Supplementary Information:
Policy impact in technology growth models of solar PV and onshore wind power

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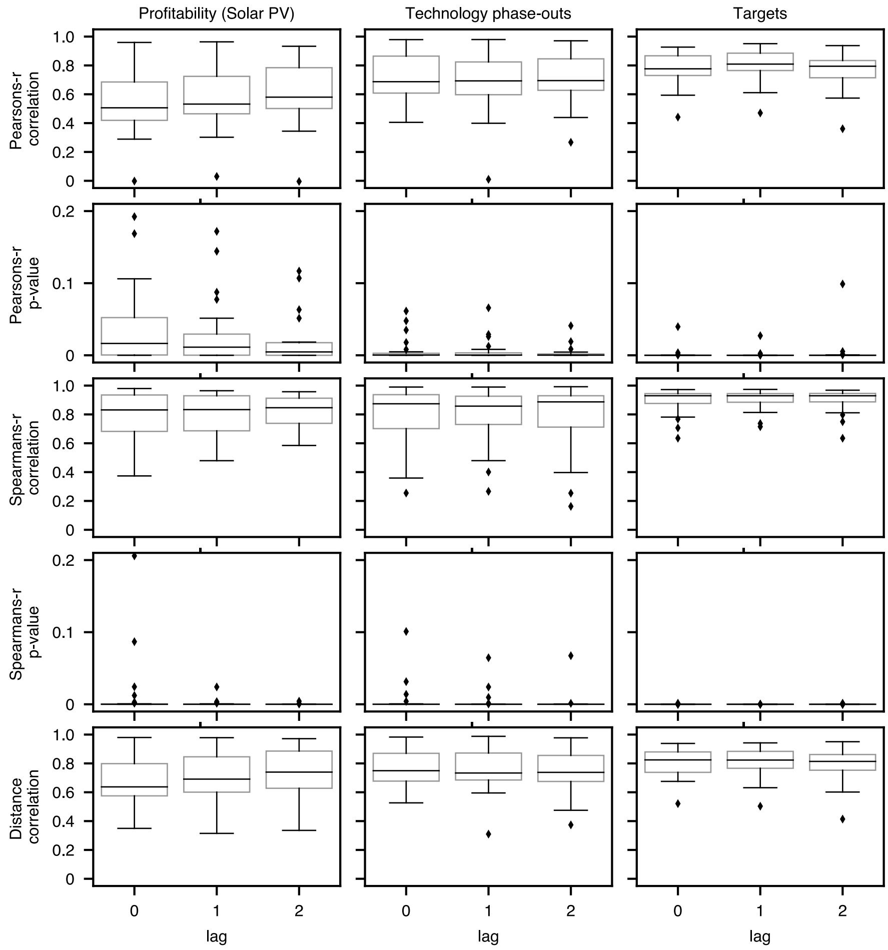
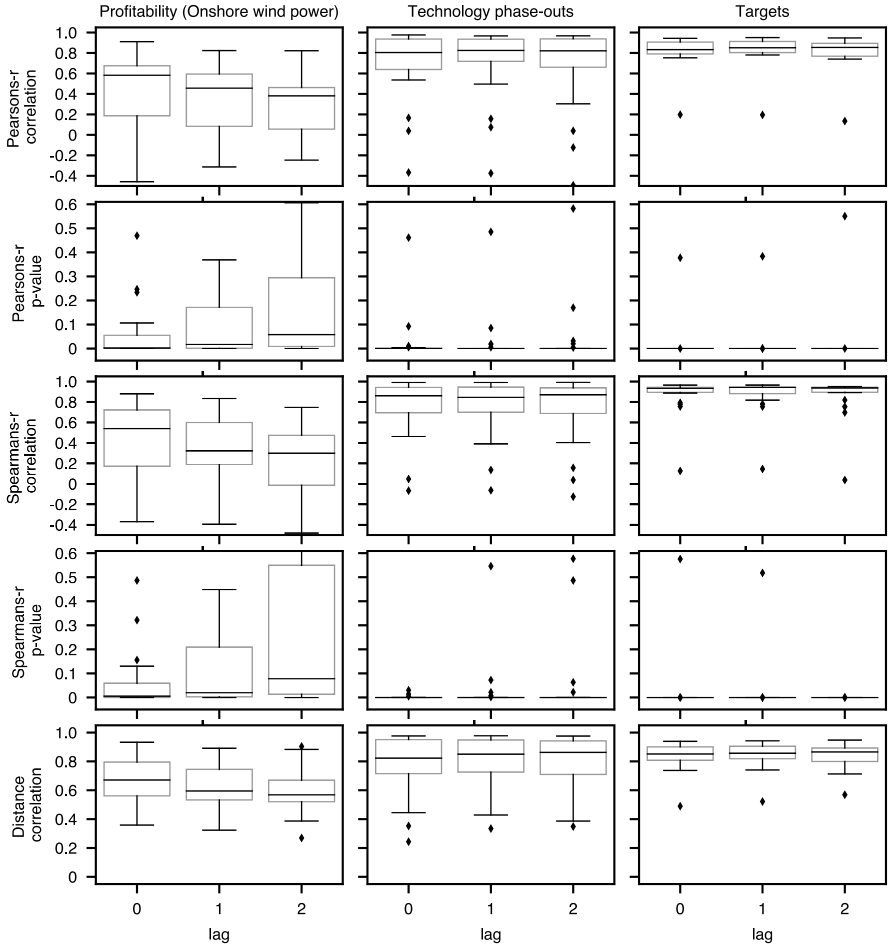


Supplementary Figure 1. Pearsons-r, Spearmans-r, and Distance correlation between historical time series of the installed capacities of solar PV and the three investigated types of policies with no lag, one year lag, and two-year lag with values from 2000 – 2023. Outliers can lay outside the plots.



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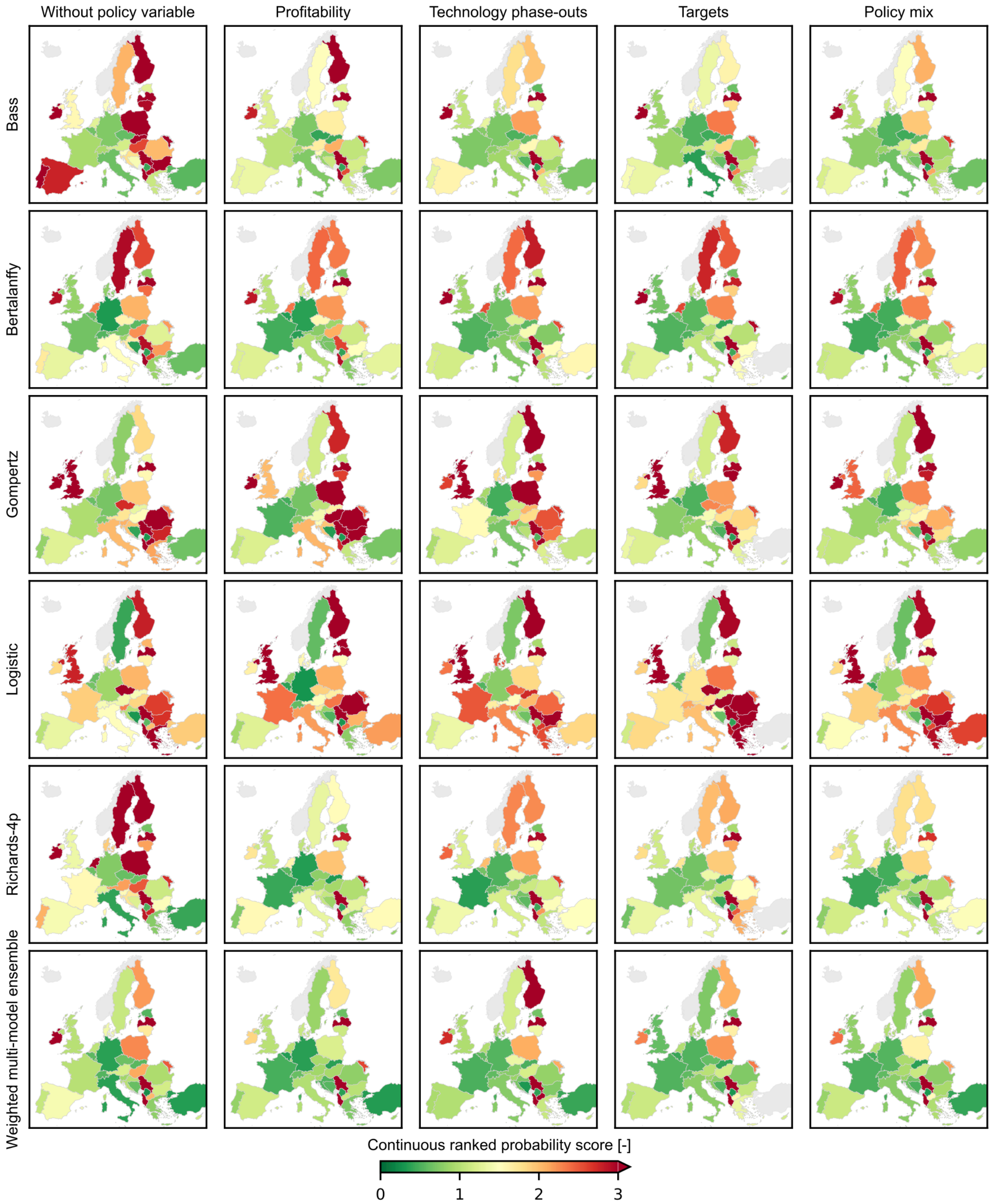
Out-of-sample performance with historical policies



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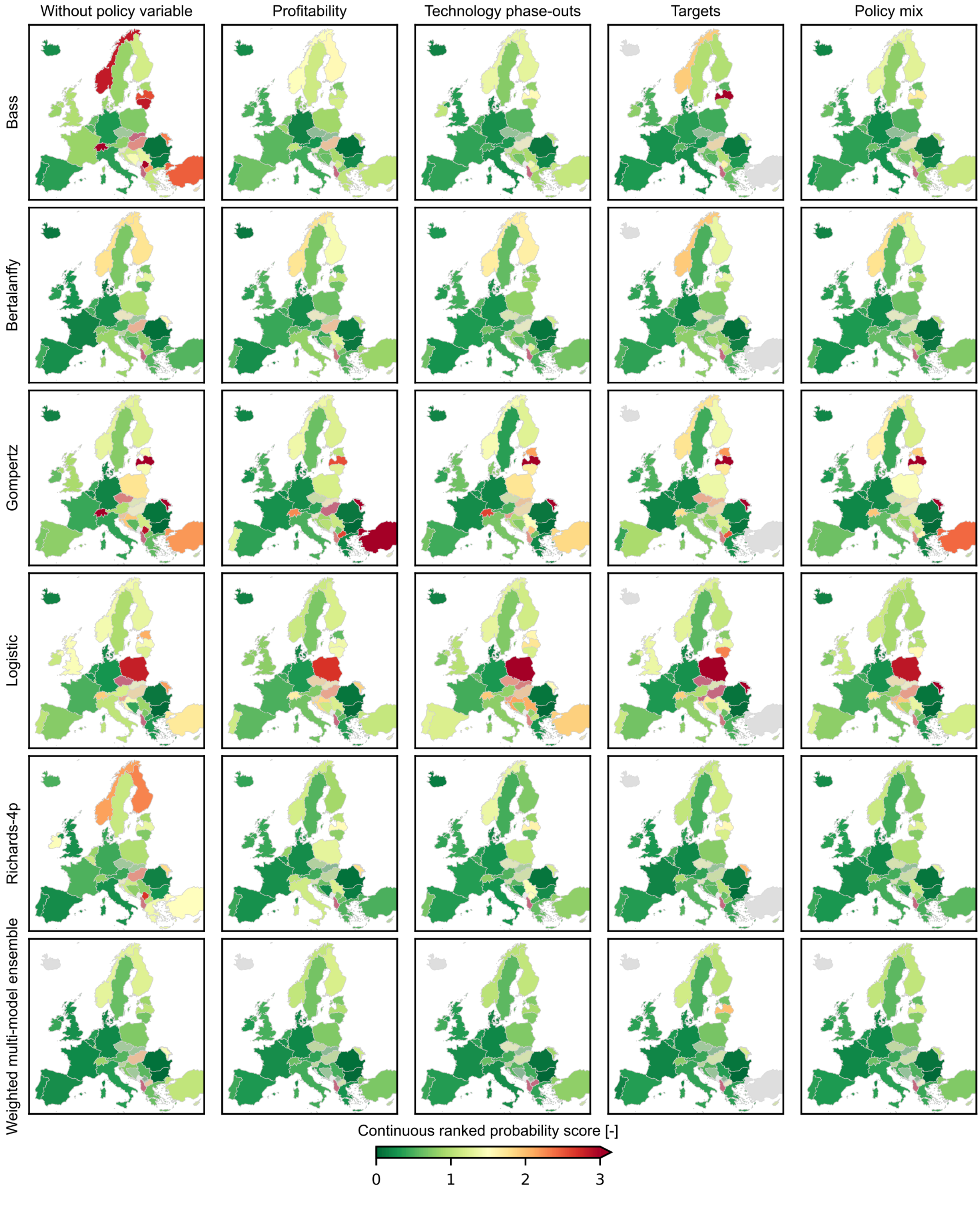

Supplementary Figure 4. Out-of-sample performance of five growth models and the weighted multi-model ensemble without an integrated policy variable and with a type of policies for onshore wind power. The continuous ranked probability score measures the out-of-sample performance in terms of calibration and sharpness of the probabilistic projections of each model in 2012 – 2023 with respective training intervals ending between 2011 and 2022. The out-of-sample testing for the weighted multi-model ensemble starts in 2014 as the ensemble uses testing of the growth models of the previous two years in the first iteration to calculate model weights for the ensemble. The higher the continuous ranked probability score, the lower the performance. The shown scores are medians over all years and hindcasting intervals. Countries in grey have no projections. Geographical data to visualize country boundaries comes from references[1–3]. Supplementary Figure 3 compares all types of policies for solar PV. Supplementary Figures 5-6 show differences in continuous ranked probability scores. Related to Figure 2.

Profitability
Technology phase-outs
Targets
Policy mix
Bass
Bertalanffy
Gompertz
Logistic
Richards-4p
Weighted multi-model ensemble
Difference in continuous ranked probability score
to model without policy variable
−1.0
−0.5
0.0
0.5
1.0

Supplementary Figure 5. Difference in out-of-sample performance of five growth models and the weighted multi-model ensemble without an integrated policy variable and with a type of policies for solar PV. The continuous ranked probability score measures the out-of-sample performance in terms of calibration and sharpness of the probabilistic projections of each model in 2012 – 2023 with respective training intervals ending between 2011 and 2022. The out-of-sample testing for the weighted multi-model ensemble starts in 2014 as the ensemble uses testing of the growth models of the previous two years in the first iteration to calculate model weights for the ensemble. The higher the continuous ranked probability score, the lower the performance. The shown scores are medians over all years and hindcasting intervals. Countries in grey have no projections. Geographical data to visualize country boundaries comes from references[1–3]. Supplementary Figure 6 compares all types of policies for onshore wind power. Supplementary Figures 3-4 show continuous ranked probability scores directly. Related to Figure 2.

Profitability
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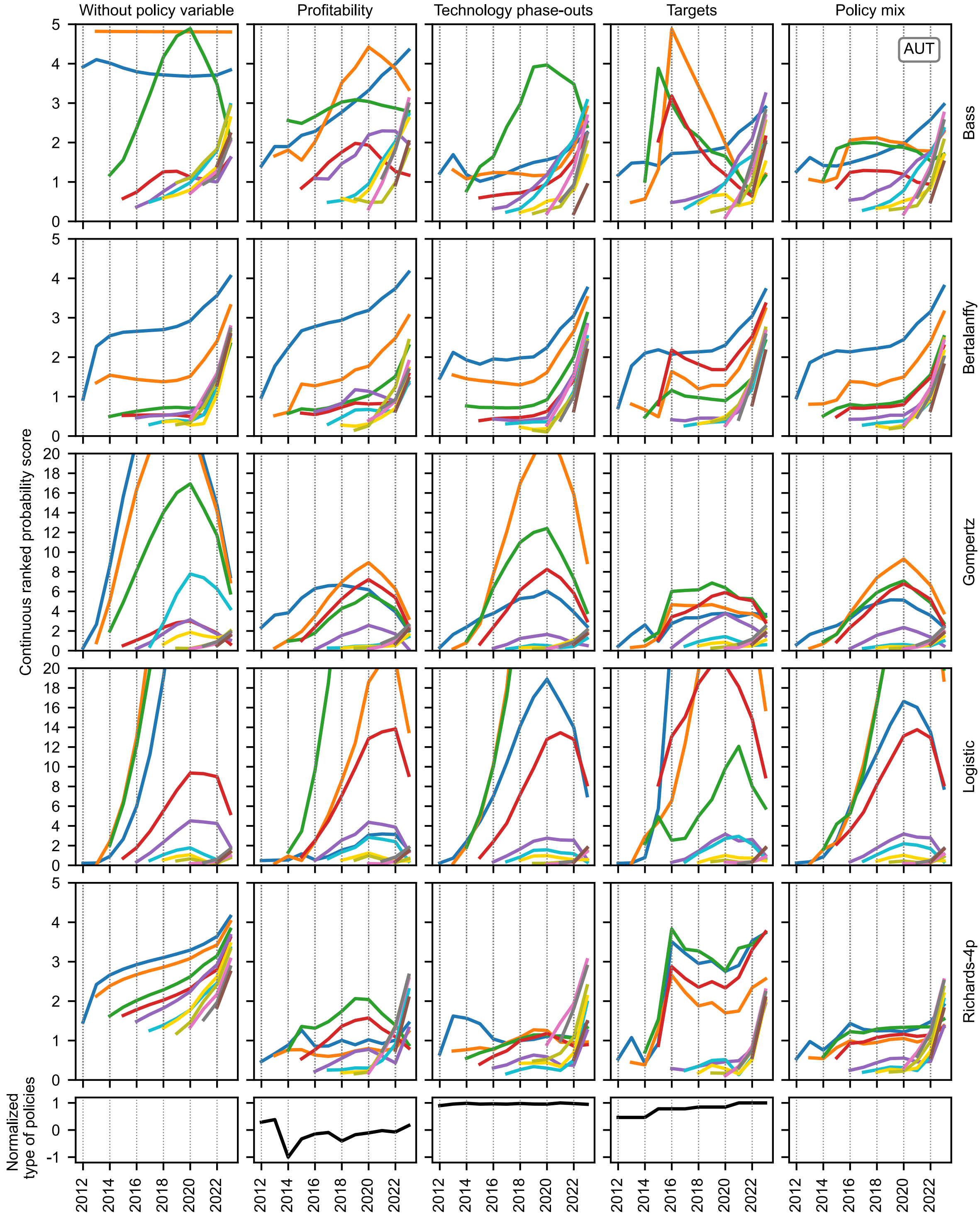
Supplementary Figure 6. Difference in out-of-sample performance of five growth models and the weighted multi-model ensemble without an integrated policy variable and with a type of policies for onshore wind power. The continuous ranked probability score measures the out-of-sample performance in terms of calibration and sharpness of the probabilistic projections of each model in 2012 – 2023 with respective training intervals ending between 2011 and 2022. The out-of-sample testing for the weighted multi-model ensemble starts in 2014 as the ensemble uses testing of the growth models of the previous two years in the first iteration to calculate model weights for the ensemble. The higher the continuous ranked probability score, the lower the performance. The shown scores are medians over all years and hindcasting intervals. Countries in grey have no projections. Geographical data to visualize country boundaries comes from references[1–3]. Supplementary Figure 5 compares all types of policies for solar PV. Supplementary Figures 3-4 show continuous ranked probability scores directly. Related to Figure 2.



