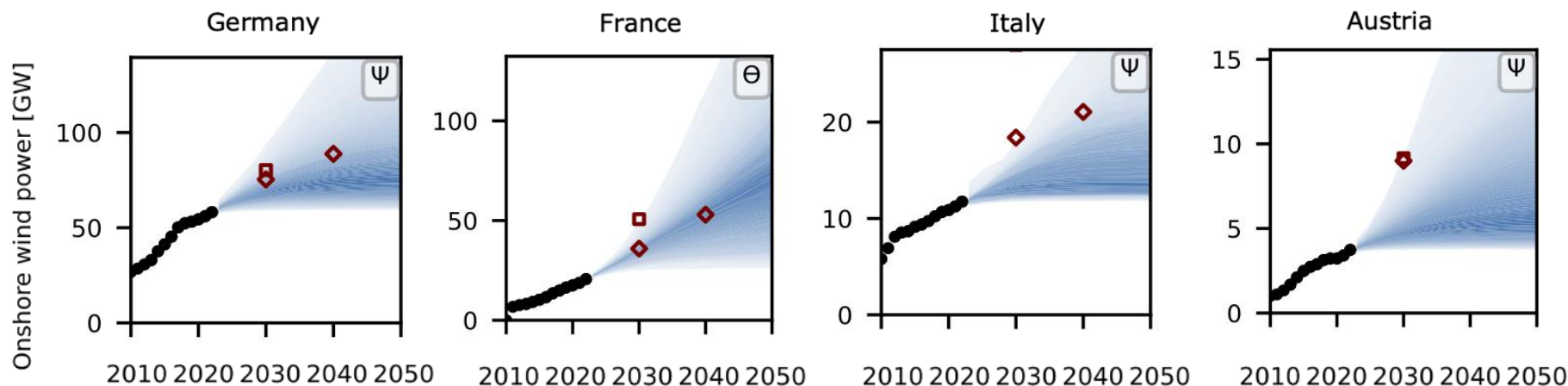
Probabilité



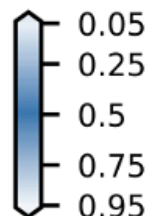
- European Green Deal - Fit for 55
- ◆ TYNDP 2022 - National Trends



Progrès attendus en Europe: éolienne terrestre

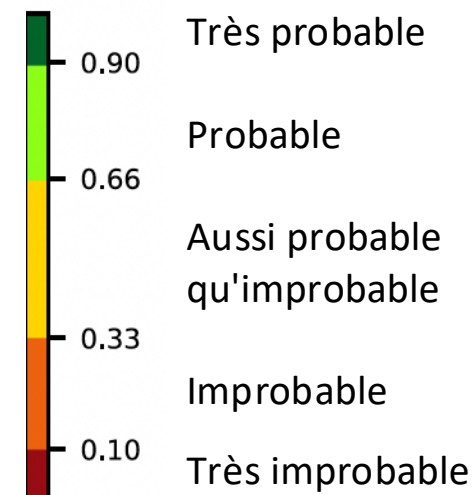


Probabilité



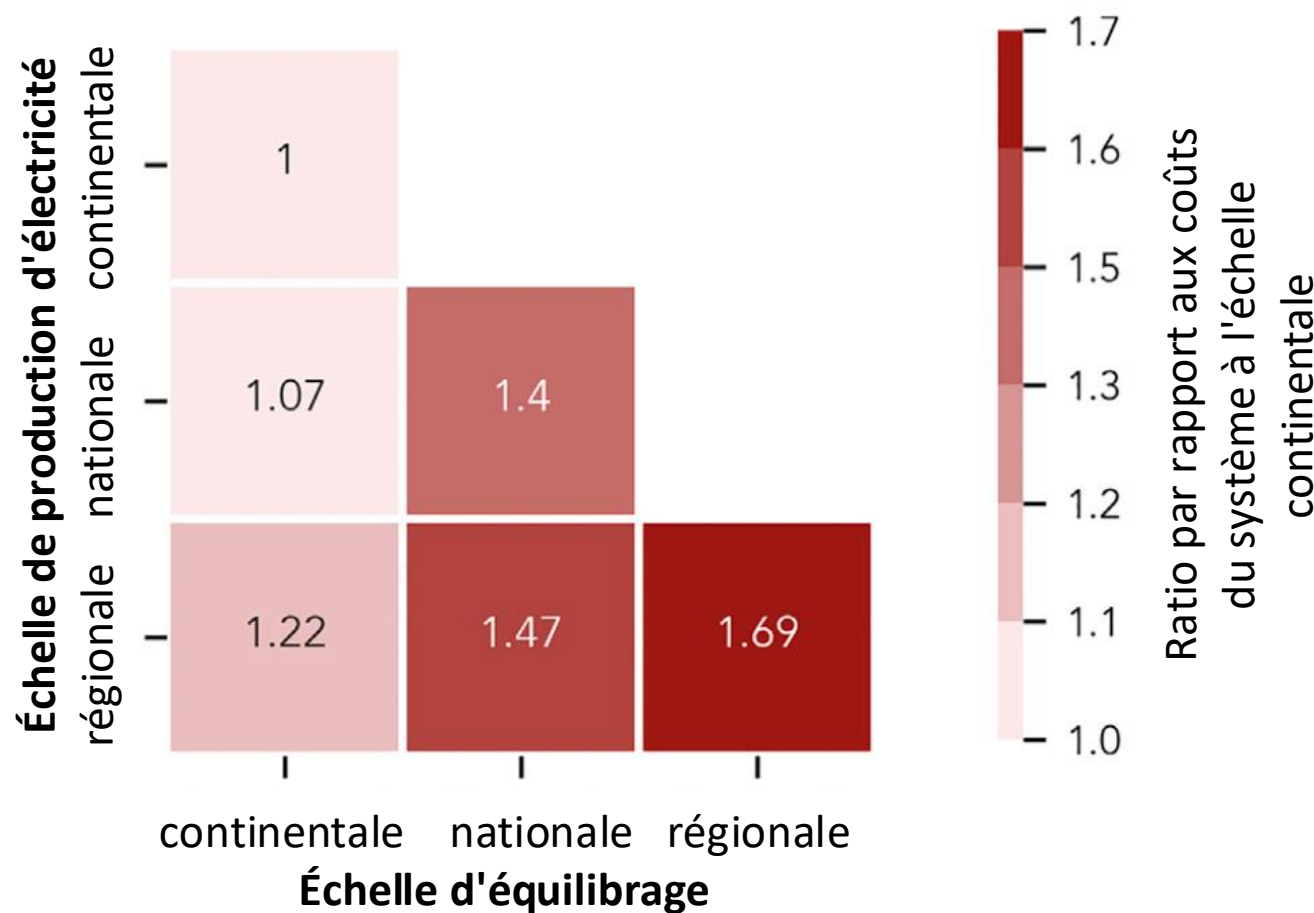
- European Green Deal - Fit for 55

◆ TYNDP 2022 - National Trends

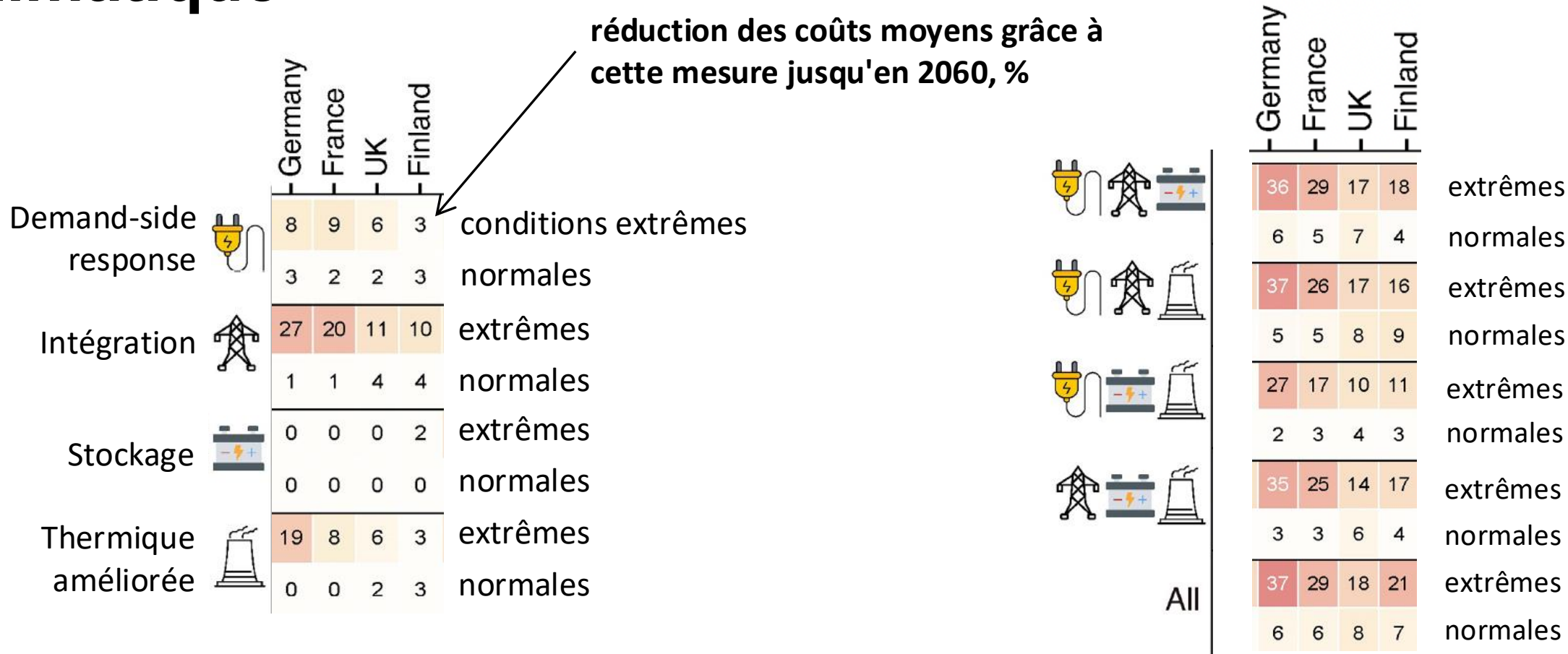


Source: Zielonka and Trutnevyyte (2025)
iScience, Zielonka et al. (2023) *PNAS Nexus*

Coûts élevés de l'isolement dans un système où la part des énergies renouvelables est importante



Coûts liés à la préparation aux effets du changement climatique



SWEET EDGE Renewable Energy Outlooks



Renewable Energy Outlook 2024 (UNIGE, ETHZ, EPFL, UNIBE)

- Objectifs de 17 TWh, 25 TWh, et 35 TWh pour la nouvelle électricité renouvelable en 2035