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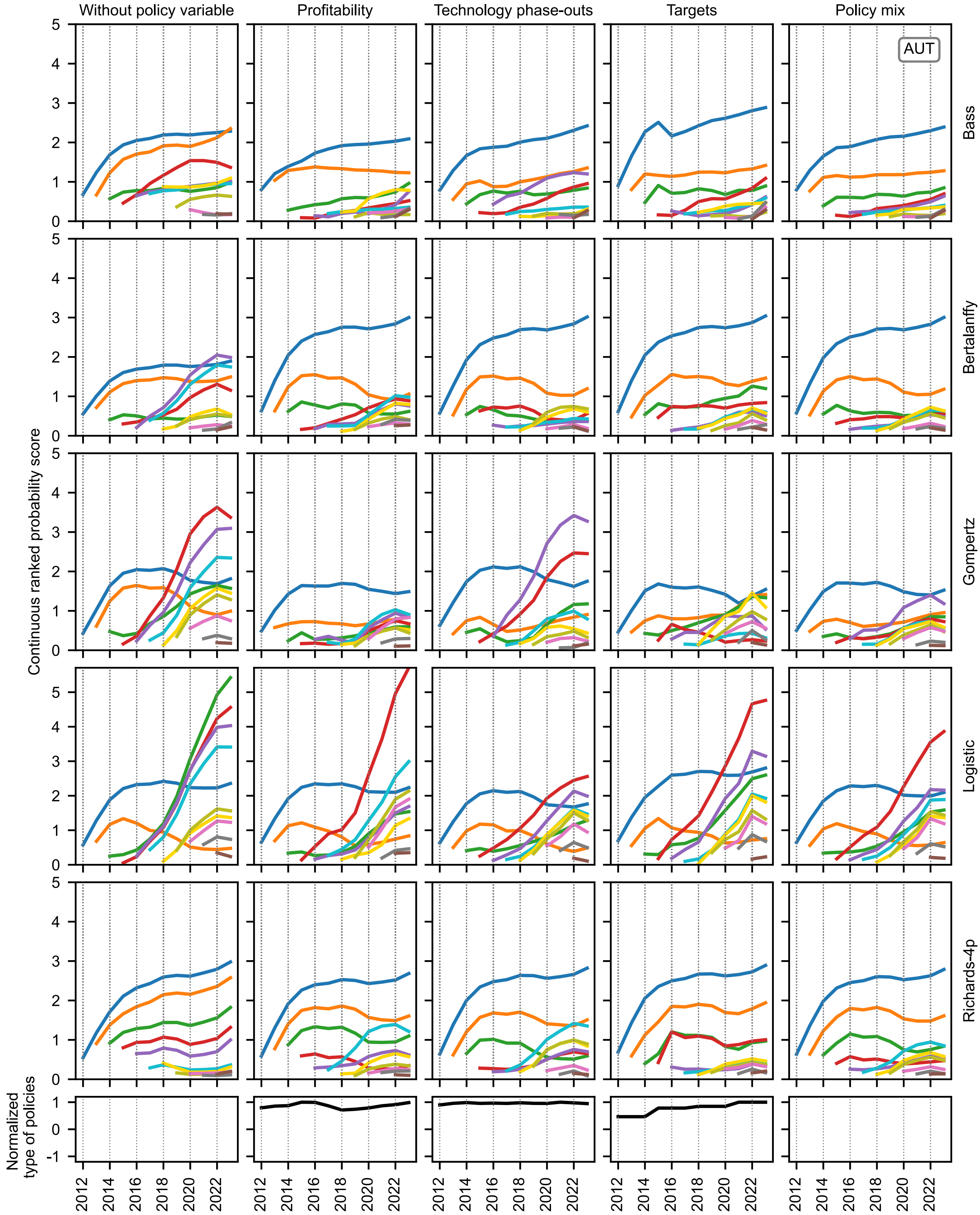

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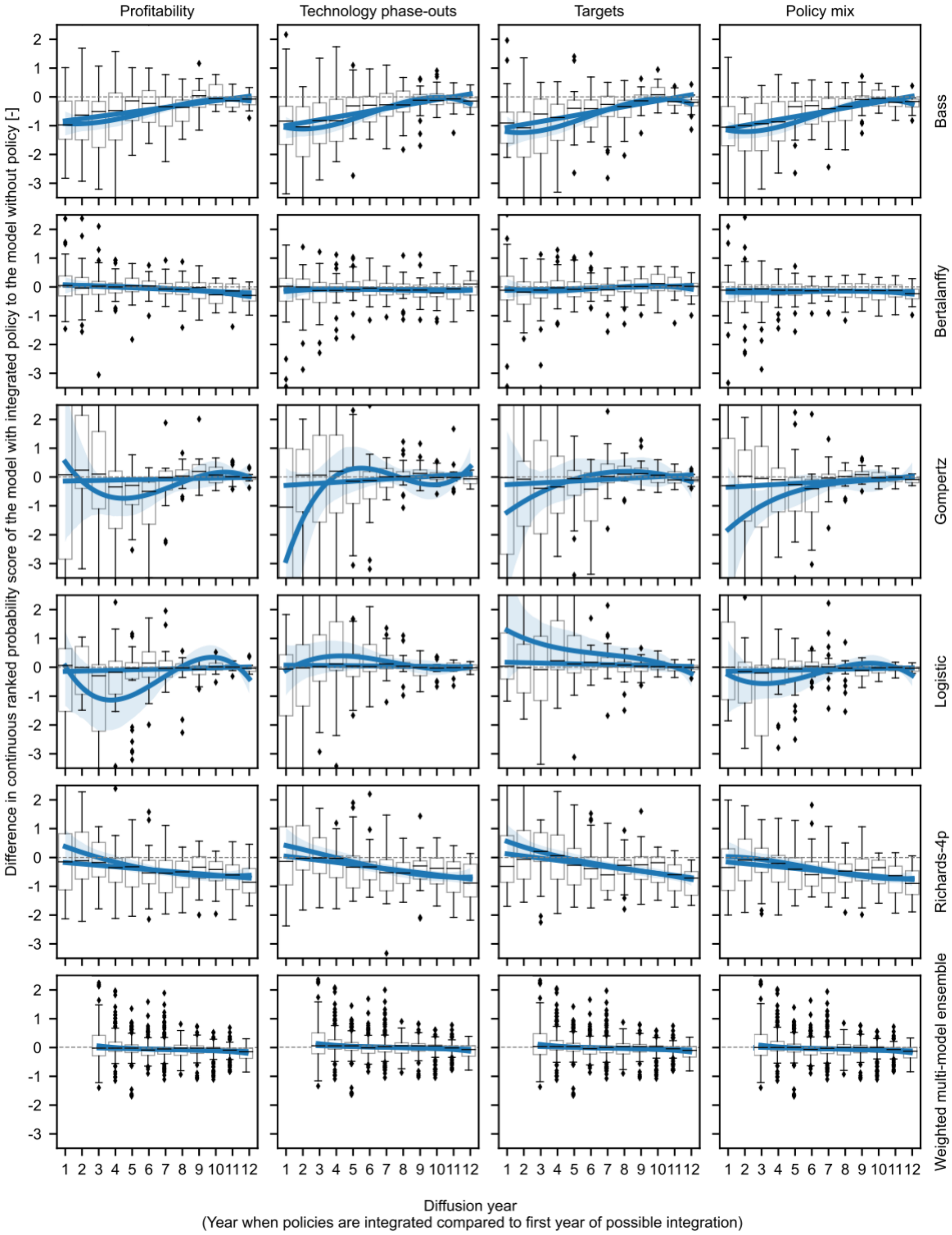
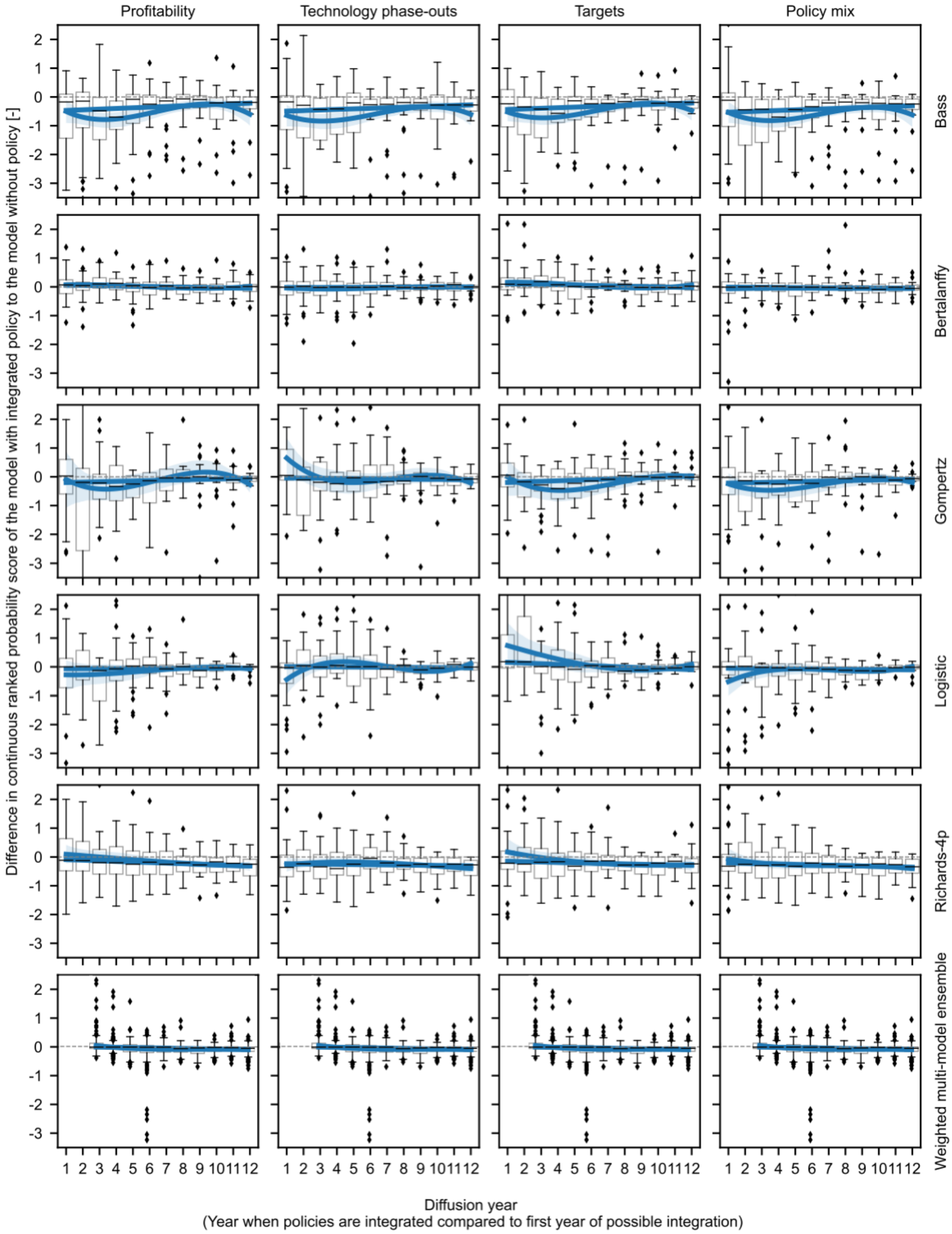
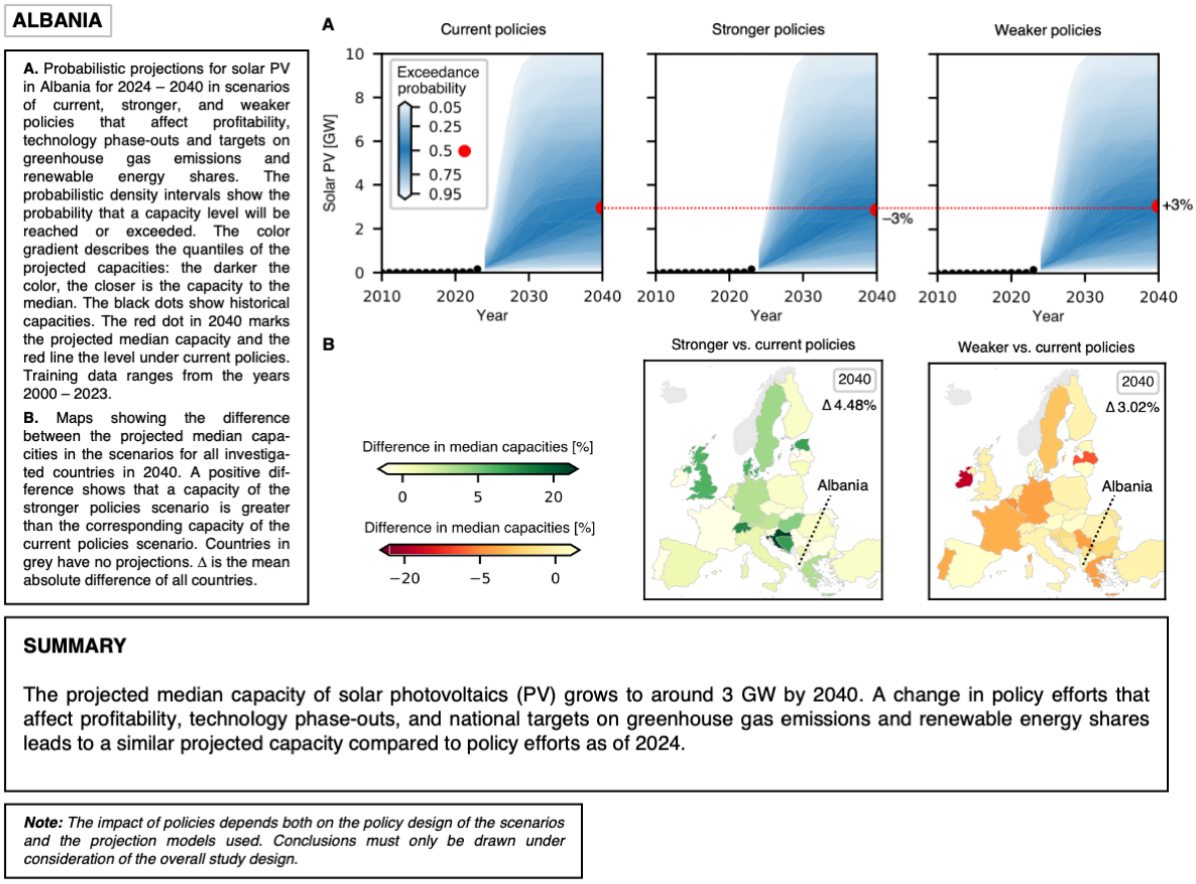


Supplementary Figure 9. Difference in continuous ranked probability score of the investigated growth models and the weighted multi-model ensemble between versions with and without type of policies for solar PV for all countries. The more negative the difference in the continuous ranked probability score, the higher the improvement in performance by integrating policies. The results are grouped by technology diffusion stage, which is the difference in years between the year when policies are integrated (i.e., first year of out-of-sample testing in each hindcasting iteration) and the first year of possible integration (i.e., the last training year in the first projection). The diffusion stage is individual to each technology and country. The bold lines are linear and cubic fits of the data with confidence intervals depicted as shaded areas. Supplementary Figure 10 shows the corresponding box plots for onshore wind power. Related to Figure 3.



Supplementary Figure 10. Difference in continuous ranked probability score of the investigated growth models and the weighted multi-model ensemble between versions with and without type of policies for onshore wind power for all countries. The more negative the difference in the continuous ranked probability score, the higher the improvement in performance by integrating policies. The results are grouped by technology diffusion stage, which is the difference in years between the year when policies are integrated (i.e., first year of out-of-sample testing in each hindcasting iteration) and the first year of possible integration (i.e., the last training year in the first projection). The diffusion stage is individual to each technology and country. The bold lines are linear and cubic fits of the data with confidence intervals depicted as shaded areas. Supplementary Figure 9 shows the corresponding box plots for solar PV. Related to Figure 3.

Country factsheets for future scenarios of current, stronger, and weaker policies

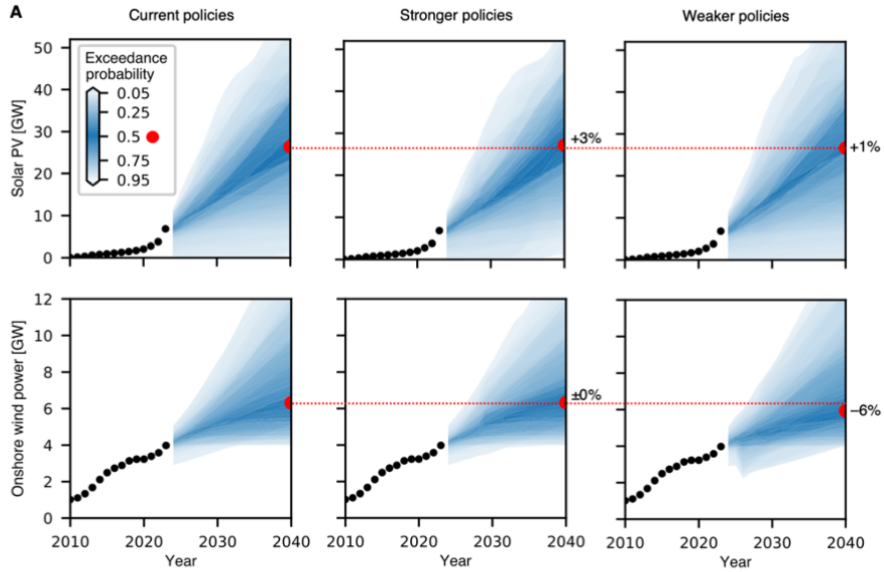


Supplementary Figure 11. Factsheet comparing the probabilistic projections of solar PV between the scenarios of current, stronger, and weaker policies for Albania. Geographical data to visualize country boundaries comes from references[1–3]. Related to Figures 4-5.

AUSTRIA

A. Probabilistic projections for solar PV and onshore wind power in Austria for 2024 – 2040 in scenarios of current, stronger, and weaker policies that affect profitability, technology phase-outs and targets on greenhouse gas emissions and renewable energy shares. The probabilistic density intervals show the probability that a capacity level will be reached or exceeded. The color gradient describes the quantiles of the projected capacities: the darker the color, the closer is the capacity to the median. The black dots show historical capacities. The red dot in 2040 marks the projected median capacity and the red line the level under current policies. Training data ranges from the years 2000 – 2023.

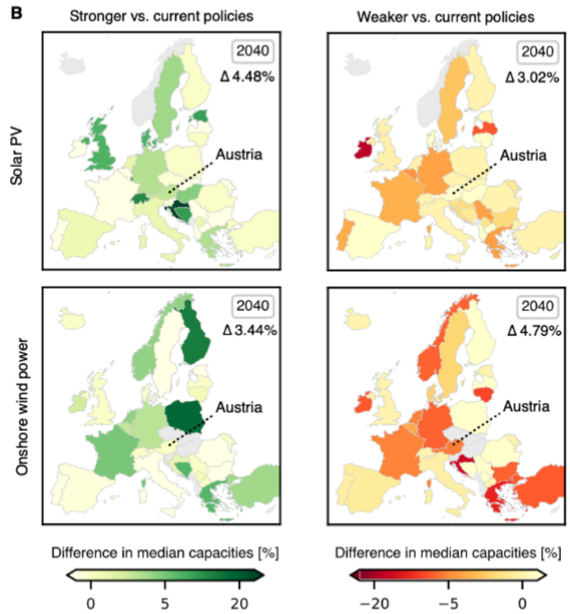
B. Maps showing the difference between the projected median capacities in the scenarios for all investigated countries in 2040. A positive difference shows that a capacity of the stronger policies scenario is greater than the corresponding capacity of the current policies scenario. Countries in grey have no projections. Δ is the mean absolute difference of all countries.



SUMMARY

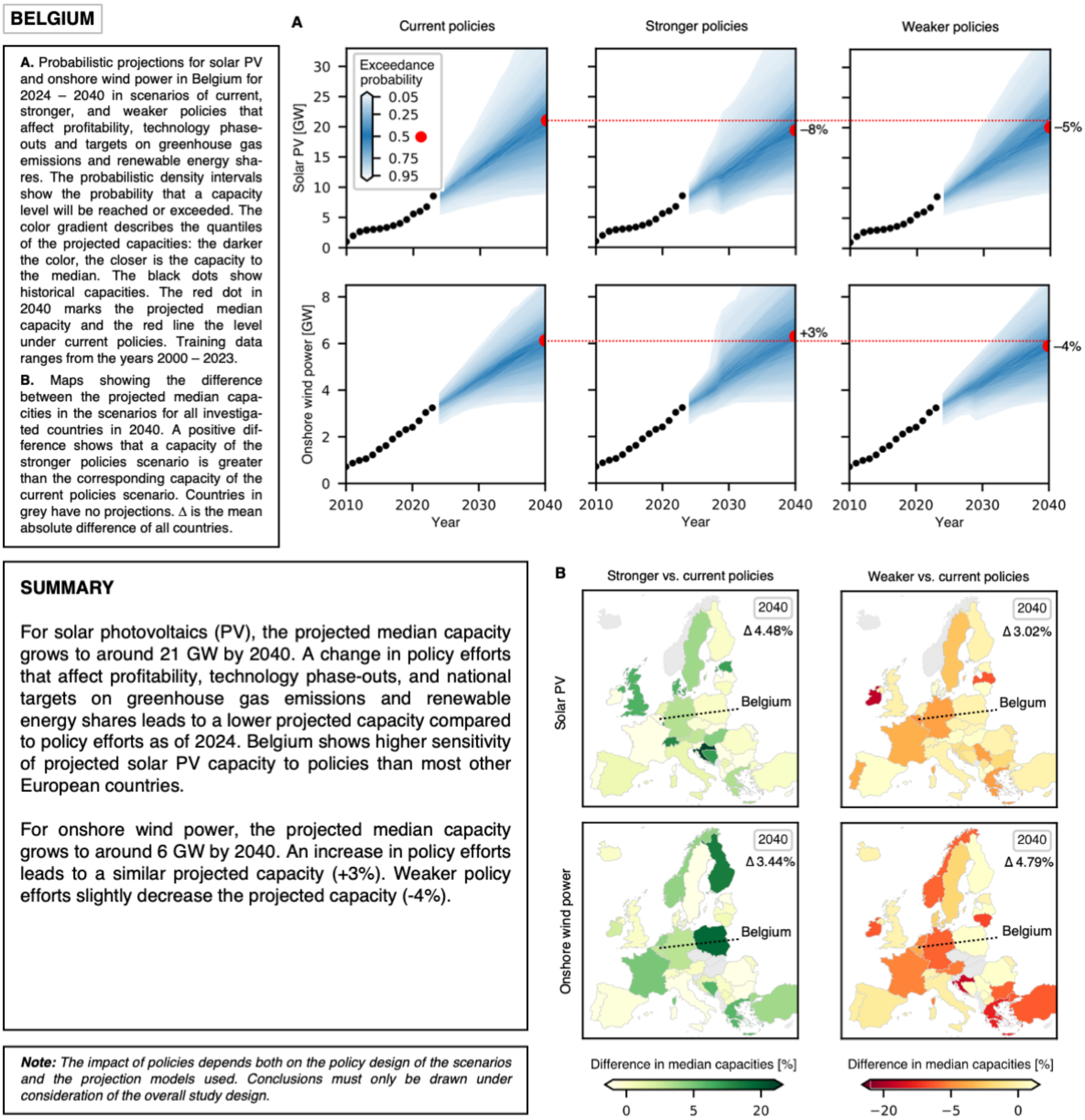
For solar photovoltaics (PV), the projected median capacity grows to around 26 GW by 2040. An increase in policy efforts that affect profitability, technology phase-outs, and national targets on greenhouse gas emissions and renewable energy shares leads to a similar projected capacity compared to policy efforts as of 2024 (+3%). Weaker policy efforts show no considerable effect on the projected capacity either.