Renewable Energy Outlook II 2025 (ETHZ, UNIGE, EPFL, ZHAW, UNIBE)

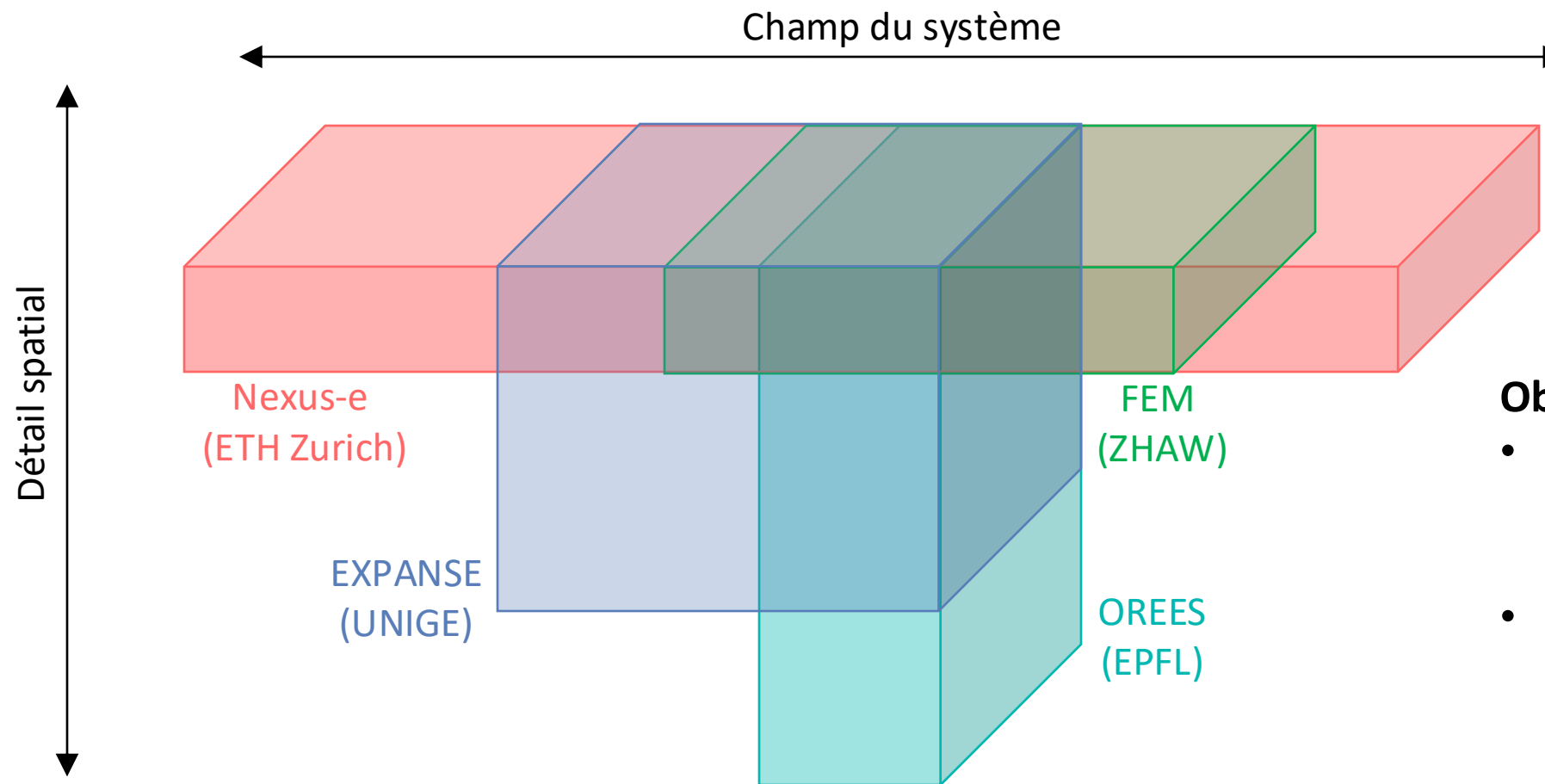
- Objectifs de 45 TWh et 5 TWh pour les importations nettes en hiver en 2050, avec et sans contraintes d'intégration du marché européen



Renewable Energy Outlook III 2026 (UNIGE, ETHZ, EPFL, ZHAW)

- Parts importantes de l'électricité renouvelable en Suisse dans le contexte de différentes évolutions de la génération décentralisée et centralisée en Europe et en Suisse, y compris l'énergie nucléaire