For onshore wind power, the projected median capacity grows to around 6 GW by 2040. An increase in policy efforts shows no effect on the projected capacity. In contrast, weaker policy efforts decrease the projected capacity (-6%). Thereby, Austria shows higher sensitivity of projected onshore wind power capacity to weaker policies than most other European countries.



***Note:** The impact of policies depends both on the policy design of the scenarios and the projection models used. Conclusions must only be drawn under consideration of the overall study design.*

Supplementary Figure 12. Factsheet comparing the probabilistic projections of solar PV and onshore wind power between the scenarios of current, stronger, and weaker policies for Austria. Geographical data to visualize country boundaries comes from references[1–3]. Related to Figures 4-5.

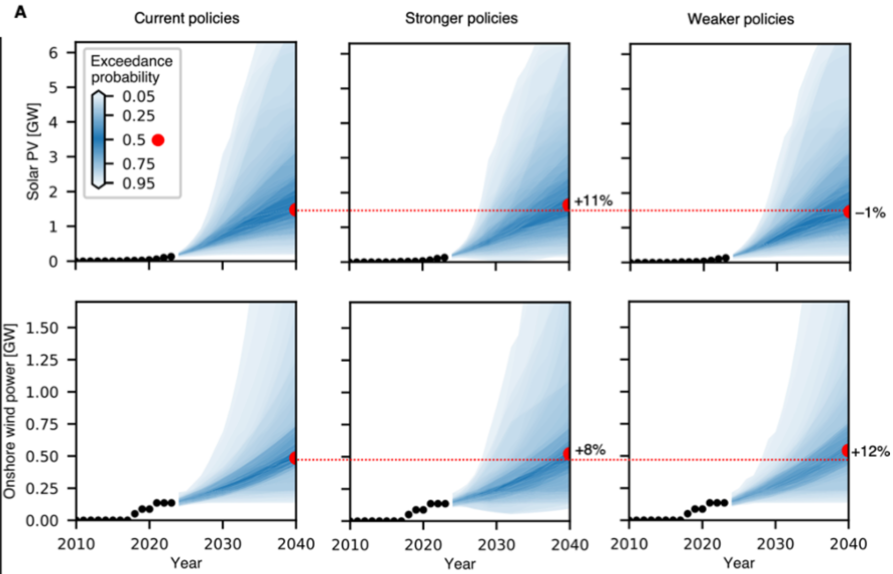


Supplementary Figure 13. Factsheet comparing the probabilistic projections of solar PV and onshore wind power between the scenarios of current, stronger, and weaker policies for Belgium. Geographical data to visualize country boundaries comes from references[1–3]. Related to Figures 4-5.

BOSNIA AND HERZEGOVINA

A. Probabilistic projections for solar PV and onshore wind power in Bosnia and Herzegovina for 2024 – 2040 in scenarios of current, stronger, and weaker policies that affect profitability, technology phase-outs and targets on greenhouse gas emissions and renewable energy shares. The probabilistic density intervals show the probability that a capacity level will be reached or exceeded. The color gradient describes the quantiles of the projected capacities: the darker the color, the closer is the capacity to the median. The black dots show historical capacities. The red dot in 2040 marks the projected median capacity and the red line the level under current policies. Training data ranges from the years 2000 – 2023.

B. Maps showing the difference between the projected median capacities in the scenarios for all investigated countries in 2040. A positive difference shows that a capacity of the stronger policies scenario is greater than the corresponding capacity of the current policies scenario. Countries in grey have no projections. Δ is the mean absolute difference of all countries.



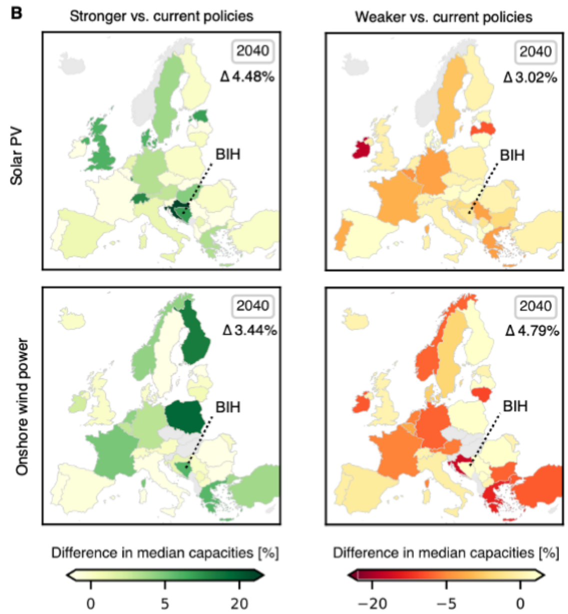
SUMMARY

For solar photovoltaics (PV), the projected median capacity grows to around 1.4 GW by 2040. An increase in policy efforts that affect profitability, technology phase-outs, and national targets on greenhouse gas emissions and renewable energy shares leads to a considerable increase in projected capacity compared to policy efforts as of 2024 (+11%). Weaker policy efforts show no considerable effect on the projected capacity.

For onshore wind power, the projected median capacity grows to around 0.5 GW by 2040. A change in policy efforts considerably increases the projected capacity.

Bosnia and Herzegovina (BIH) show higher sensitivity of projected capacities to policies than most other European countries.

Note: The impact of policies depends both on the policy design of the scenarios and the projection models used. Conclusions must only be drawn under consideration of the overall study design.

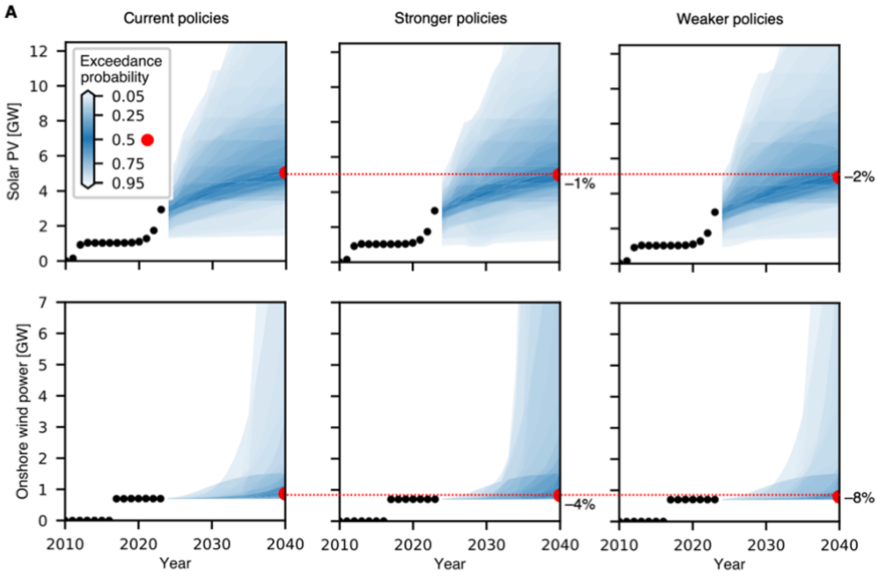


Supplementary Figure 14. Factsheet comparing the probabilistic projections of solar PV and onshore wind power between the scenarios of current, stronger, and weaker policies for Bosnia and Herzegovina. Geographical data to visualize country boundaries comes from references[1–3]. Related to Figures 4-5.

BULGARIA

A. Probabilistic projections for solar PV and onshore wind power in Bulgaria for 2024 – 2040 in scenarios of current, stronger, and weaker policies that affect profitability, technology phase-outs and targets on greenhouse gas emissions and renewable energy shares. The probabilistic density intervals show the probability that a capacity level will be reached or exceeded. The color gradient describes the quantiles of the projected capacities: the darker the color, the closer is the capacity to the median. The black dots show historical capacities. The red dot in 2040 marks the projected median capacity and the red line the level under current policies. Training data ranges from the years 2000 – 2023.

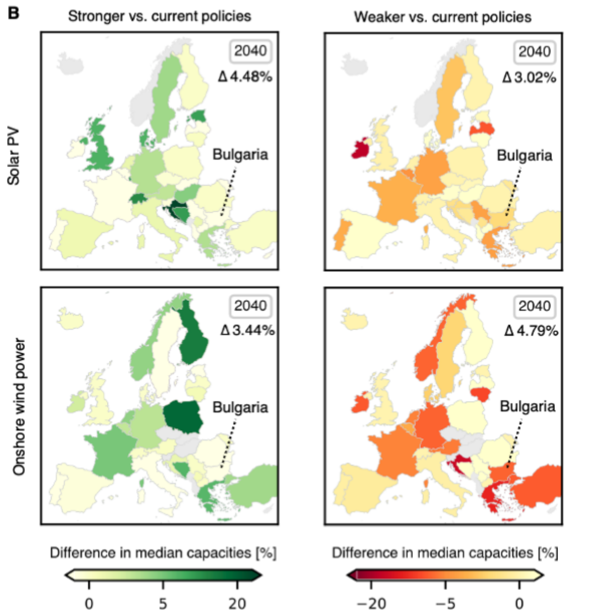
B. Maps showing the difference between the projected median capacities in the scenarios for all investigated countries in 2040. A positive difference shows that a capacity of the stronger policies scenario is greater than the corresponding capacity of the current policies scenario. Countries in grey have no projections. Δ is the mean absolute difference of all countries.



SUMMARY

For solar photovoltaics (PV), the projected median capacity grows to around 5 GW by 2040. A change in policy efforts that affect profitability, technology phase-outs, and national targets on greenhouse gas emissions and renewable energy shares shows no considerable effect on the projected capacity compared to policy efforts as of 2024.

For onshore wind power, the projected median capacity stays at around 0.9 GW by 2040 as there were almost no changes in capacity in previous years. Therefore, comparisons of policy efforts have limited meaning.



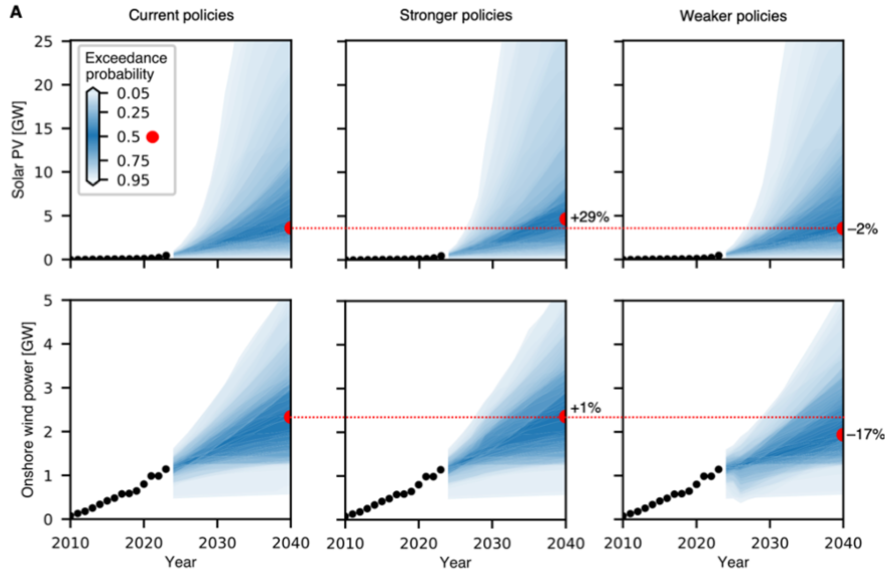
***Note:** The impact of policies depends both on the policy design of the scenarios and the projection models used. Conclusions must only be drawn under consideration of the overall study design.*

Supplementary Figure 15. Factsheet comparing the probabilistic projections of solar PV and onshore wind power between the scenarios of current, stronger, and weaker policies for Bulgaria. Geographical data to visualize country boundaries comes from references[1–3]. Related to Figures 4-5.

CROATIA

A. Probabilistic projections for solar PV and onshore wind power in Croatia for 2024 – 2040 in scenarios of current, stronger, and weaker policies that affect profitability, technology phase-outs and targets on greenhouse gas emissions and renewable energy shares. The probabilistic density intervals show the probability that a capacity level will be reached or exceeded. The color gradient describes the quantiles of the projected capacities: the darker the color, the closer is the capacity to the median. The black dots show historical capacities. The red dot in 2040 marks the projected median capacity and the red line the level under current policies. Training data ranges from the years 2000 – 2023.

B. Maps showing the difference between the projected median capacities in the scenarios for all investigated countries in 2040. A positive difference shows that a capacity of the stronger policies scenario is greater than the corresponding capacity of the current policies scenario. Countries in grey have no projections. Δ is the mean absolute difference of all countries.

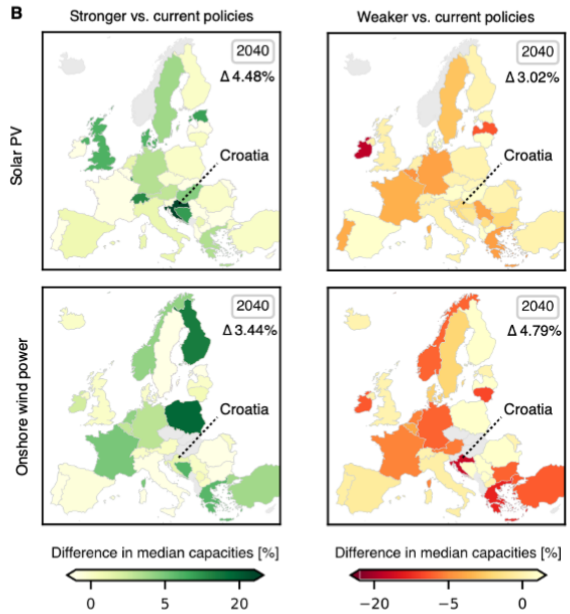


SUMMARY

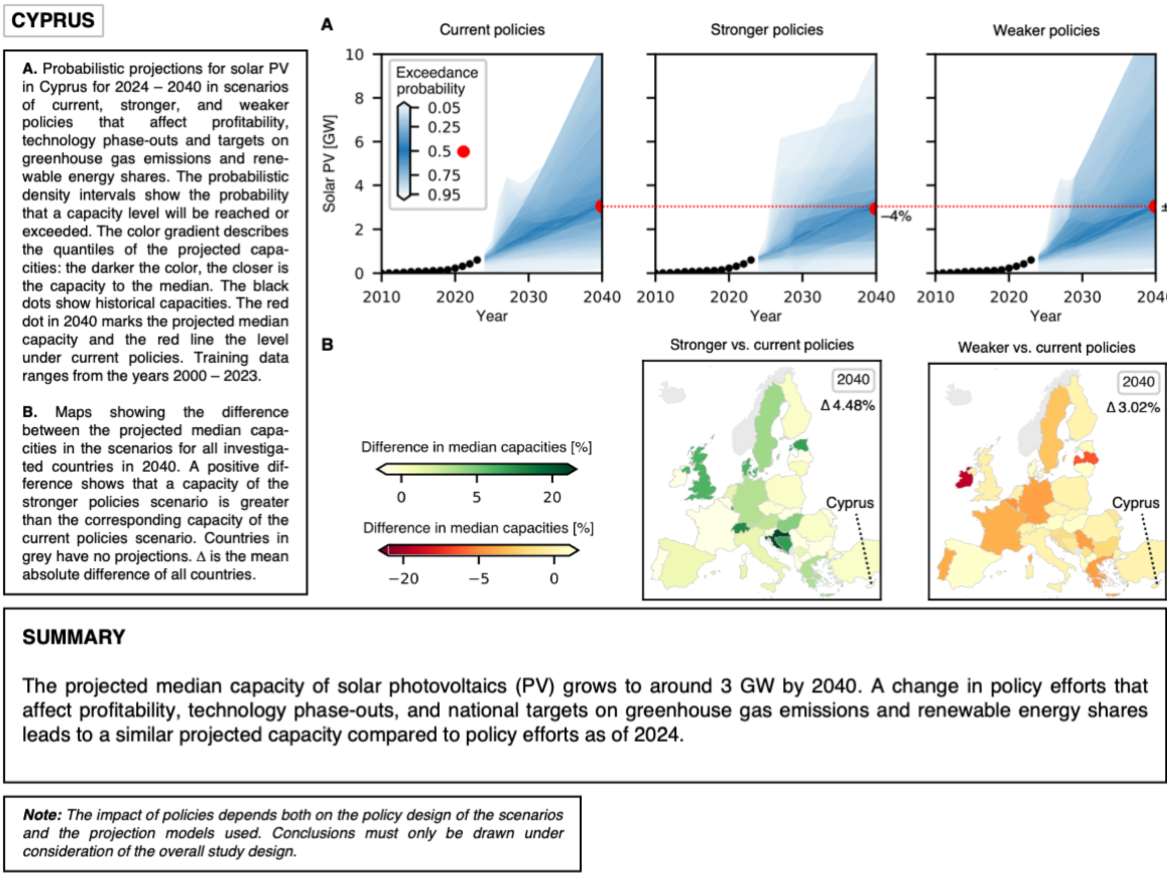
For solar photovoltaics (PV), the projected median capacity grows to around 4 GW by 2040. A change in policy efforts that affect profitability, technology phase-outs, and national targets on greenhouse gas emissions and renewable energy shares show a strong increase in the projected capacity compared to policy efforts as of 2024 (+29%). Weaker policy efforts show no considerable effect on the projected capacity. For onshore wind power, the projected median capacity grows to around 2 GW by 2040. An increase in policy efforts leads to a similar projected capacity (+3%). In contrast, weaker policy efforts considerably decrease the projected capacity (-17%).

Across all European countries, Croatia shows highest sensitivity of projected solar PV capacity to stronger policies and of onshore wind power to weaker policies.