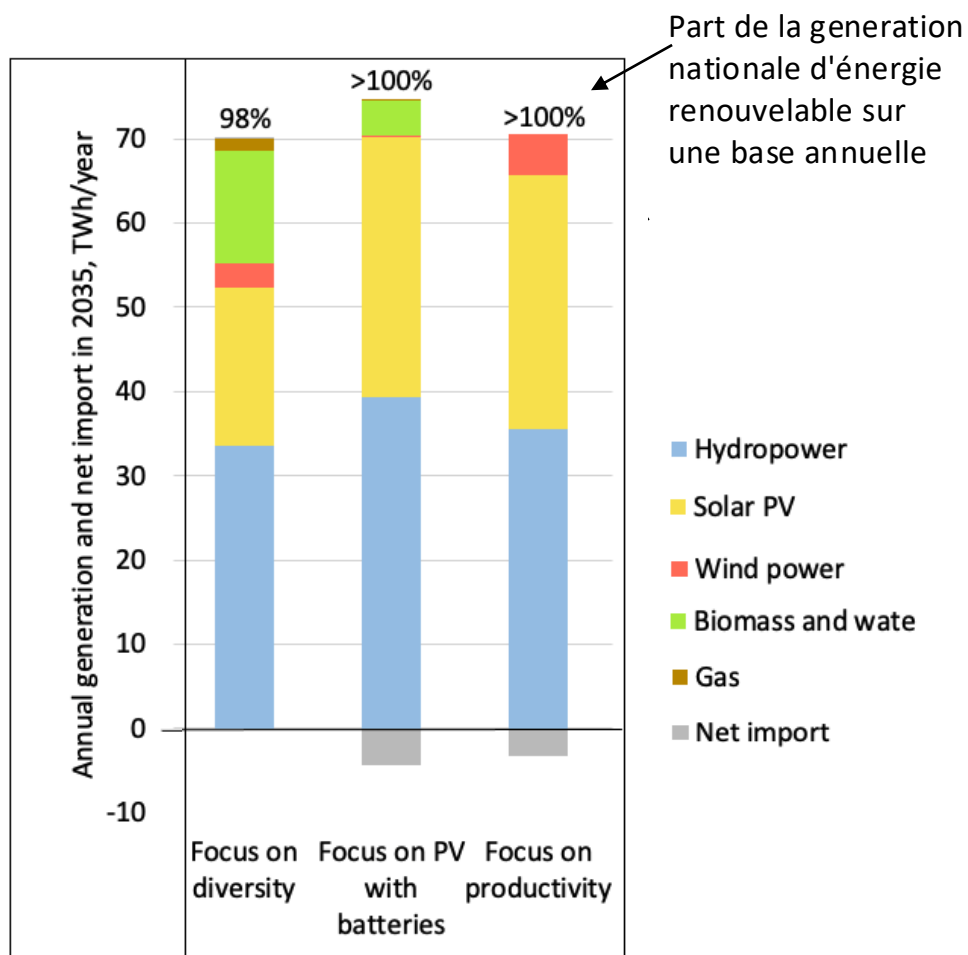
Comparaisons entre modèles



Objectif:

- Répondre aux questions de manière plus robuste et complète
- Identifier un consensus malgré les différences entre modèles

Renewable Energy Outlook I: objectif de 35 TWh et sensibilité de la demande



-3.7 TWh/année

-4.1 TWh/année

-3.2 TWh/année

-1.9 TWh/année

Demande finale d'électricité:

61.2 TWh/année

+5.6 TWh/année

Importations nettes:

Accent sur la diversité

+6.6 TWh/année

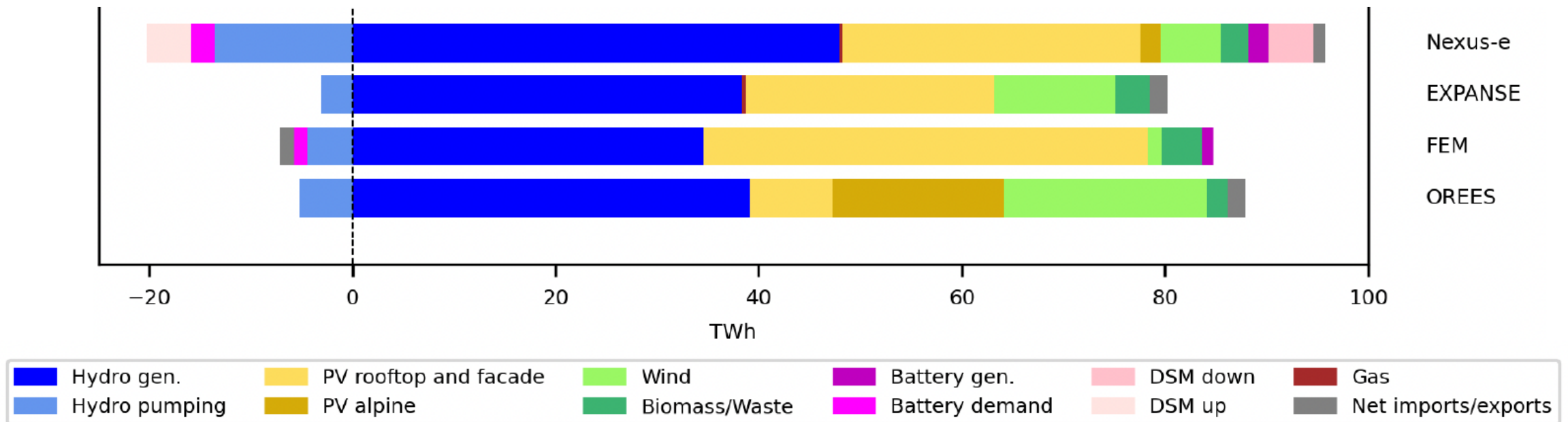
Accent sur le PV avec batteries

+5.9 TWh/année

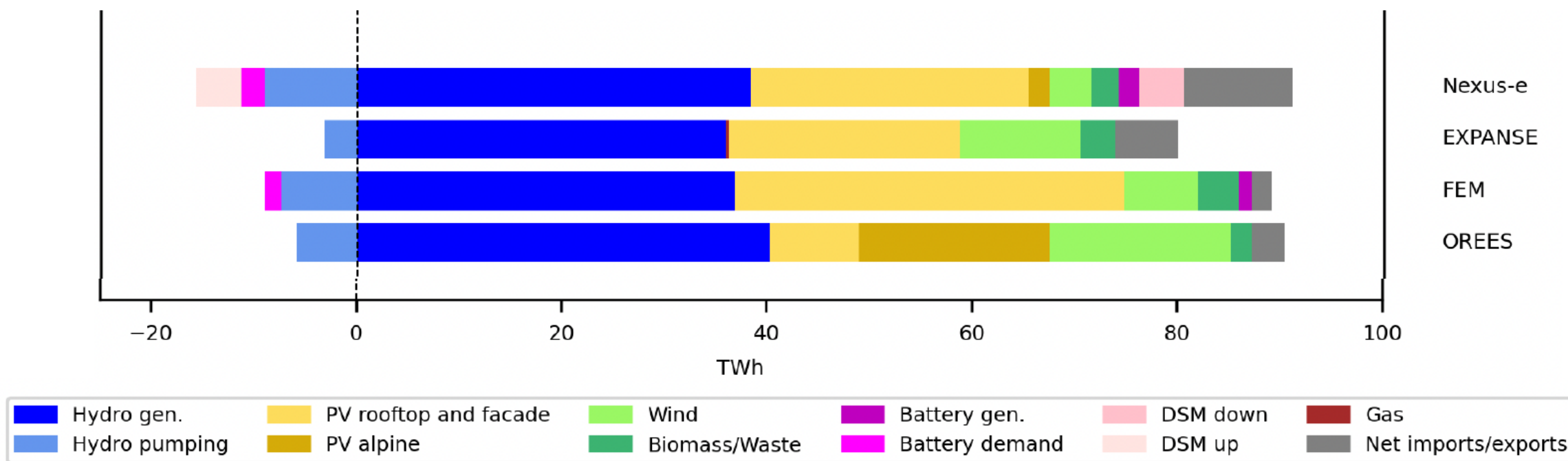
Accent sur la productivité

+3.4 TWh/année

Renewable Energy Outlook II: objectif de 45 TWh en 2050

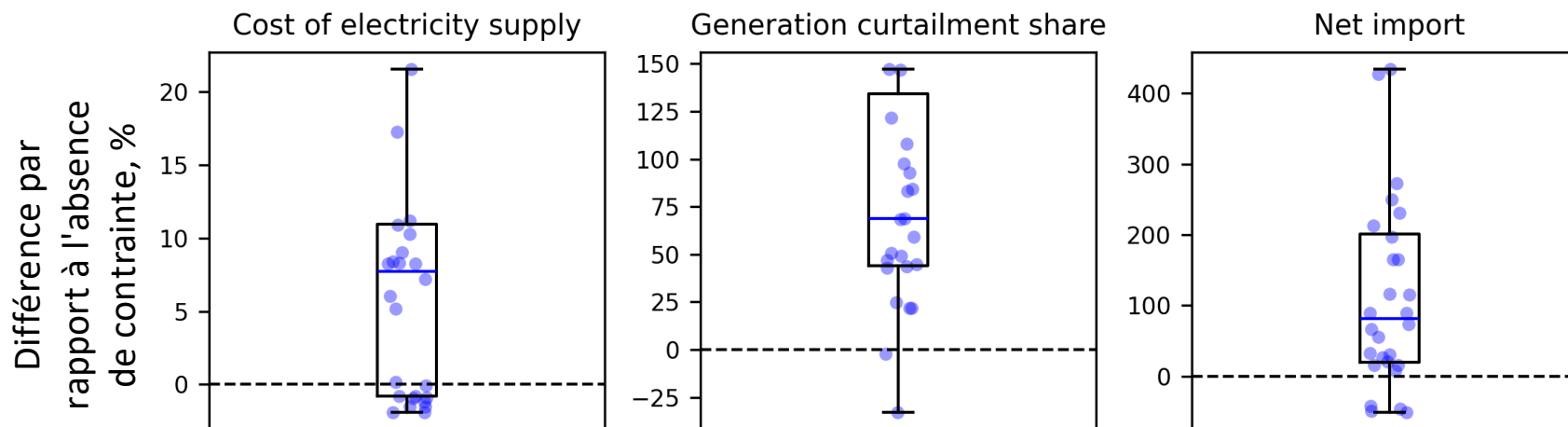


Renewable Energy Outlook II: objectif de 45 TWh en 2050 et contrainte d'intégration