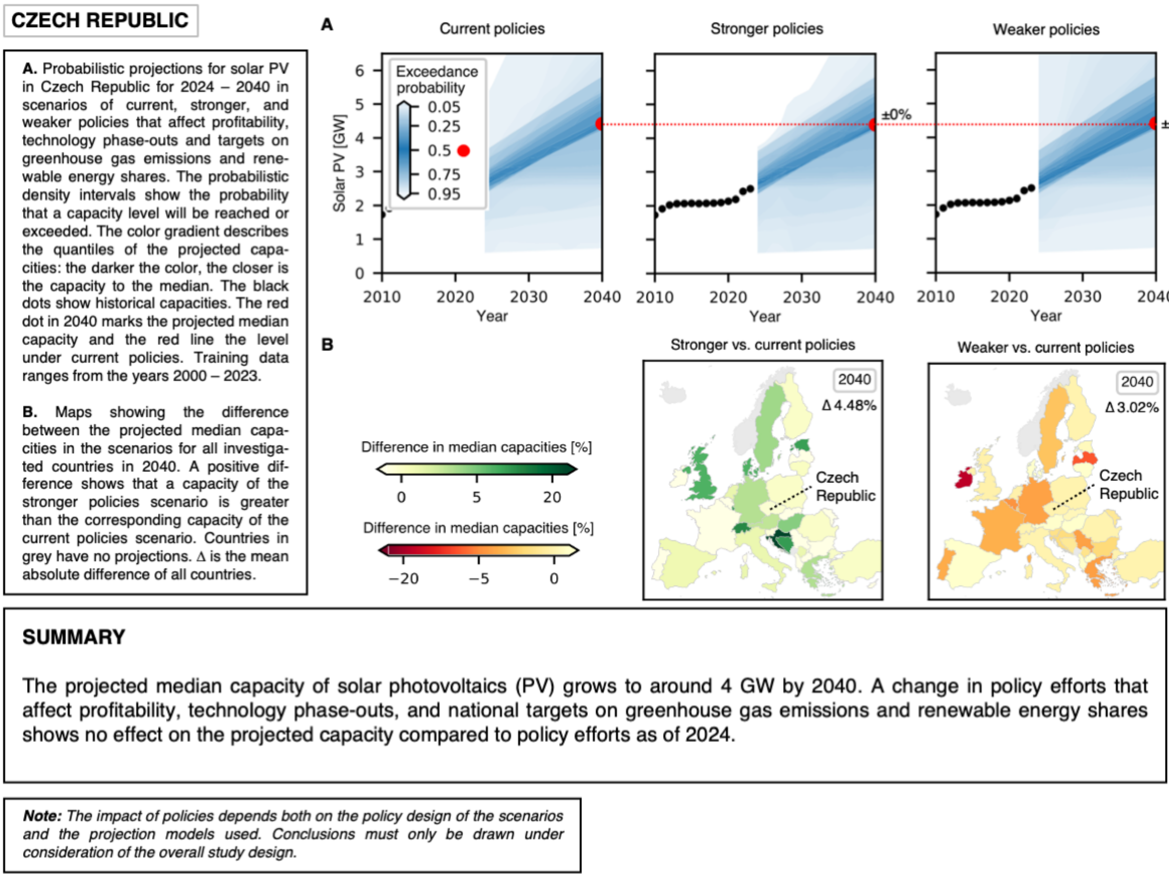
Note: *The impact of policies depends both on the policy design of the scenarios and the projection models used. Conclusions must only be drawn under consideration of the overall study design.*



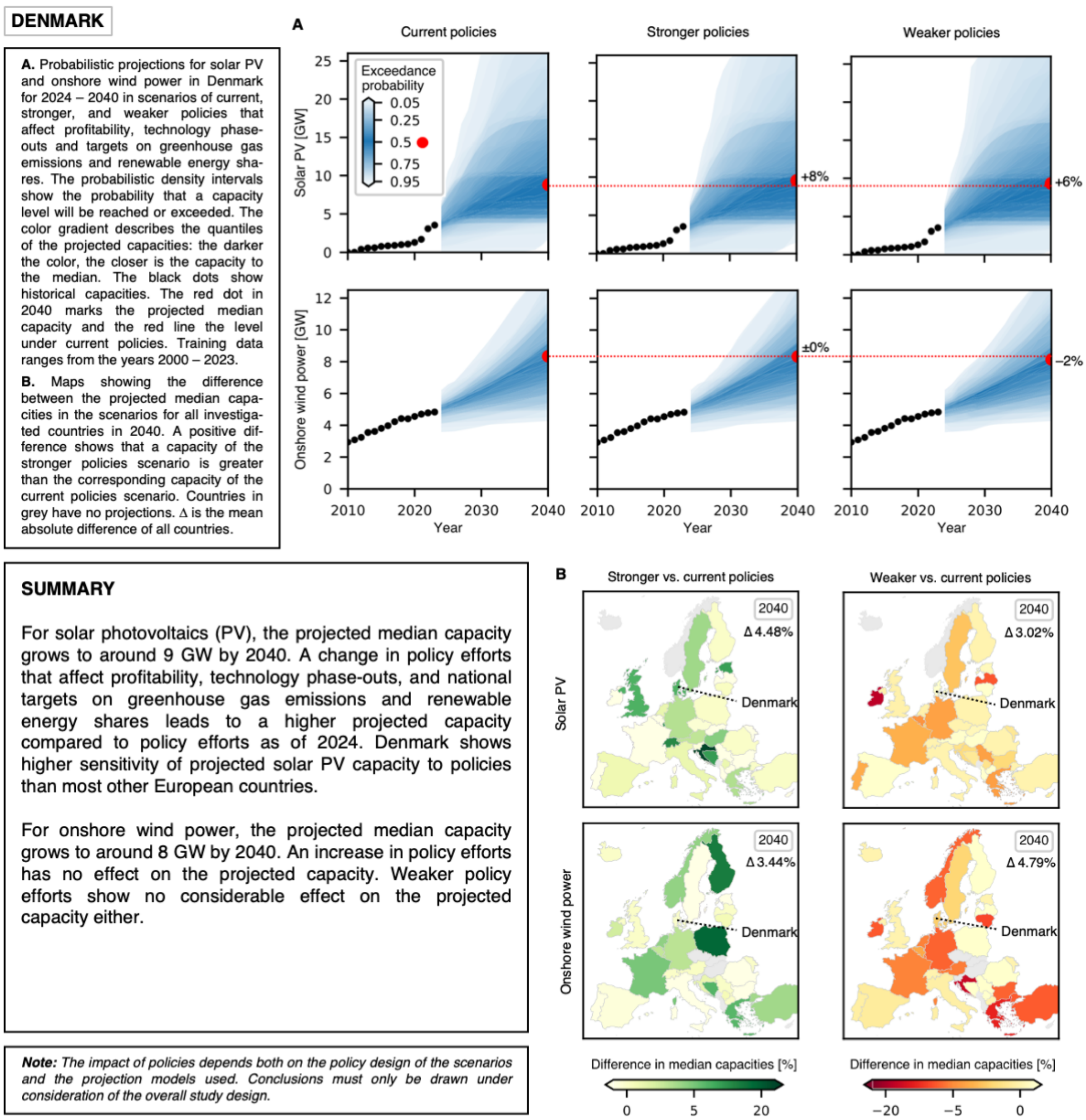
Supplementary Figure 16. Factsheet comparing the probabilistic projections of solar PV and onshore wind power between the scenarios of current, stronger, and weaker policies for Croatia. Geographical data to visualize country boundaries comes from references[1–3]. Related to Figures 4-5.



Supplementary Figure 17. Factsheet comparing the probabilistic projections of solar PV between the scenarios of current, stronger, and weaker policies for Cyprus. Geographical data to visualize country boundaries comes from references[1–3]. Related to Figures 4-5.



Supplementary Figure 18. Factsheet comparing the probabilistic projections of solar PV between the scenarios of current, stronger, and weaker policies for Czech Republic. Geographical data to visualize country boundaries comes from references[1–3]. Related to Figures 4-5.

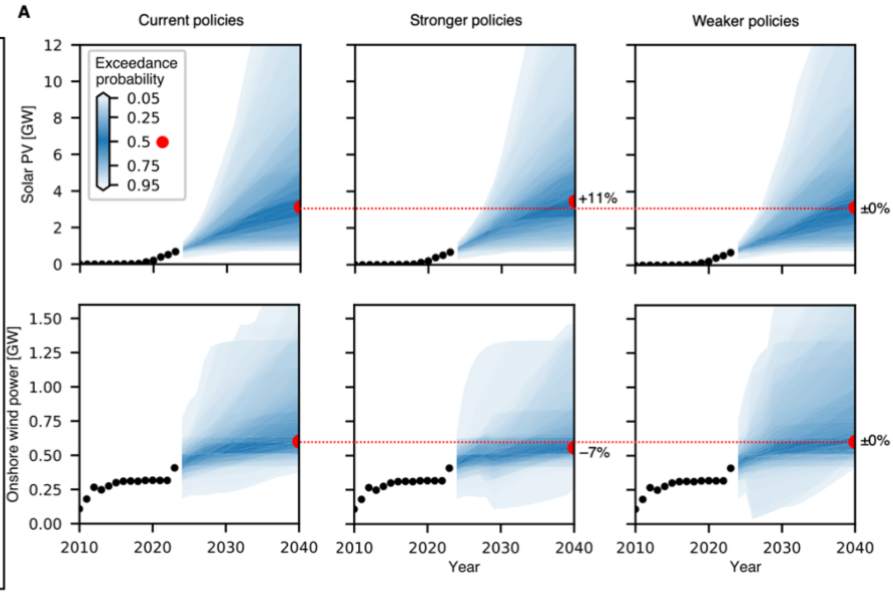


Supplementary Figure 19. Factsheet comparing the probabilistic projections of solar PV and onshore wind power between the scenarios of current, stronger, and weaker policies for Denmark. Geographical data to visualize country boundaries comes from references[1–3]. Related to Figures 4-5.

ESTONIA

A. Probabilistic projections for solar PV and onshore wind power in Estonia for 2024 – 2040 in scenarios of current, stronger, and weaker policies that affect profitability, technology phase-outs and targets on greenhouse gas emissions and renewable energy shares. The probabilistic density intervals show the probability that a capacity level will be reached or exceeded. The color gradient describes the quantiles of the projected capacities: the darker the color, the closer is the capacity to the median. The black dots show historical capacities. The red dot in 2040 marks the projected median capacity and the red line the level under current policies. Training data ranges from the years 2000 – 2023.

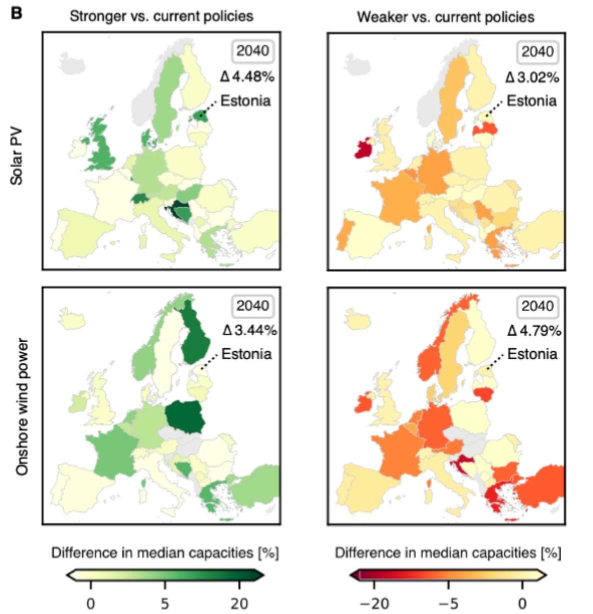
B. Maps showing the difference between the projected median capacities in the scenarios for all investigated countries in 2040. A positive difference shows that a capacity of the stronger policies scenario is greater than the corresponding capacity of the current policies scenario. Countries in grey have no projections. Δ is the mean absolute difference of all countries.



SUMMARY

For solar photovoltaics (PV), the projected median capacity grows to around 3 GW by 2040. An increase in policy efforts that affect profitability, technology phase-outs, and national targets on greenhouse gas emissions and renewable energy shares show a considerable increase in the projected capacity compared to policy efforts as of 2024 (+11%). Estonia shows higher sensitivity of projected solar PV capacity to stronger policies than most other European countries. In contrast, weaker policy efforts show no effect on the projected capacity.

For onshore wind power, the projected median capacity grows to around 0.6 GW by 2040. An increase in policy efforts has no positive effect on the projected capacity. Weaker policy efforts show no effect on the projected capacity.



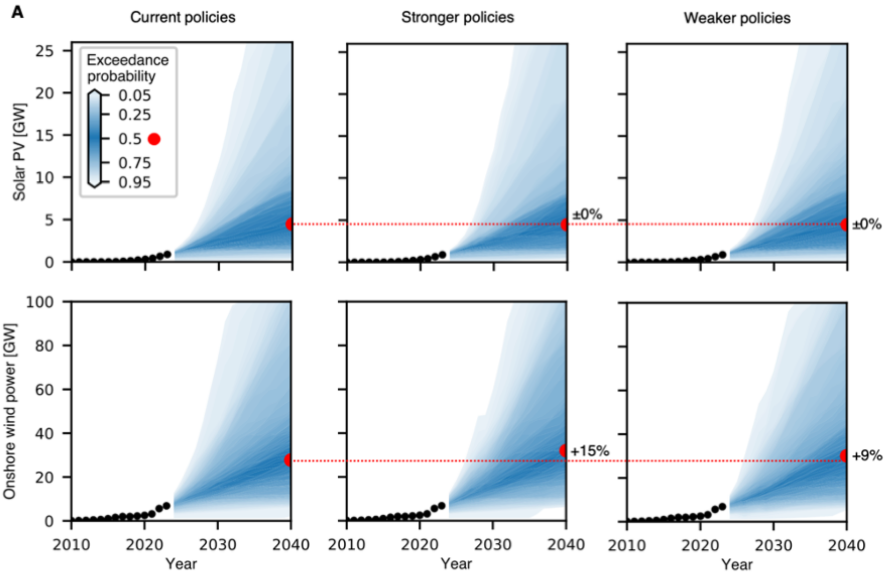
Note: *The impact of policies depends both on the policy design of the scenarios and the projection models used. Conclusions must only be drawn under consideration of the overall study design.*

Supplementary Figure 20. Factsheet comparing the probabilistic projections of solar PV and onshore wind power between the scenarios of current, stronger, and weaker policies for Estonia. Geographical data to visualize country boundaries comes from references[1–3]. Related to Figures 4-5.

FINLAND

A. Probabilistic projections for solar PV and onshore wind power in Finland for 2024 – 2040 in scenarios of current, stronger, and weaker policies that affect profitability, technology phase-outs and targets on greenhouse gas emissions and renewable energy shares. The probabilistic density intervals show the probability that a capacity level will be reached or exceeded. The color gradient describes the quantiles of the projected capacities: the darker the color, the closer is the capacity to the median. The black dots show historical capacities. The red dot in 2040 marks the projected median capacity and the red line the level under current policies. Training data ranges from the years 2000 – 2023.

B. Maps showing the difference between the projected median capacities in the scenarios for all investigated countries in 2040. A positive difference shows that a capacity of the stronger policies scenario is greater than the corresponding capacity of the current policies scenario. Countries in grey have no projections. Δ is the mean absolute difference of all countries.

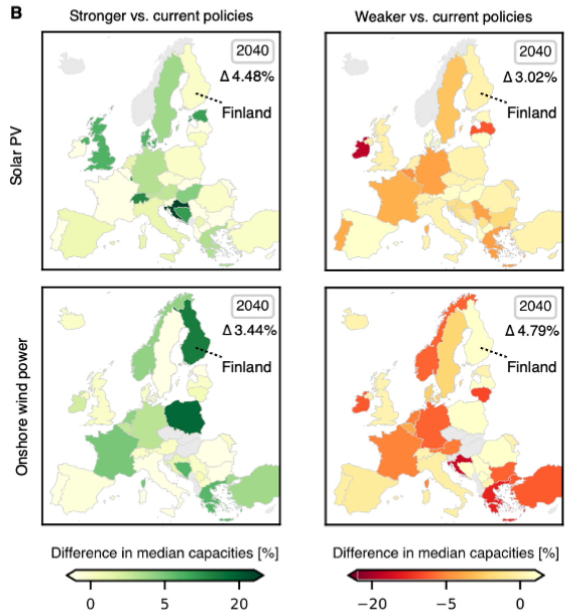


SUMMARY

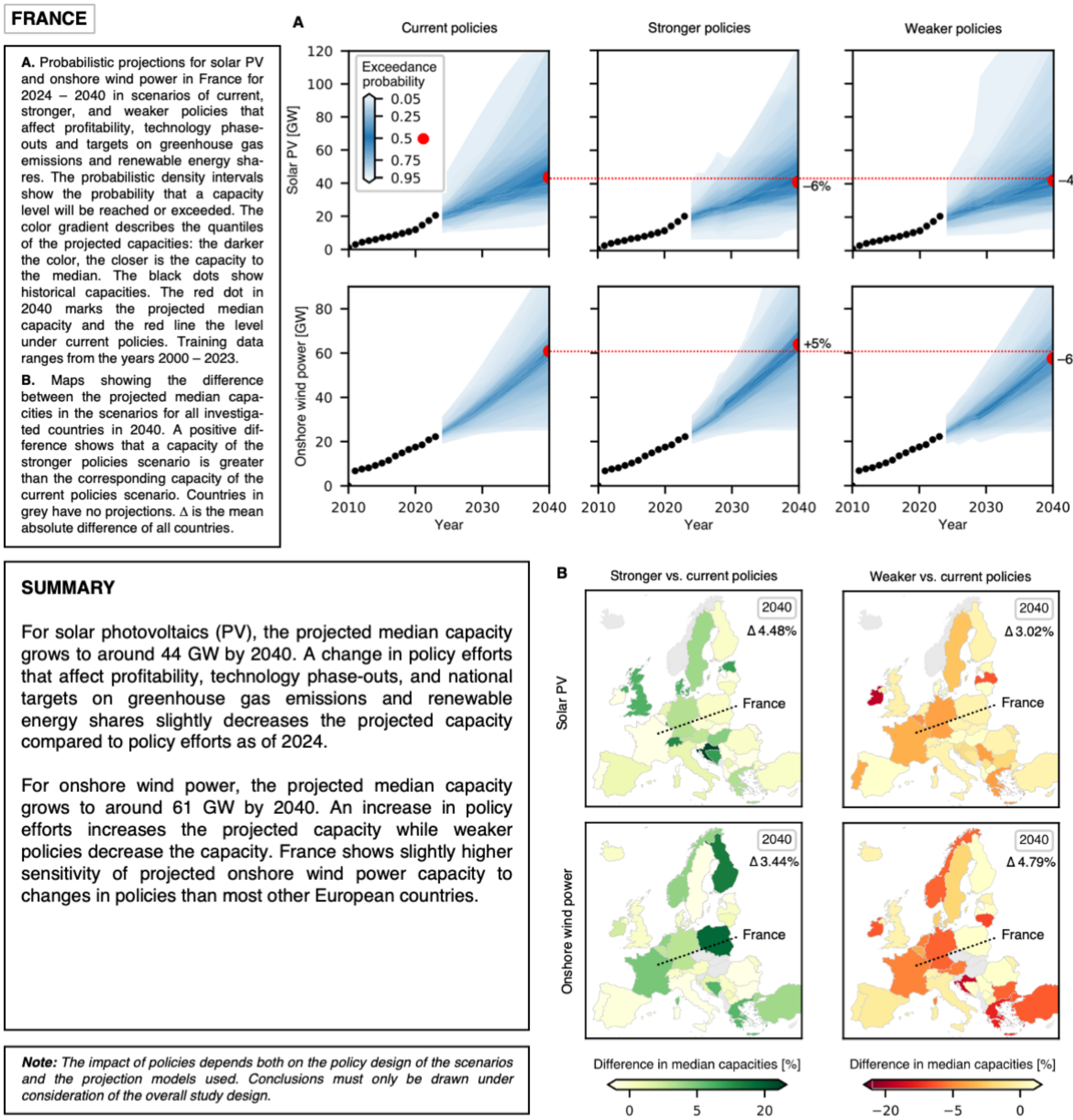
For solar photovoltaics (PV), the projected median capacity grows to around 4 GW by 2040. A change in policy efforts that affect profitability, technology phase-outs, and national targets on greenhouse gas emissions and renewable energy shares shows no effect on the projected capacity compared to policy efforts as of 2024.

For onshore wind power, the projected median capacity grows to around 28 GW by 2040. A change in policy efforts considerably increases the projected capacity. Finland shows higher sensitivity of projected onshore wind power capacity to changes in policies than most other European countries.

Note: The impact of policies depends both on the policy design of the scenarios and the projection models used. Conclusions must only be drawn under consideration of the overall study design.



Supplementary Figure 21. Factsheet comparing the probabilistic projections of solar PV and onshore wind power between the scenarios of current, stronger, and weaker policies for Finland. Geographical data to visualize country boundaries comes from references[1–3]. Related to Figures 4-5.

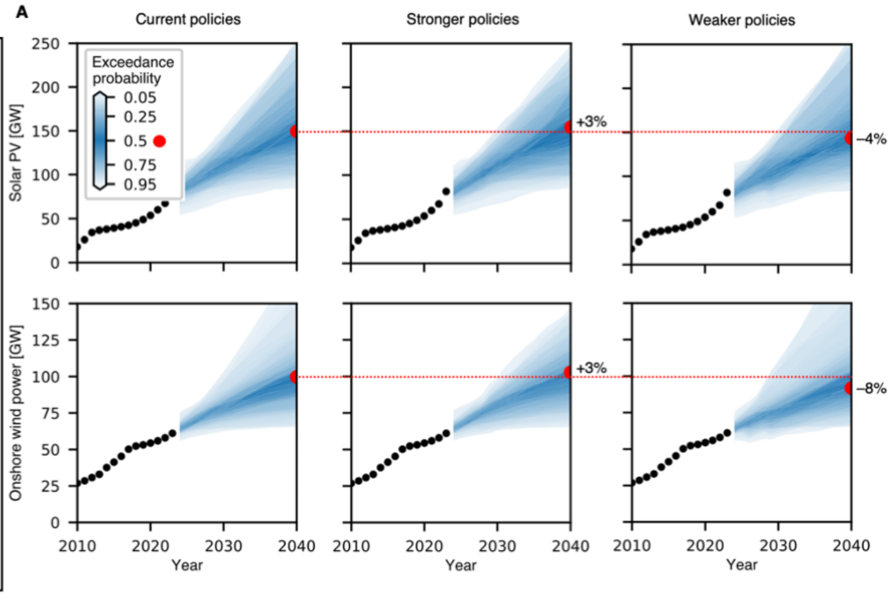


Supplementary Figure 22. Factsheet comparing the probabilistic projections of solar PV and onshore wind power between the scenarios of current, stronger, and weaker policies for France. Geographical data to visualize country boundaries comes from references[1–3]. Related to Figures 4-5.