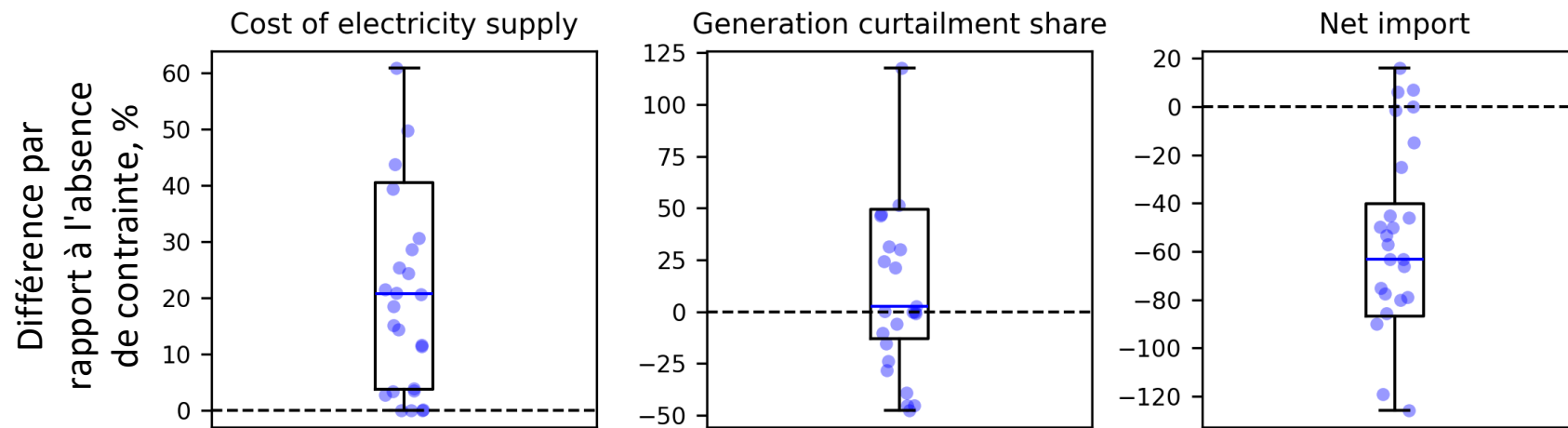
Renewable Energy Outlook II: objectif de 45 TWh en 2050 et contrainte d'intégration

- Une intégration limitée entraîne une augmentation des coûts du système, une hausse des prix marginaux et une baisse de l'utilisation des centrales renouvelables, y compris les centrales hydroélectriques à accumulation par pompage
- Les importations nettes annuelles augmentent, principalement en raison d'une capacité d'exportation limitée en été

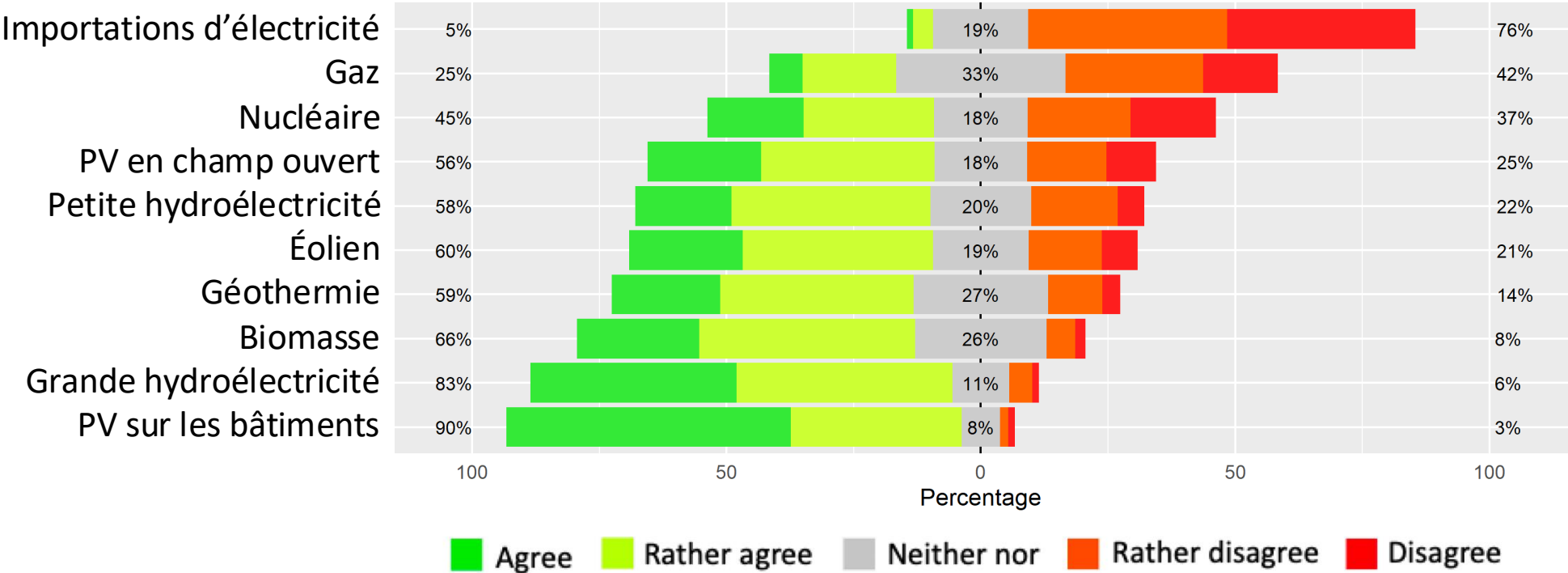


Renewable Energy Outlook II: objectif de 5 TWh en hiver

- La limitation des importations nettes en hiver augmente les coûts d'approvisionnement en électricité et les prix de l'électricité, a un impact négatif sur le fonctionnement des centrales hydroélectriques à accumulation par pompage et accroît les besoins en énergie éolienne et en gaz



Défi non technique: préférences technologiques



Panels de citoyens informés



Zurich, 2018
N=46

Genève, 2019
N=33

Net import from abroad

Swiss electricity grid is connected with the grids of France, Germany, Austria, Italy, and Lichtenstein. Electricity is being imported to and exported from Switzerland every day based on the differences between countries in terms of electricity price, demand, and amounts of generated electricity.

Looking throughout one year, Switzerland could import more electricity from abroad than it exports. This would lead if Switzerland decides to cover parts of its electricity demand with net import, less power plants would be built in Switzerland.

Situation today
41 billion kWh of electricity per year are imported and 43 billion kWh of electricity per year are exported during the year and in amounts, however, change from year to year.

Situation in the future
The estimates of how much more electricity could be imported from Switzerland in principle depend on future decisions to capacity of grid connections. Energy analysis has so far considered 1 kWh per year as the maximum (for over 3 million households).

Capacity of grid connections
Electricity exchange with the other countries can be flexibly decreased. Currently, 60% of imports come from France, 26% from Austria, and 14% from Italy. How much electricity is actually imported depends on the whole supply chain is accounted, the average unit of electricity from France is 1,000 milligrams, from Germany 4,000 milligrams, from Austria 1,000 milligrams. Electricity from Germany and France contribute most and acid rain with sulphur dioxide (SO₂) and nitrogen oxides (NO_x) from coal power).

Impact on local air pollution
Impact on local air pollution by imported electricity depends on where electricity comes from. This impact would not occur in Swiss supply chain is accounted, the average unit of electricity from France is 1,000 milligrams, from Germany 4,000 milligrams, from Austria 1,000 milligrams. Electricity from Germany and France contribute most and acid rain with sulphur dioxide (SO₂) and nitrogen oxides (NO_x) from coal power).

Impact on water
Impact on water by imported electricity depends on where electricity comes from. This impact would not occur in Switzerland. In all the Switzerland imports from, electricity generation has large to very large water. In France, large portions of electricity are produced by nuclear power. In Germany, large portions of electricity are produced by nuclear power. In Austria, large portions of electricity are produced by nuclear power.

Electricity costs
The costs of imported electricity depend on the country from which the electricity is imported. Currently, the electricity from France on average costs about 5 Rp. per kWh, from Germany about 4 Rp. per kWh, from Austria about 4 Rp. per kWh, and from Italy about 6 Rp. per kWh. The future costs will depend on strategic decisions about the electricity generation mix in these countries.

Electricity supply reliability
Electricity import from abroad is a reliable and steady electricity source that can be used flexibly to contribute to the Swiss electricity needs and to benefit from difference in electricity generation costs. As electricity generation and the neighboring countries is subject to the strategic decisions of every individual country, relying to a larger extent on electricity imports in Switzerland also means relying on strategic decisions elsewhere too.