GERMANY

A. Probabilistic projections for solar PV and onshore wind power in Germany for 2024 – 2040 in scenarios of current, stronger, and weaker policies that affect profitability, technology phase-outs and targets on greenhouse gas emissions and renewable energy shares. The probabilistic density intervals show the probability that a capacity level will be reached or exceeded. The color gradient describes the quantiles of the projected capacities: the darker the color, the closer is the capacity to the median. The black dots show historical capacities. The red dot in 2040 marks the projected median capacity and the red line the level under current policies. Training data ranges from the years 2000 – 2023.

B. Maps showing the difference between the projected median capacities in the scenarios for all investigated countries in 2040. A positive difference shows that a capacity of the stronger policies scenario is greater than the corresponding capacity of the current policies scenario. Countries in grey have no projections. Δ is the mean absolute difference of all countries.

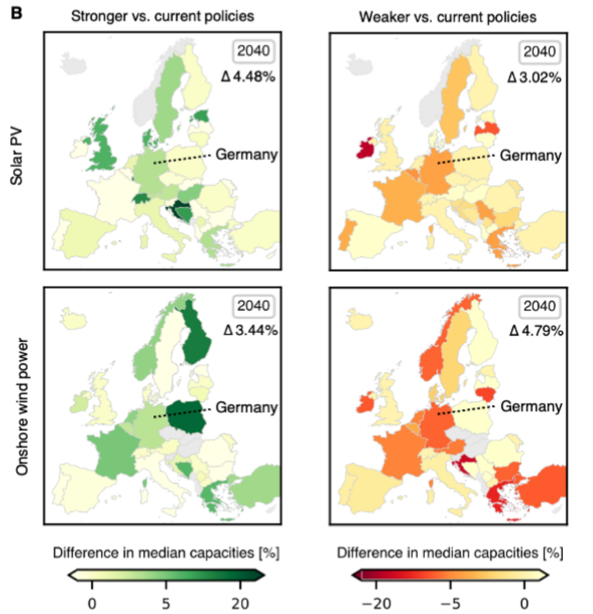


SUMMARY

For solar photovoltaics (PV), the projected median capacity grows to around 150 GW by 2040. An increase in policy efforts that affect profitability, technology phase-outs, and national targets on greenhouse gas emissions and renewable energy shares leads to a similar projected capacity compared to policy efforts as of 2024. Weaker policies slightly decrease the capacity.

For onshore wind power, the projected median capacity grows to around 100 GW by 2040. An increase in policy efforts leads to a similar level of the projected capacity while weaker policies decrease the capacity (-8%).

Germany shows higher sensitivity of projected capacities to weaker policies than most other European countries.



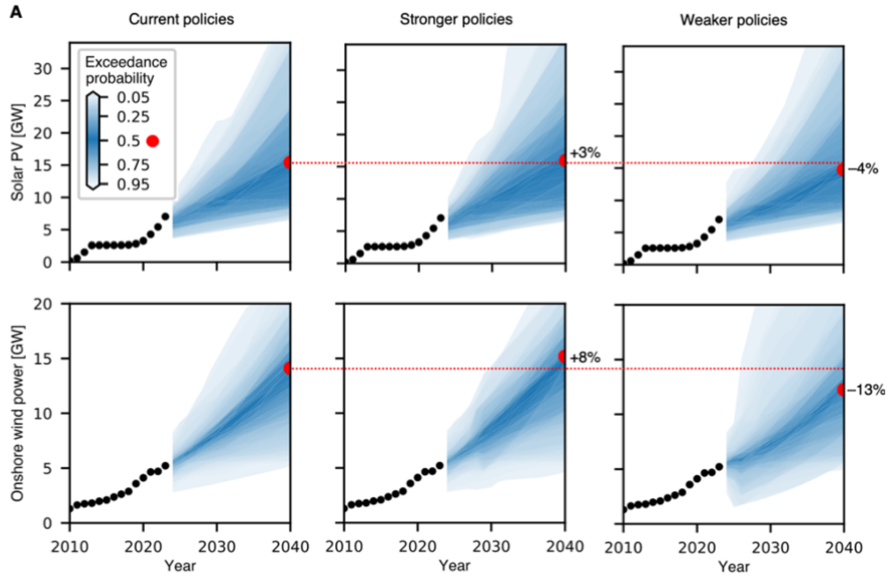
Note: *The impact of policies depends both on the policy design of the scenarios and the projection models used. Conclusions must only be drawn under consideration of the overall study design.*

Supplementary Figure 23. Factsheet comparing the probabilistic projections of solar PV and onshore wind power between the scenarios of current, stronger, and weaker policies for Germany. Geographical data to visualize country boundaries comes from references[1–3]. Related to Figures 4-5.

GREECE

A. Probabilistic projections for solar PV and onshore wind power in Greece for 2024 – 2040 in scenarios of current, stronger, and weaker policies that affect profitability, technology phase-outs and targets on greenhouse gas emissions and renewable energy shares. The probabilistic density intervals show the probability that a capacity level will be reached or exceeded. The color gradient describes the quantiles of the projected capacities: the darker the color, the closer is the capacity to the median. The black dots show historical capacities. The red dot in 2040 marks the projected median capacity and the red line the level under current policies. Training data ranges from the years 2000 – 2023.

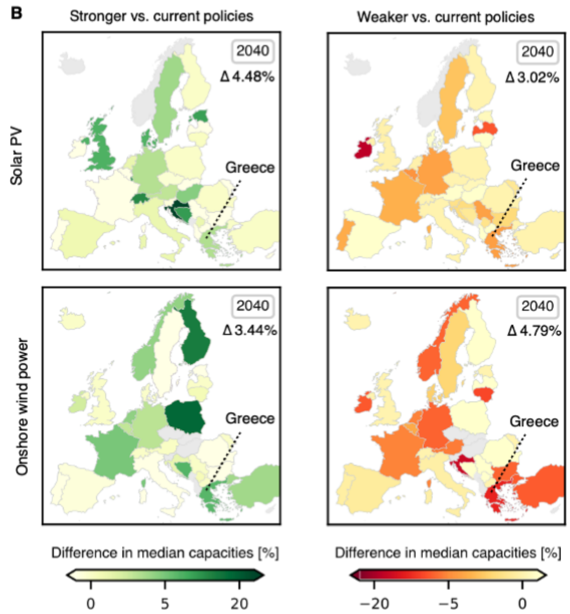
B. Maps showing the difference between the projected median capacities in the scenarios for all investigated countries in 2040. A positive difference shows that a capacity of the stronger policies scenario is greater than the corresponding capacity of the current policies scenario. Countries in grey have no projections. Δ is the mean absolute difference of all countries.



SUMMARY

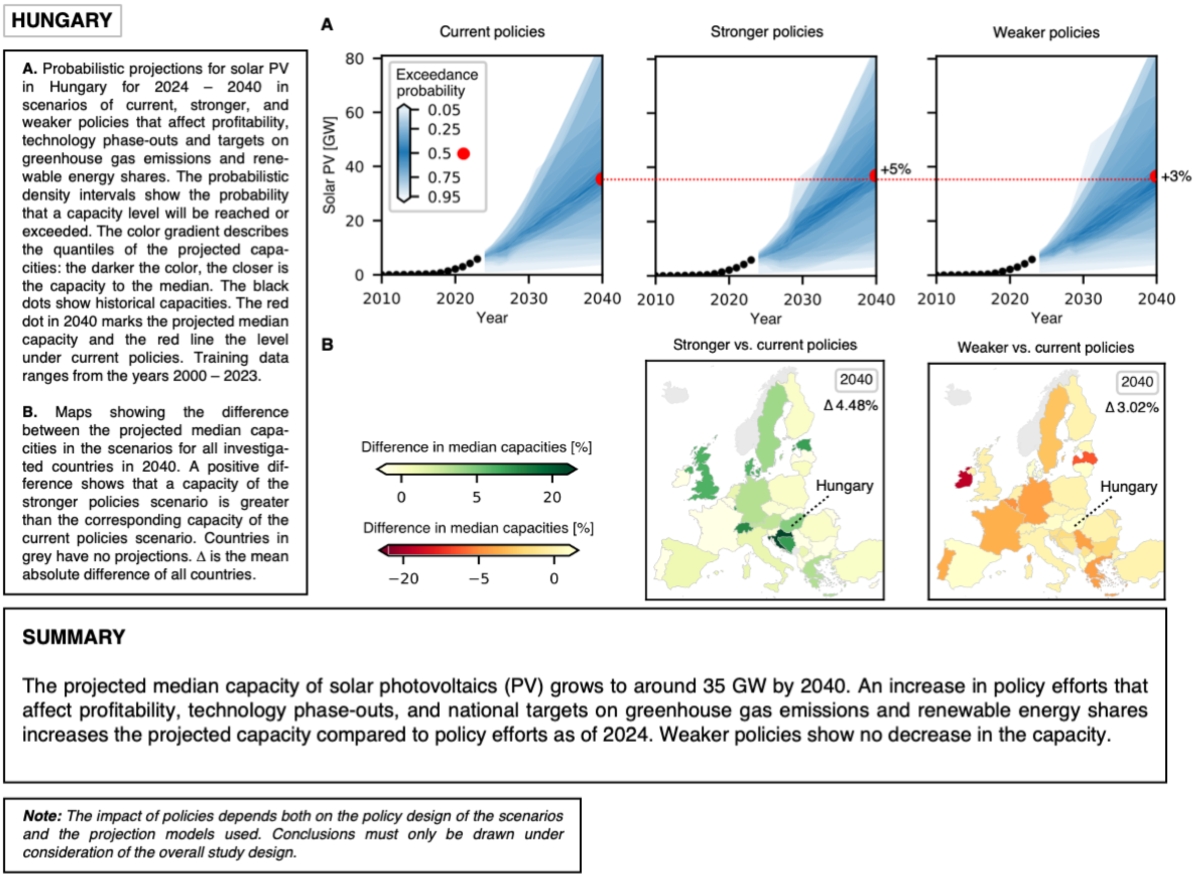
For solar photovoltaics (PV), the projected median capacity grows to around 15 GW by 2040. An increase in policy efforts that affect profitability, technology phase-outs, and national targets on greenhouse gas emissions and renewable energy shares leads to a similar projected capacity compared to policy efforts as of 2024. Weaker policies slightly decrease the capacity.

For onshore wind power, the projected median capacity grows to around 14 GW by 2040. An increase in policy efforts considerably increases the projected capacity (+8%) while weaker policies considerably decrease the capacity (-13%). Greece shows higher sensitivity of projected onshore wind power capacity to changes in policies than most other European countries.

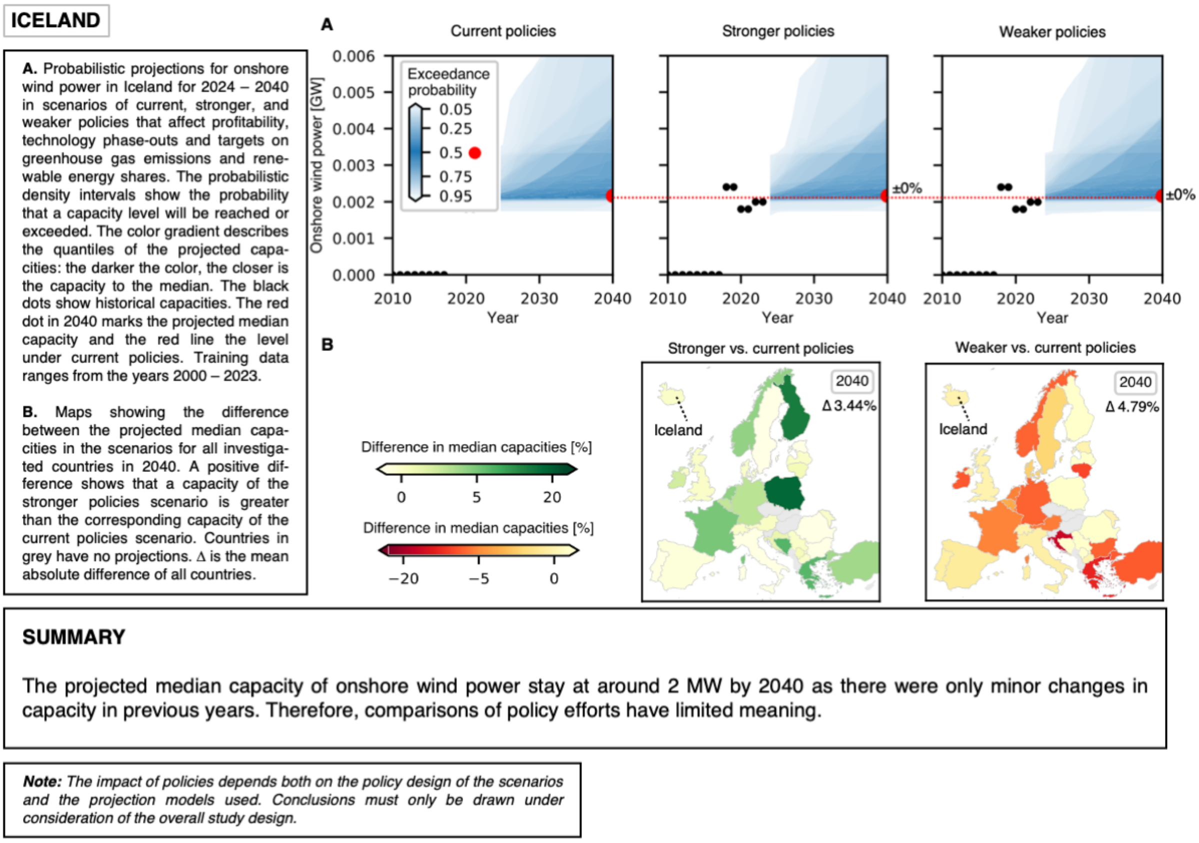


Note: *The impact of policies depends both on the policy design of the scenarios and the projection models used. Conclusions must only be drawn under consideration of the overall study design.*

Supplementary Figure 24. Factsheet comparing the probabilistic projections of solar PV and onshore wind power between the scenarios of current, stronger, and weaker policies for Greece. Geographical data to visualize country boundaries comes from references[1–3]. Related to Figures 4-5.



Supplementary Figure 25. Factsheet comparing the probabilistic projections of solar PV between the scenarios of current, stronger, and weaker policies for Hungary. Geographical data to visualize country boundaries comes from references[1–3]. Related to Figures 4-5.

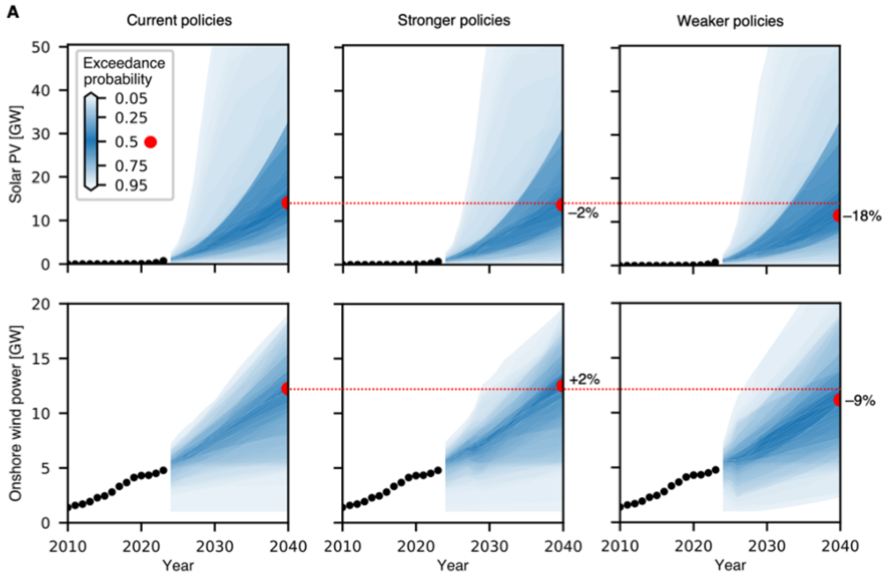


Supplementary Figure 26. Factsheet comparing the probabilistic projections of onshore wind power between the scenarios of current, stronger, and weaker policies for Iceland. Geographical data to visualize country boundaries comes from references[1–3]. Related to Figures 4-5.

IRELAND

A. Probabilistic projections for solar PV and onshore wind power in Ireland for 2024 – 2040 in scenarios of current, stronger, and weaker policies that affect profitability, technology phase-outs and targets on greenhouse gas emissions and renewable energy shares. The probabilistic density intervals show the probability that a capacity level will be reached or exceeded. The color gradient describes the quantiles of the projected capacities: the darker the color, the closer is the capacity to the median. The black dots show historical capacities. The red dot in 2040 marks the projected median capacity and the red line the level under current policies. Training data ranges from the years 2000 – 2023.

B. Maps showing the difference between the projected median capacities in the scenarios for all investigated countries in 2040. A positive difference shows that a capacity of the stronger policies scenario is greater than the corresponding capacity of the current policies scenario. Countries in grey have no projections. Δ is the mean absolute difference of all countries.

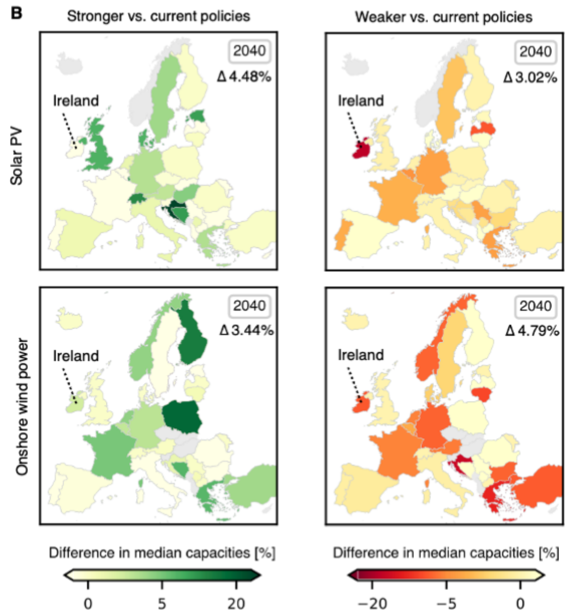


SUMMARY

For solar photovoltaics (PV), the projected median capacity grows to around 14 GW by 2040. An increase in policy efforts that affect profitability, technology phase-outs, and national targets on greenhouse gas emissions and renewable energy shares shows no considerable effect on the projected capacity compared to policy efforts as of 2024. In contrast, weaker policies considerably decrease the capacity (-18%).

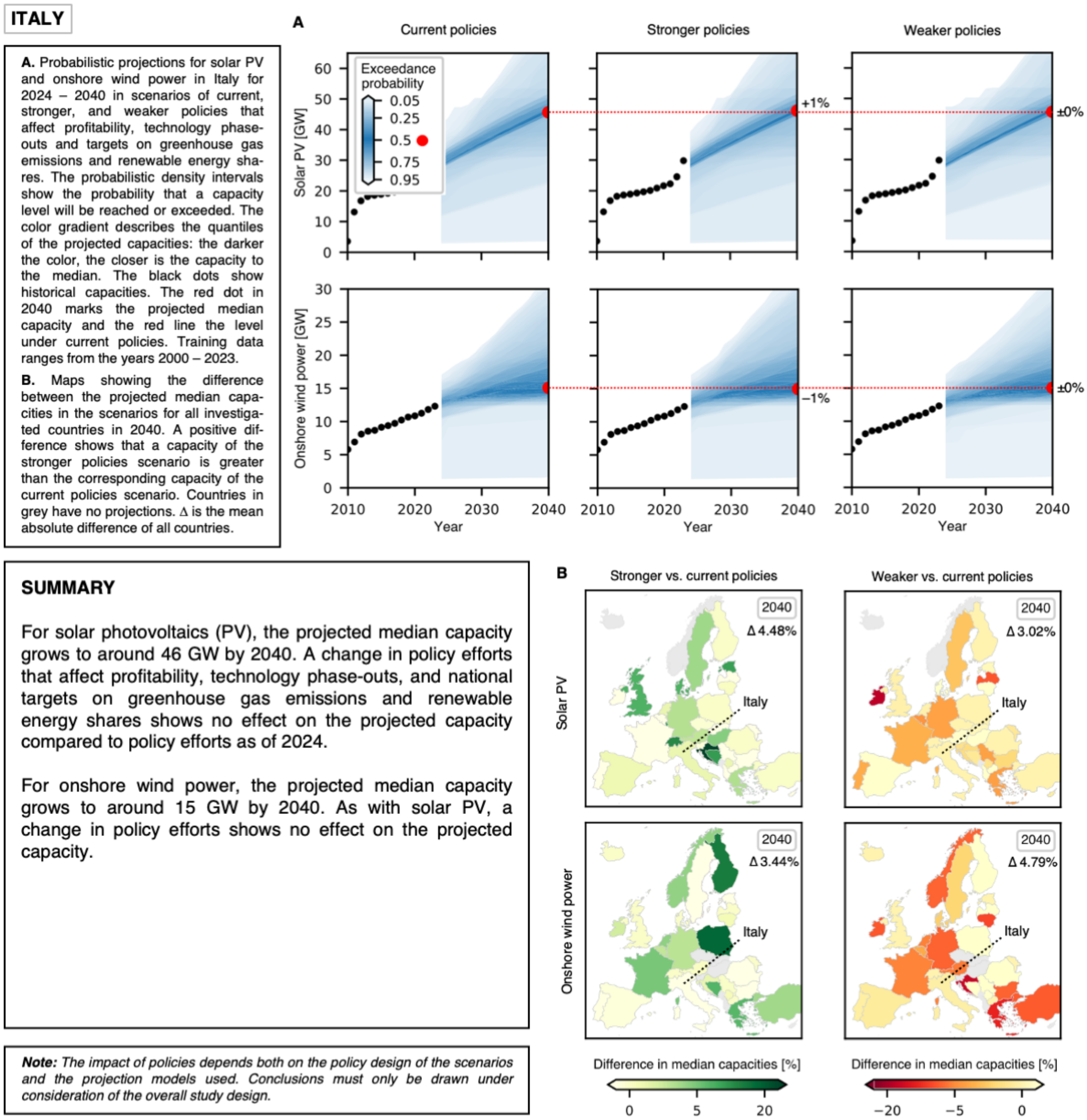
For onshore wind power, the projected median capacity grows to around 12 GW by 2040. An increase in policy efforts leads to a similar projected capacity while weaker policies considerably decrease the capacity (-9%).