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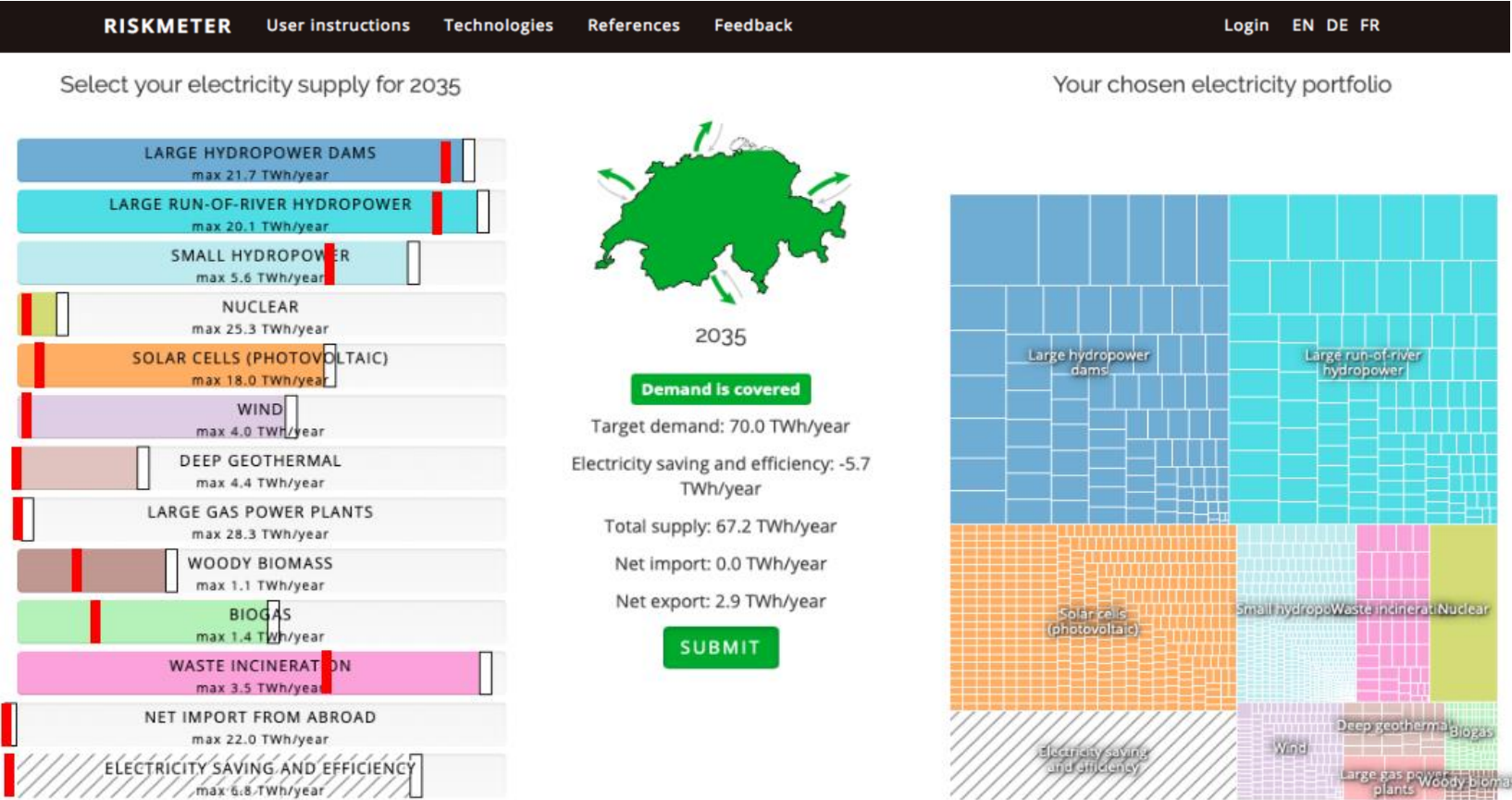
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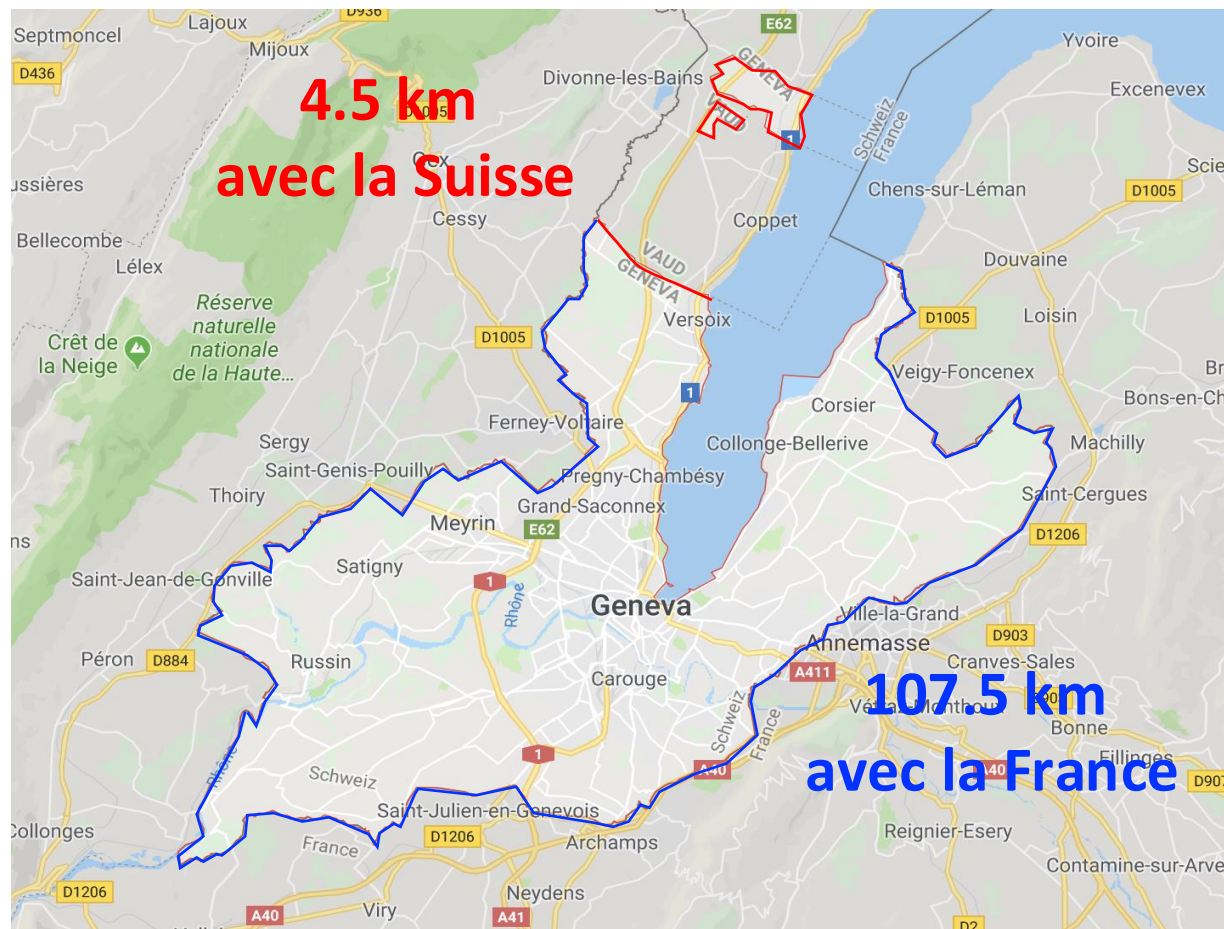
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Résumé

- L'avenir du secteur européen de l'électricité et l'importance de l'intégration des marchés
 - L'Europe s'oriente vers une **part importante d'électricité renouvelable**
 - L'intégration des marchés **réduit les coûts totaux** du système, tant pour l'approvisionnement que pour l'équilibrage
 - L'intégration des marchés est la mesure la plus rentable pour faire face aux **conditions météorologiques extrêmes** liées au changement climatique
- L'importance de l'intégration pour la Suisse et le défi non technique
 - L'intégration des marchés est essentielle pour **s'adapter à l'incertitude** de la demande en électricité
 - Les contraintes sur l'intégration entraîneraient une **augmentation des coûts et des prix** du système électrique et augmenteraient les importations nettes
 - Les avantages de l'intégration doivent être **communiqués de manière répétée et aussi largement que possible**, car l'acceptation publique des importations est extrêmement faible



Merci beaucoup!

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