Ireland shows higher sensitivity of projected capacities to weaker policies than most other European countries.



***Note:** The impact of policies depends both on the policy design of the scenarios and the projection models used. Conclusions must only be drawn under consideration of the overall study design.*

Supplementary Figure 27. Factsheet comparing the probabilistic projections of solar PV and onshore wind power between the scenarios of current, stronger, and weaker policies for Ireland. Geographical data to visualize country boundaries comes from references[1–3]. Related to Figures 4-5.

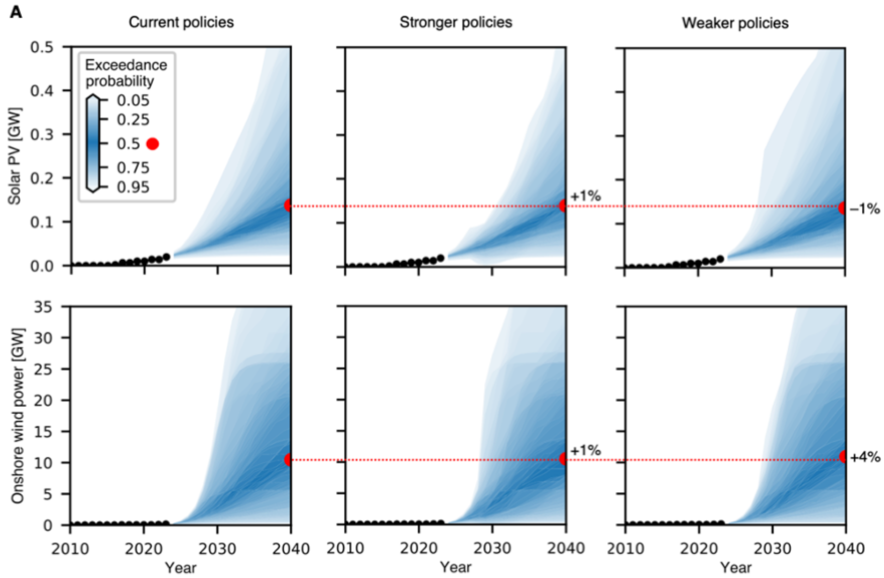


Supplementary Figure 28. Factsheet comparing the probabilistic projections of solar PV and onshore wind power between the scenarios of current, stronger, and weaker policies for Italy. Geographical data to visualize country boundaries comes from references[1–3]. Related to Figures 4-5.

KOSOVO

A. Probabilistic projections for solar PV and onshore wind power in Kosovo for 2024 – 2040 in scenarios of current, stronger, and weaker policies that affect profitability, technology phase-outs and targets on greenhouse gas emissions and renewable energy shares. The probabilistic density intervals show the probability that a capacity level will be reached or exceeded. The color gradient describes the quantiles of the projected capacities: the darker the color, the closer is the capacity to the median. The black dots show historical capacities. The red dot in 2040 marks the projected median capacity and the red line the level under current policies. Training data ranges from the years 2000 – 2023.

B. Maps showing the difference between the projected median capacities in the scenarios for all investigated countries in 2040. A positive difference shows that a capacity of the stronger policies scenario is greater than the corresponding capacity of the current policies scenario. Countries in grey have no projections. Δ is the mean absolute difference of all countries.

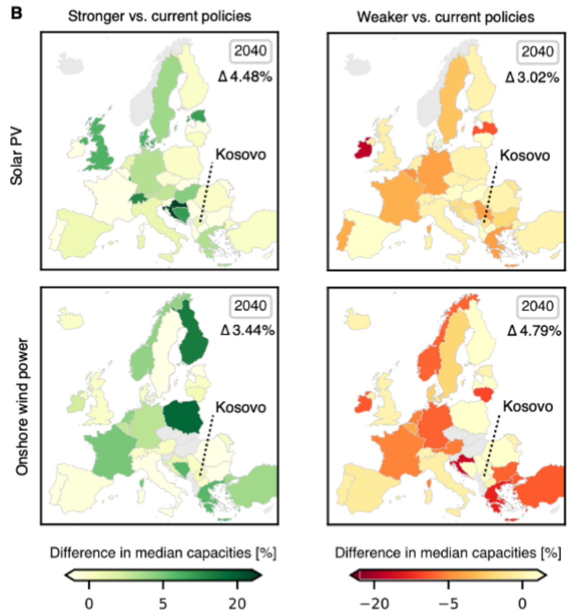


SUMMARY

For solar photovoltaics (PV), the projected median capacity grows to around 140 MW by 2040. A change in policy efforts that affect profitability, technology phase-outs, and national targets on greenhouse gas emissions and renewable energy shares shows no considerable effect on the projected capacity compared to policy efforts as of 2024.

For onshore wind power, the projected median capacity grows to around 10 GW by 2040. An increase in policy efforts shows no considerable effect on the projected capacity. Weaker policies show no negative effect on the capacity.

Note: The impact of policies depends both on the policy design of the scenarios and the projection models used. Conclusions must only be drawn under consideration of the overall study design.

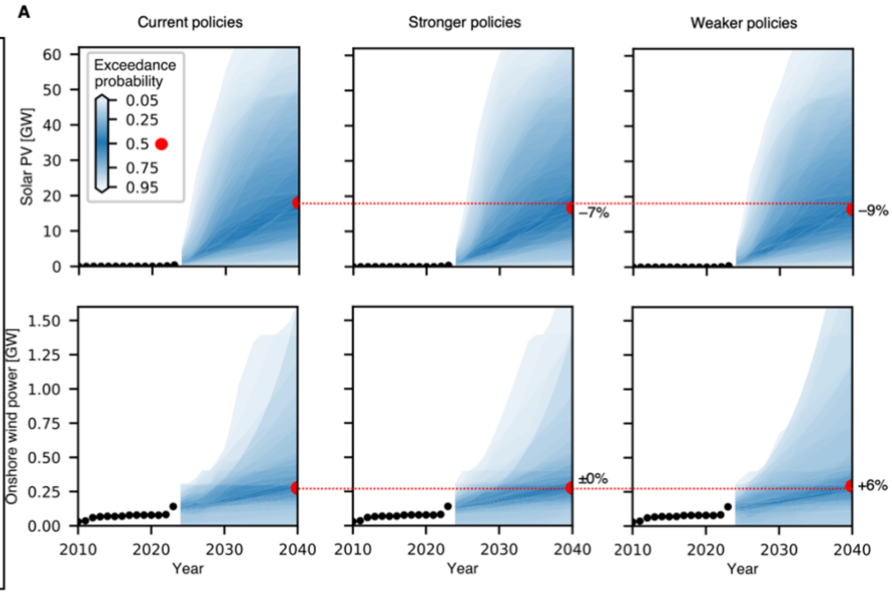


Supplementary Figure 29. Factsheet comparing the probabilistic projections of solar PV and onshore wind power between the scenarios of current, stronger, and weaker policies for Kosovo. Geographical data to visualize country boundaries comes from references[1–3]. Related to Figures 4-5.

LATVIA

A. Probabilistic projections for solar PV and onshore wind power in Latvia for 2024 – 2040 in scenarios of current, stronger, and weaker policies that affect profitability, technology phase-outs and targets on greenhouse gas emissions and renewable energy shares. The probabilistic density intervals show the probability that a capacity level will be reached or exceeded. The color gradient describes the quantiles of the projected capacities: the darker the color, the closer is the capacity to the median. The black dots show historical capacities. The red dot in 2040 marks the projected median capacity and the red line the level under current policies. Training data ranges from the years 2000 – 2023.

B. Maps showing the difference between the projected median capacities in the scenarios for all investigated countries in 2040. A positive difference shows that a capacity of the stronger policies scenario is greater than the corresponding capacity of the current policies scenario. Countries in grey have no projections. Δ is the mean absolute difference of all countries.

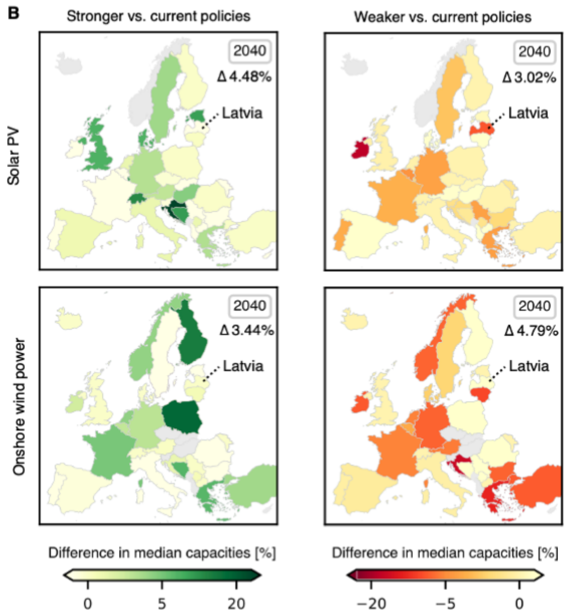


SUMMARY

For solar photovoltaics (PV), the projected median capacity grows to around 18 GW by 2040. A change in policy efforts that affect profitability, technology phase-outs, and national targets on greenhouse gas emissions and renewable energy shares shows negative effect on the projected capacity compared to policy efforts as of 2024. Latvia shows higher sensitivity of the projected solar PV capacity to policies than most other European countries.

For onshore wind power, the projected median capacity grows to around 0.3 GW by 2040. An increase in policy efforts shows no effect on the projected capacity. Weaker policies show no negative effect on the capacity.

Note: *The impact of policies depends both on the policy design of the scenarios and the projection models used. Conclusions must only be drawn under consideration of the overall study design.*

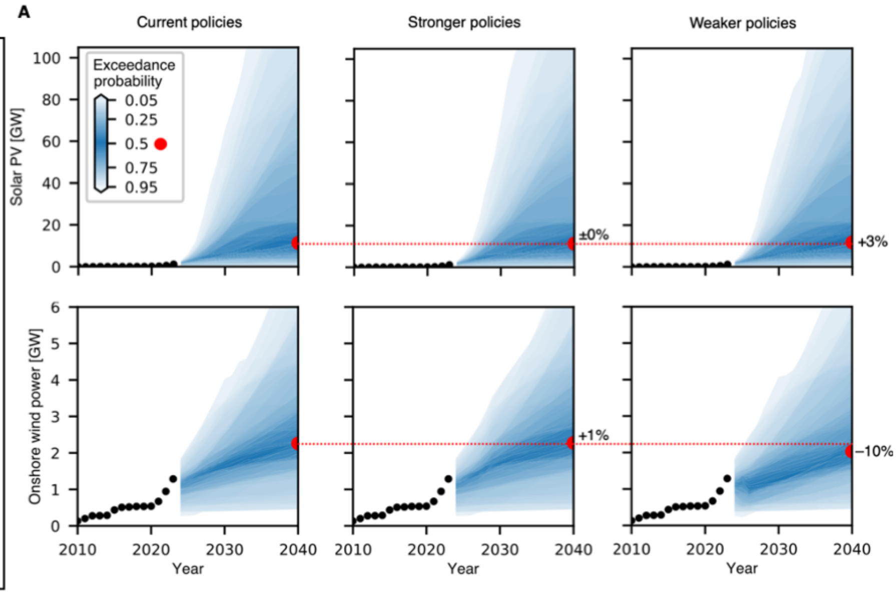


Supplementary Figure 30. Factsheet comparing the probabilistic projections of solar PV and onshore wind power between the scenarios of current, stronger, and weaker policies for Latvia. Geographical data to visualize country boundaries comes from references[1–3]. Related to Figures 4-5.

LITHUANIA

A. Probabilistic projections for solar PV and onshore wind power in Lithuania for 2024 – 2040 in scenarios of current, stronger, and weaker policies that affect profitability, technology phase-outs and targets on greenhouse gas emissions and renewable energy shares. The probabilistic density intervals show the probability that a capacity level will be reached or exceeded. The color gradient describes the quantiles of the projected capacities: the darker the color, the closer is the capacity to the median. The black dots show historical capacities. The red dot in 2040 marks the projected median capacity and the red line the level under current policies. Training data ranges from the years 2000 – 2023.

B. Maps showing the difference between the projected median capacities in the scenarios for all investigated countries in 2040. A positive difference shows that a capacity of the stronger policies scenario is greater than the corresponding capacity of the current policies scenario. Countries in grey have no projections. Δ is the mean absolute difference of all countries.

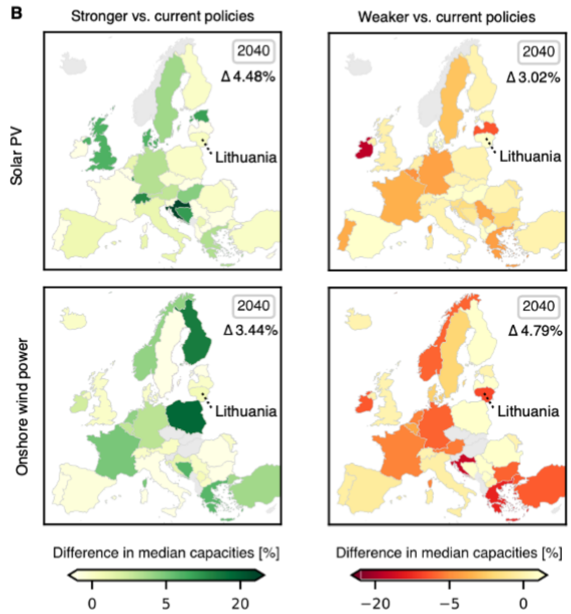


SUMMARY

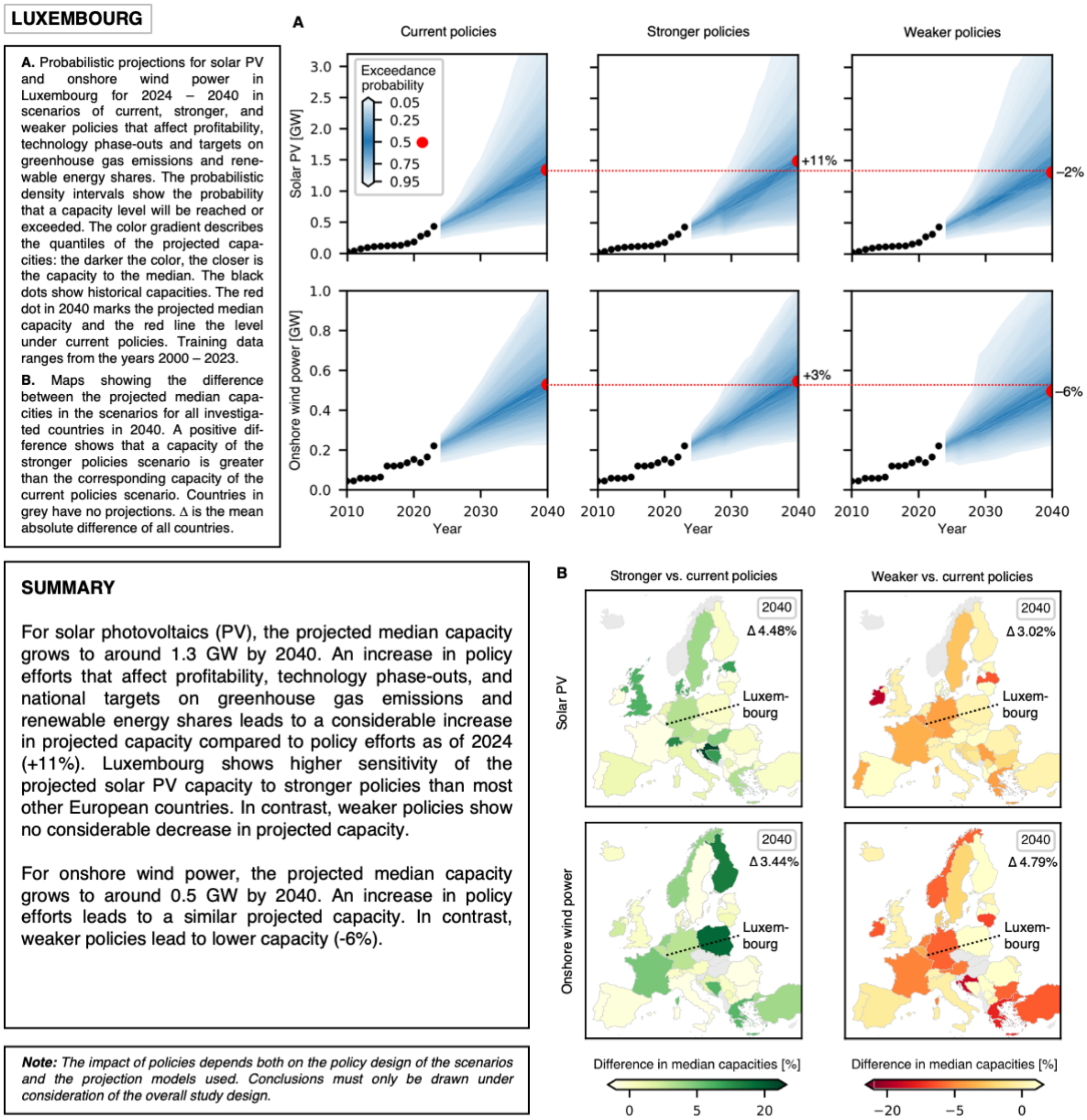
For solar photovoltaics (PV), the projected median capacity grows to around 11 GW by 2040. An increase in policy efforts that affect profitability, technology phase-outs, and national targets on greenhouse gas emissions and renewable energy shares shows no effect on the projected capacity compared to policy efforts as of 2024. Weaker policies lead to a similar projected capacity too.

For onshore wind power, the projected median capacity grows to around 2 GW by 2040. An increase in policy efforts shows no considerable effect on the projected capacity. In contrast, weaker policies lead to considerably lower capacity (-10%). Lithuania shows higher sensitivity of the projected onshore wind power capacity to weaker policies than most other European countries.

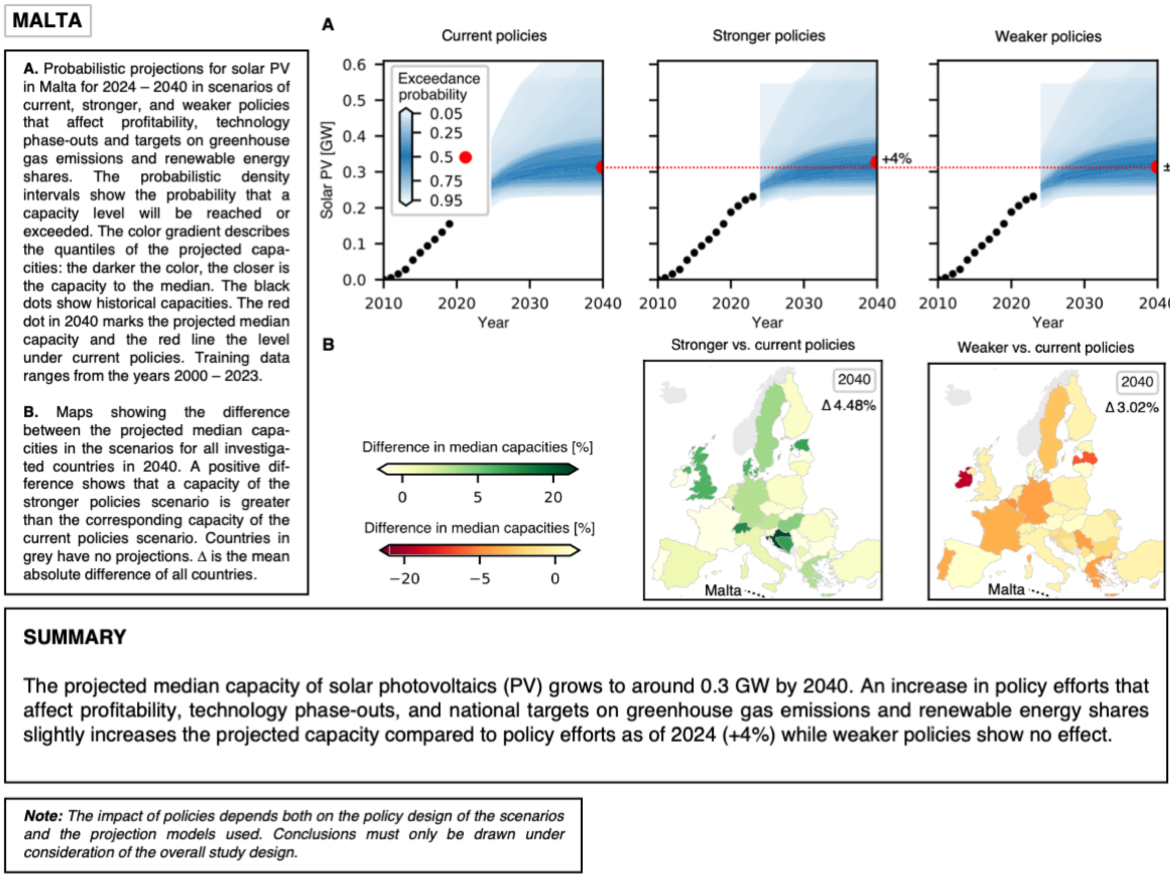
Note: The impact of policies depends both on the policy design of the scenarios and the projection models used. Conclusions must only be drawn under consideration of the overall study design.



Supplementary Figure 31. Factsheet comparing the probabilistic projections of solar PV and onshore wind power between the scenarios of current, stronger, and weaker policies for Lithuania. Geographical data to visualize country boundaries comes from references[1–3]. Related to Figures 4-5.



Supplementary Figure 32. Factsheet comparing the probabilistic projections of solar PV and onshore wind power between the scenarios of current, stronger, and weaker policies for Luxembourg. Geographical data to visualize country boundaries comes from references[1–3]. Related to Figures 4-5.

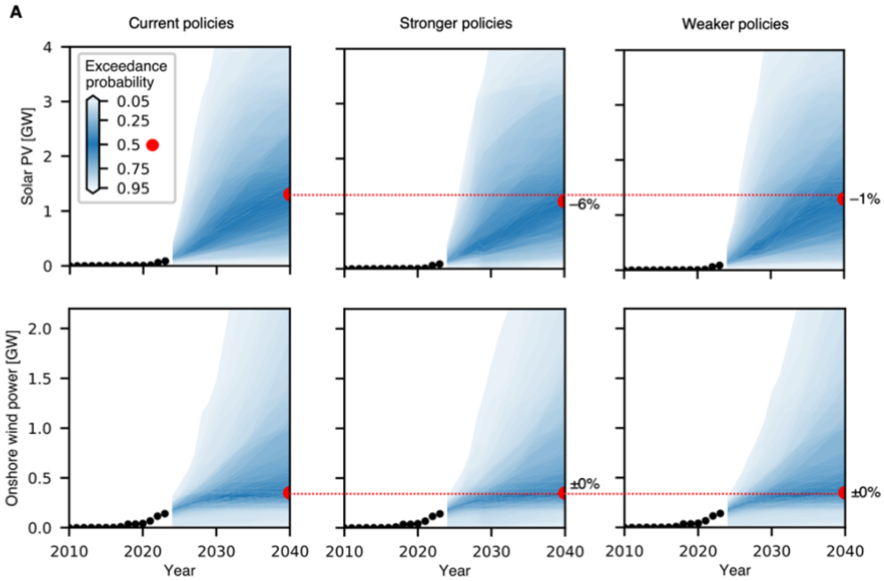


Supplementary Figure 33. Factsheet comparing the probabilistic projections of solar PV between the scenarios of current, stronger, and weaker policies for Malta. Geographical data to visualize country boundaries comes from references[1–3]. Related to Figures 4-5.

MOLDOVA

A. Probabilistic projections for solar PV and onshore wind power in Moldova for 2024 – 2040 in scenarios of current, stronger, and weaker policies that affect profitability, technology phase-outs and targets on greenhouse gas emissions and renewable energy shares. The probabilistic density intervals show the probability that a capacity level will be reached or exceeded. The color gradient describes the quantiles of the projected capacities: the darker the color, the closer is the capacity to the median. The black dots show historical capacities. The red dot in 2040 marks the projected median capacity and the red line the level under current policies. Training data ranges from the years 2000 – 2023.

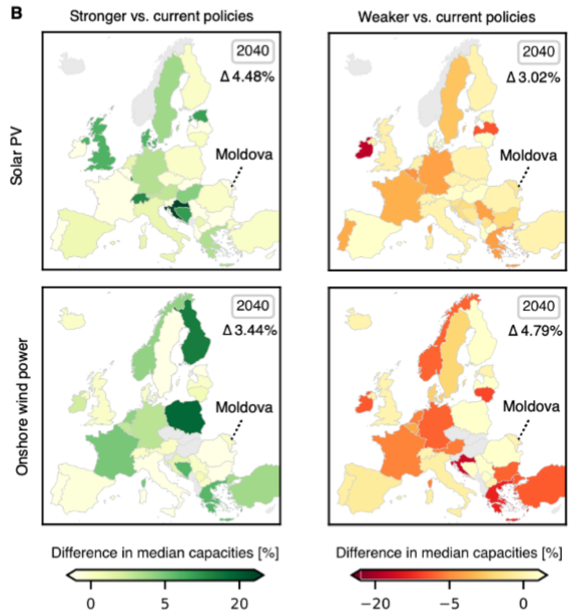
B. Maps showing the difference between the projected median capacities in the scenarios for all investigated countries in 2040. A positive difference shows that a capacity of the stronger policies scenario is greater than the corresponding capacity of the current policies scenario. Countries in grey have no projections. Δ is the mean absolute difference of all countries.



SUMMARY

For solar photovoltaics (PV), the projected median capacity grows to around 1.3 GW by 2040. A decrease in policy efforts that affect profitability, technology phase-outs, and national targets on greenhouse gas emissions and renewable energy shares shows no increase in projected capacity compared to policy efforts as of 2024. Weaker policies show no considerable effect on projected capacity.

For onshore wind power, the projected median capacity grows to around 0.3 GW by 2040. A change in policy efforts shows no effect on the projected capacity.



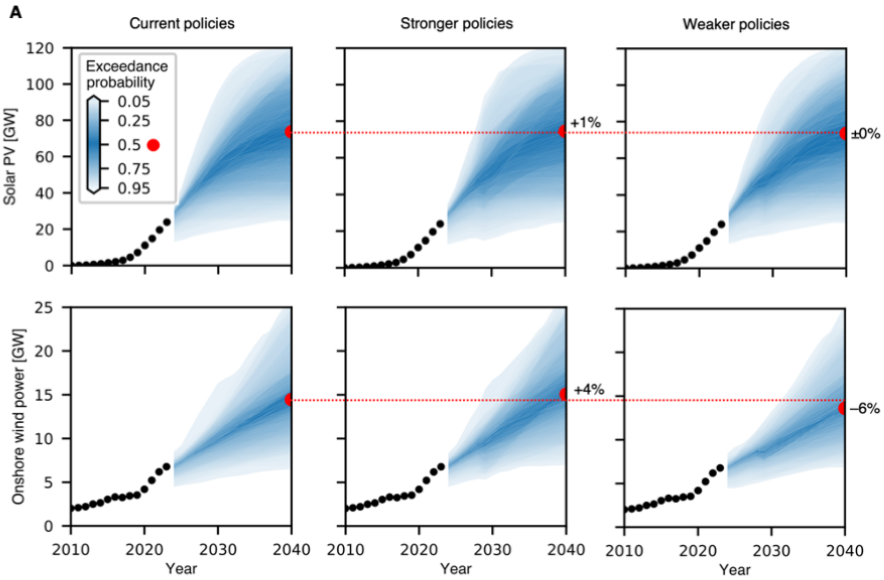
Note: The impact of policies depends both on the policy design of the scenarios and the projection models used. Conclusions must only be drawn under consideration of the overall study design.

Supplementary Figure 34. Factsheet comparing the probabilistic projections of solar PV and onshore wind power between the scenarios of current, stronger, and weaker policies for Moldova. Geographical data to visualize country boundaries comes from references[1–3]. Related to Figures 4-5.

NETHERLANDS

A. Probabilistic projections for solar PV and onshore wind power in Netherlands for 2024 – 2040 in scenarios of current, stronger, and weaker policies that affect profitability, technology phase-outs and targets on greenhouse gas emissions and renewable energy shares. The probabilistic density intervals show the probability that a capacity level will be reached or exceeded. The color gradient describes the quantiles of the projected capacities: the darker the color, the closer is the capacity to the median. The black dots show historical capacities. The red dot in 2040 marks the projected median capacity and the red line the level under current policies. Training data ranges from the years 2000 – 2023.

B. Maps showing the difference between the projected median capacities in the scenarios for all investigated countries in 2040. A positive difference shows that a capacity of the stronger policies scenario is greater than the corresponding capacity of the current policies scenario. Countries in grey have no projections. Δ is the mean absolute difference of all countries.



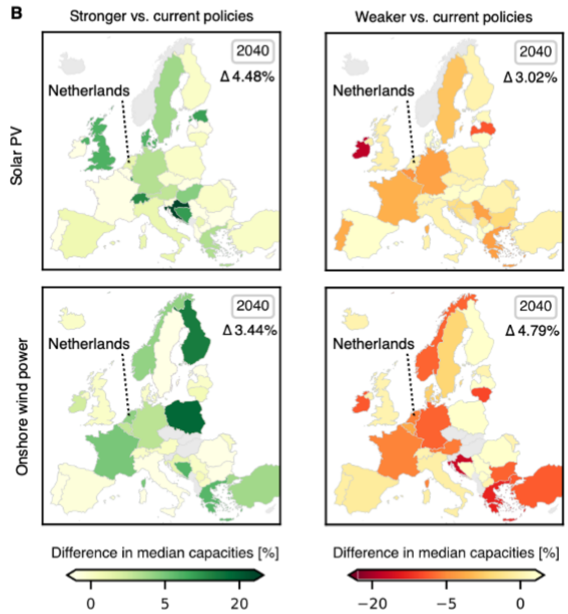
SUMMARY

For solar photovoltaics (PV), the projected median capacity grows to around 74 GW by 2040. A change in policy efforts that affect profitability, technology phase-outs, and national targets on greenhouse gas emissions and renewable energy shares shows no effect on the projected capacity compared to policy efforts as of 2024.

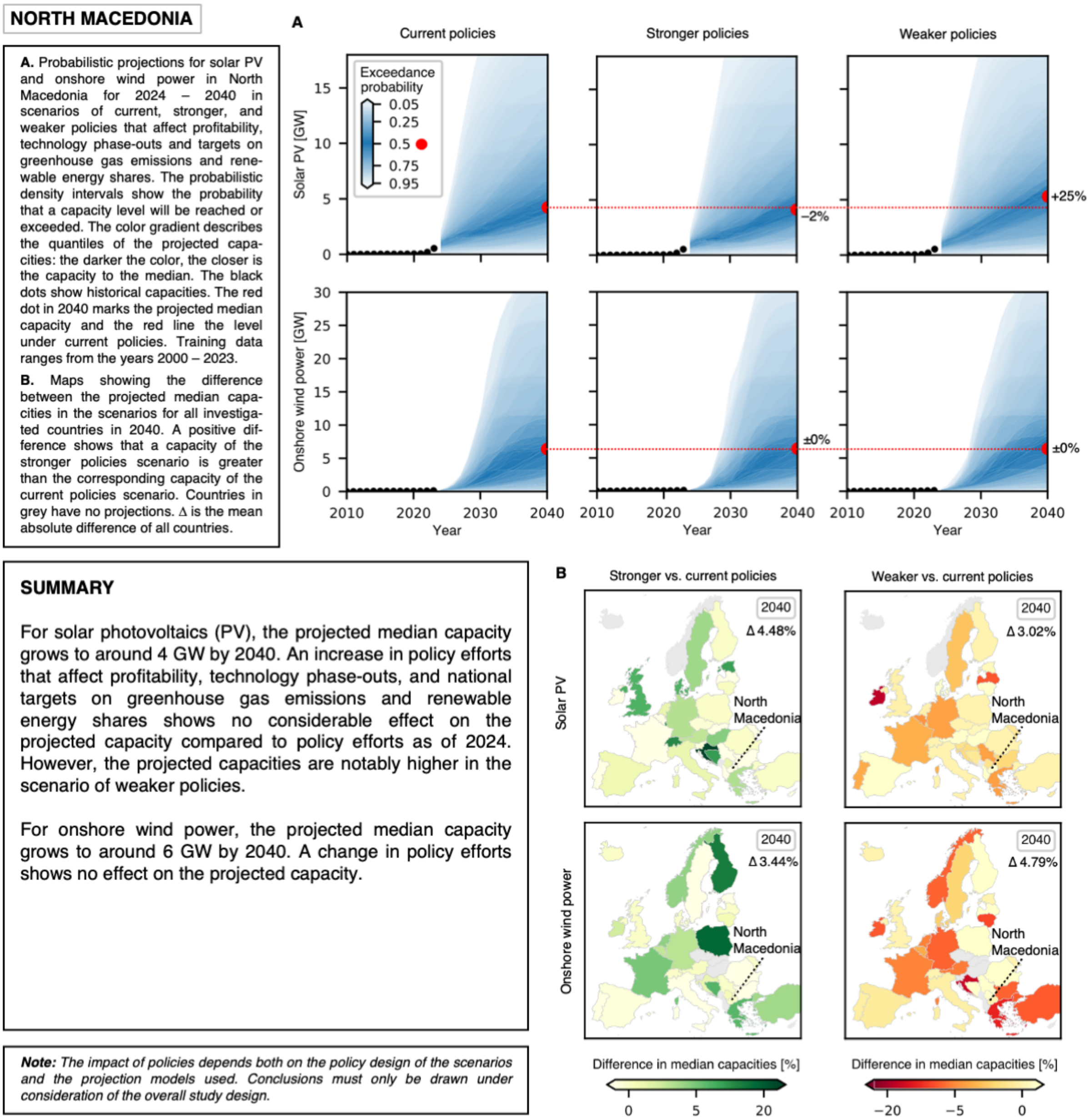
For onshore wind power, the projected median capacity grows to around 14 GW by 2040. An increase in policy efforts leads to slightly higher projected capacity (+4%) while weaker policies lead to lower capacity (-6%).

The Netherlands show slightly higher sensitivity of projected onshore wind power capacities to changes in policies than most other European countries.

Note: The impact of policies depends both on the policy design of the scenarios and the projection models used. Conclusions must only be drawn under consideration of the overall study design.



Supplementary Figure 35. Factsheet comparing the probabilistic projections of solar PV and onshore wind power between the scenarios of current, stronger, and weaker policies for the Netherlands. Geographical data to visualize country boundaries comes from references[1–3]. Related to Figures 4-5.

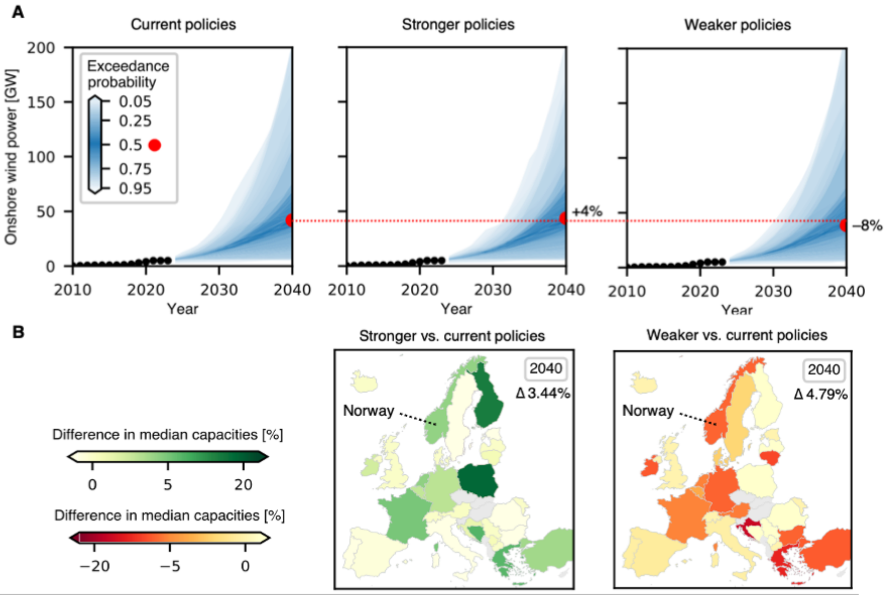


Supplementary Figure 36. Factsheet comparing the probabilistic projections of solar PV and onshore wind power between the scenarios of current, stronger, and weaker policies for North Macedonia. Geographical data to visualize country boundaries comes from references[1–3]. Related to Figures 4-5.

NORWAY

A. Probabilistic projections for onshore wind power in Norway for 2024 – 2040 in scenarios of current, stronger, and weaker policies that affect profitability, technology phase-outs and targets on greenhouse gas emissions and renewable energy shares. The probabilistic density intervals show the probability that a capacity level will be reached or exceeded. The color gradient describes the quantiles of the projected capacities: the darker the color, the closer is the capacity to the median. The black dots show historical capacities. The red dot in 2040 marks the projected median capacity and the red line the level under current policies. Training data ranges from the years 2000 – 2023.

B. Maps showing the difference between the projected median capacities in the scenarios for all investigated countries in 2040. A positive difference shows that a capacity of the stronger policies scenario is greater than the corresponding capacity of the current policies scenario. Countries in grey have no projections. Δ is the mean absolute difference of all countries.



SUMMARY

The projected median capacity of onshore wind power grows to around 42 GW by 2040. An increase in policy efforts that affect profitability, technology phase-outs, and national targets on greenhouse gas emissions and renewable energy shares slightly increases the projected capacity compared to policy efforts as of 2024 (+4%). In contrast, weaker policies considerably decrease the capacity (-8%). Norway shows higher sensitivity of projected onshore wind power capacities to policies than most other European countries.

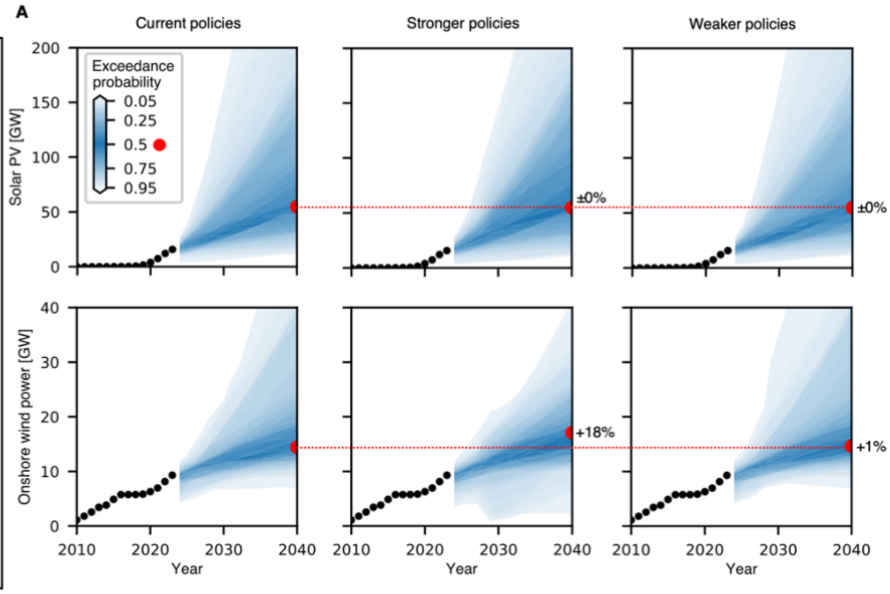
Note: *The impact of policies depends both on the policy design of the scenarios and the projection models used. Conclusions must only be drawn under consideration of the overall study design.*

Supplementary Figure 37. Factsheet comparing the probabilistic projections of onshore wind power between the scenarios of current, stronger, and weaker policies for Norway. Geographical data to visualize country boundaries comes from references[1–3]. Related to Figures 4-5.

POLAND

A. Probabilistic projections for solar PV and onshore wind power in Poland for 2024 – 2040 in scenarios of current, stronger, and weaker policies that affect profitability, technology phase-outs and targets on greenhouse gas emissions and renewable energy shares. The probabilistic density intervals show the probability that a capacity level will be reached or exceeded. The color gradient describes the quantiles of the projected capacities: the darker the color, the closer is the capacity to the median. The black dots show historical capacities. The red dot in 2040 marks the projected median capacity and the red line the level under current policies. Training data ranges from the years 2000 – 2023.

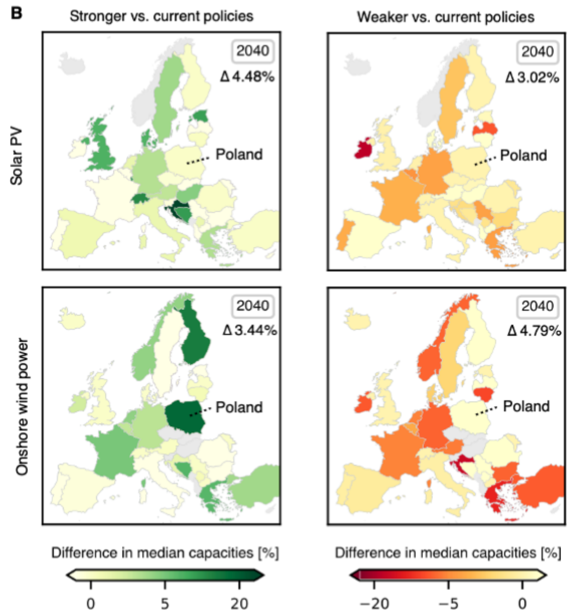
B. Maps showing the difference between the projected median capacities in the scenarios for all investigated countries in 2040. A positive difference shows that a capacity of the stronger policies scenario is greater than the corresponding capacity of the current policies scenario. Countries in grey have no projections. Δ is the mean absolute difference of all countries.



SUMMARY

For solar photovoltaics (PV), the projected median capacity grows to around 55 GW by 2040. A change in policy efforts that affect profitability, technology phase-outs, and national targets on greenhouse gas emissions and renewable energy shares shows no effect on the projected capacity compared to policy efforts as of 2024.

For onshore wind power, the projected median capacity grows to around 14 GW by 2040. An increase in policy efforts shows a strong increase in projected capacity (+18%). Poland shows higher sensitivity of projected onshore wind power capacities to stronger policies than most other European countries. In contrast, weaker policies show no considerable change in projected capacity.



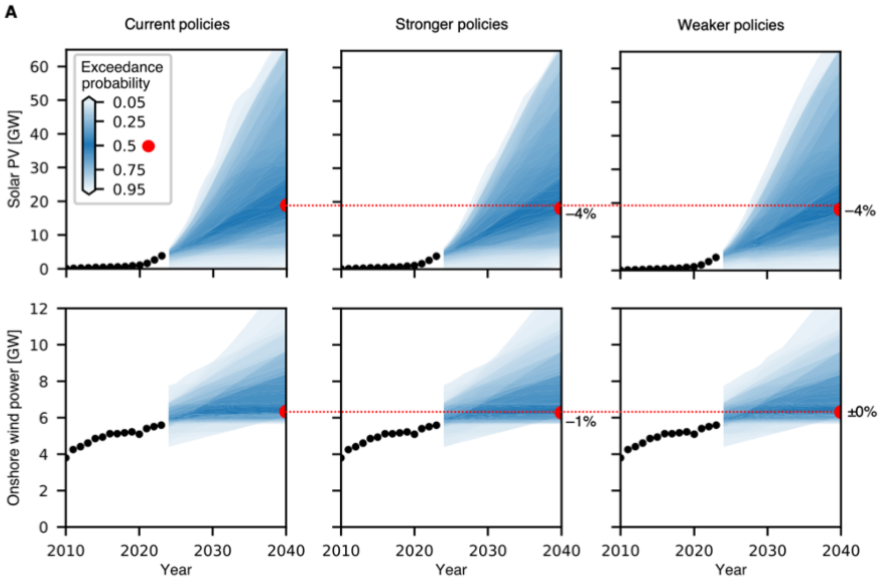
Note: *The impact of policies depends both on the policy design of the scenarios and the projection models used. Conclusions must only be drawn under consideration of the overall study design.*

Supplementary Figure 38. Factsheet comparing the probabilistic projections of solar PV and onshore wind power between the scenarios of current, stronger, and weaker policies for Poland. Geographical data to visualize country boundaries comes from references[1–3]. Related to Figures 4-5.

PORTUGAL

A. Probabilistic projections for solar PV and onshore wind power in Portugal for 2024 – 2040 in scenarios of current, stronger, and weaker policies that affect profitability, technology phase-outs and targets on greenhouse gas emissions and renewable energy shares. The probabilistic density intervals show the probability that a capacity level will be reached or exceeded. The color gradient describes the quantiles of the projected capacities: the darker the color, the closer is the capacity to the median. The black dots show historical capacities. The red dot in 2040 marks the projected median capacity and the red line the level under current policies. Training data ranges from the years 2000 – 2023.

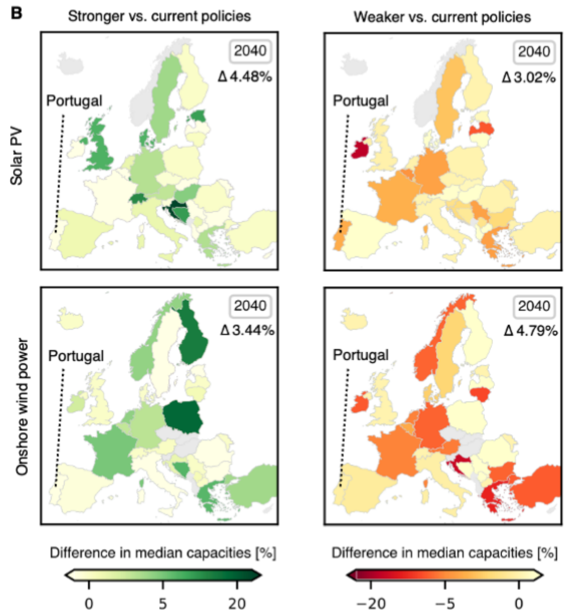
B. Maps showing the difference between the projected median capacities in the scenarios for all investigated countries in 2040. A positive difference shows that a capacity of the stronger policies scenario is greater than the corresponding capacity of the current policies scenario. Countries in grey have no projections. Δ is the mean absolute difference of all countries.



SUMMARY

For solar photovoltaics (PV), the projected median capacity grows to around 19 GW by 2040. A change in policy efforts that affect profitability, technology phase-outs, and national targets on greenhouse gas emissions and renewable energy shares shows a slight decrease in projected capacity compared to policy efforts as of 2024 (-4%).

For onshore wind power, the projected median capacity grows to around 6 GW by 2040. A change in policy efforts shows no effect on the projected capacity.



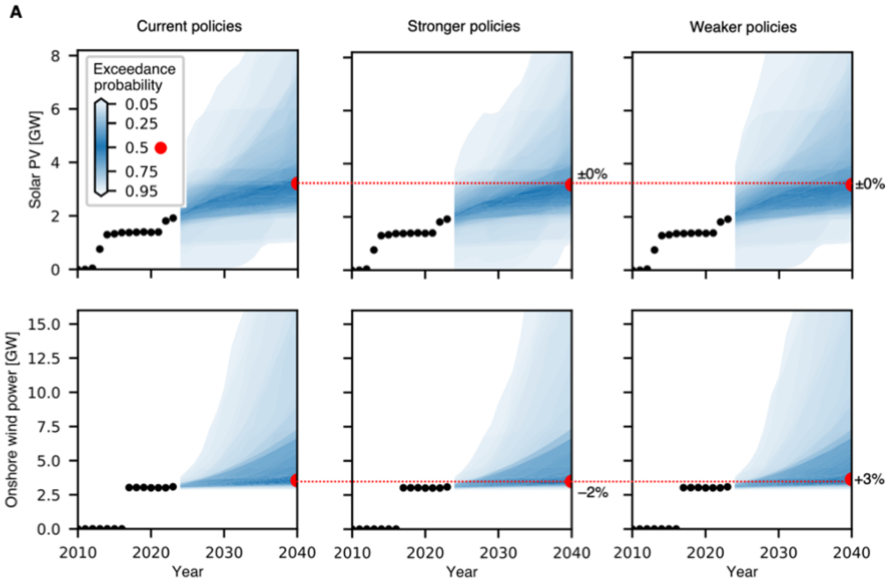
Note: *The impact of policies depends both on the policy design of the scenarios and the projection models used. Conclusions must only be drawn under consideration of the overall study design.*

Supplementary Figure 39. Factsheet comparing the probabilistic projections of solar PV and onshore wind power between the scenarios of current, stronger, and weaker policies for Portugal. Geographical data to visualize country boundaries comes from references[1–3]. Related to Figures 4-5.

ROMANIA

A. Probabilistic projections for solar PV and onshore wind power in Romania for 2024 – 2040 in scenarios of current, stronger, and weaker policies that affect profitability, technology phase-outs and targets on greenhouse gas emissions and renewable energy shares. The probabilistic density intervals show the probability that a capacity level will be reached or exceeded. The color gradient describes the quantiles of the projected capacities: the darker the color, the closer is the capacity to the median. The black dots show historical capacities. The red dot in 2040 marks the projected median capacity and the red line the level under current policies. Training data ranges from the years 2000 – 2023.

B. Maps showing the difference between the projected median capacities in the scenarios for all investigated countries in 2040. A positive difference shows that a capacity of the stronger policies scenario is greater than the corresponding capacity of the current policies scenario. Countries in grey have no projections. Δ is the mean absolute difference of all countries.

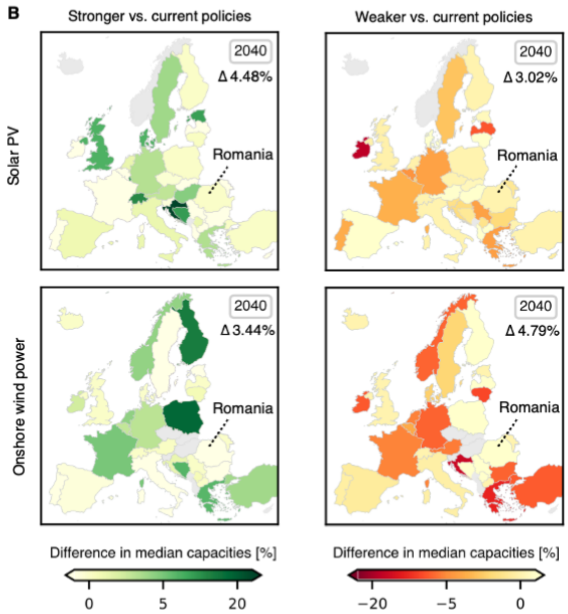


SUMMARY

For solar photovoltaics (PV), the projected median capacity grows slightly to around 3 GW by 2040. A change in policy efforts that affect profitability, technology phase-outs, and national targets on greenhouse gas emissions and renewable energy shares shows no effect on the projected capacity compared to policy efforts as of 2024.

For onshore wind power, the projected median capacity stays at around 3 GW by 2040 as there were almost no changes in capacity in previous years. Therefore, comparisons of policy efforts have limited meaning.

Note: The impact of policies depends both on the policy design of the scenarios and the projection models used. Conclusions must only be drawn under consideration of the overall study design.

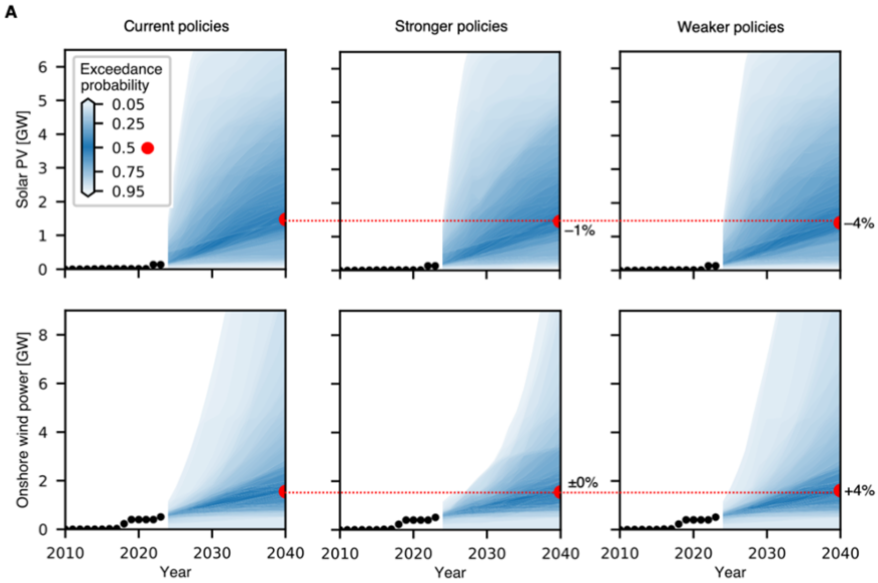


Supplementary Figure 40. Factsheet comparing the probabilistic projections of solar PV and onshore wind power between the scenarios of current, stronger, and weaker policies for Romania. Geographical data to visualize country boundaries comes from references[1–3]. Related to Figures 4-5.

SERBIA

A. Probabilistic projections for solar PV and onshore wind power in Serbia for 2024 – 2040 in scenarios of current, stronger, and weaker policies that affect profitability, technology phase-outs and targets on greenhouse gas emissions and renewable energy shares. The probabilistic density intervals show the probability that a capacity level will be reached or exceeded. The color gradient describes the quantiles of the projected capacities: the darker the color, the closer is the capacity to the median. The black dots show historical capacities. The red dot in 2040 marks the projected median capacity and the red line the level under current policies. Training data ranges from the years 2000 – 2023.

B. Maps showing the difference between the projected median capacities in the scenarios for all investigated countries in 2040. A positive difference shows that a capacity of the stronger policies scenario is greater than the corresponding capacity of the current policies scenario. Countries in grey have no projections. Δ is the mean absolute difference of all countries.

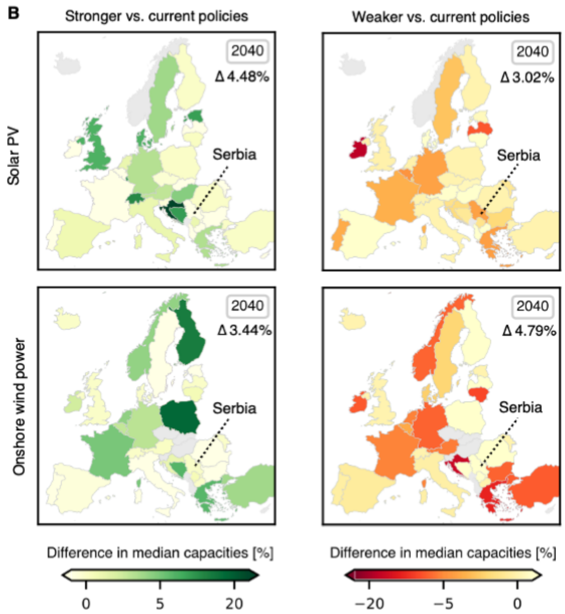


SUMMARY

For solar photovoltaics (PV), the projected median capacity grows to around 1.5 GW by 2040. An increase in policy efforts that affect profitability, technology phase-outs, and national targets on greenhouse gas emissions and renewable energy shares shows no increase in projected capacity compared to policy efforts as of 2024. Weaker policies lead to a slight decrease in the projected capacity.

For onshore wind power, the projected median capacity grows slightly to around 1.6 GW by 2040. An increase in policy efforts shows no effect on the projected capacity. Weaker policies show no decrease in the projected capacity.

Note: *The impact of policies depends both on the policy design of the scenarios and the projection models used. Conclusions must only be drawn under consideration of the overall study design.*

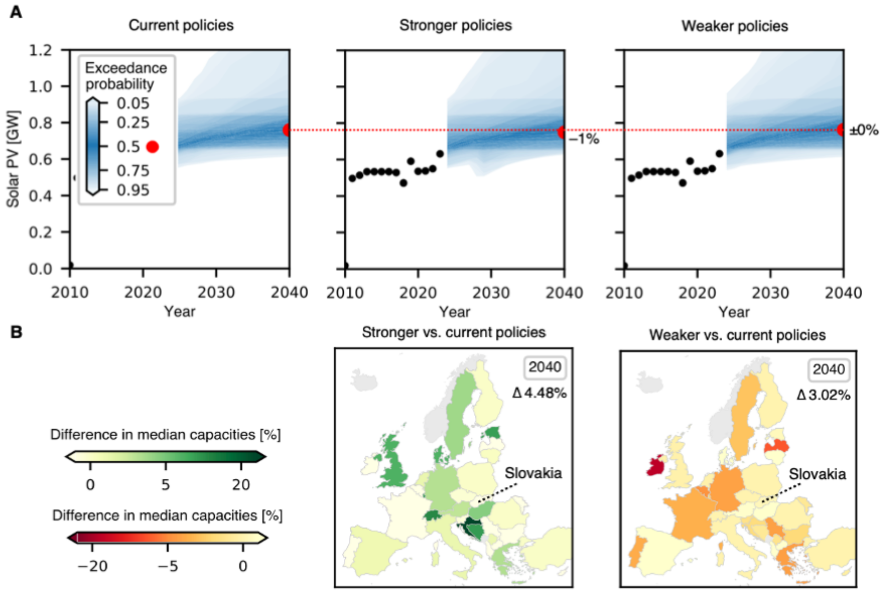


Supplementary Figure 41. Factsheet comparing the probabilistic projections of solar PV and onshore wind power between the scenarios of current, stronger, and weaker policies for Serbia. Geographical data to visualize country boundaries comes from references[1–3]. Related to Figures 4-5.

SLOVAKIA

A. Probabilistic projections for solar PV in Slovakia for 2024 – 2040 in scenarios of current, stronger, and weaker policies that affect profitability, technology phase-outs and targets on greenhouse gas emissions and renewable energy shares. The probabilistic density intervals show the probability that a capacity level will be reached or exceeded. The color gradient describes the quantiles of the projected capacities: the darker the color, the closer is the capacity to the median. The black dots show historical capacities. The red dot in 2040 marks the projected median capacity and the red line the level under current policies. Training data ranges from the years 2000 – 2023.

B. Maps showing the difference between the projected median capacities in the scenarios for all investigated countries in 2040. A positive difference shows that a capacity of the stronger policies scenario is greater than the corresponding capacity of the current policies scenario. Countries in grey have no projections. Δ is the mean absolute difference of all countries.



SUMMARY

The projected median capacity of solar photovoltaics (PV) grows to around 0.8 GW by 2040. A change in policy efforts that affect profitability, technology phase-outs, and national targets on greenhouse gas emissions and renewable energy shares shows no effect on the the projected capacity compared to policy efforts as of 2024. However, as there were only minor changes in capacity in previous years, comparisons of policy efforts have limited meaning.

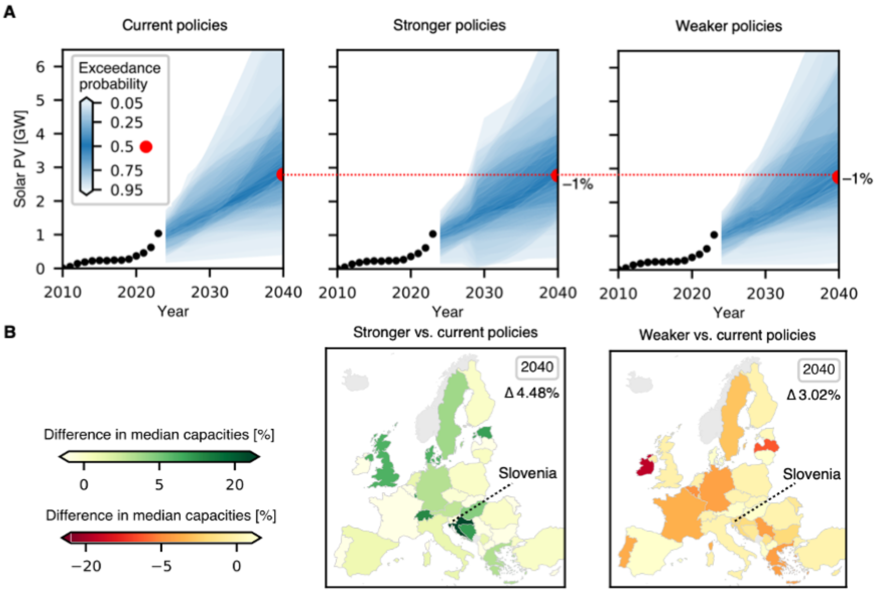
Note: *The impact of policies depends both on the policy design of the scenarios and the projection models used. Conclusions must only be drawn under consideration of the overall study design.*

Supplementary Figure 42. Factsheet comparing the probabilistic projections of solar PV between the scenarios of current, stronger, and weaker policies for Slovakia. Geographical data to visualize country boundaries comes from references[1–3]. Related to Figures 4-5.

SLOVENIA

A. Probabilistic projections for solar PV in Slovenia for 2024 – 2040 in scenarios of current, stronger, and weaker policies that affect profitability, technology phase-outs and targets on greenhouse gas emissions and renewable energy shares. The probabilistic density intervals show the probability that a capacity level will be reached or exceeded. The color gradient describes the quantiles of the projected capacities: the darker the color, the closer is the capacity to the median. The black dots show historical capacities. The red dot in 2040 marks the projected median capacity and the red line the level under current policies. Training data ranges from the years 2000 – 2023.

B. Maps showing the difference between the projected median capacities in the scenarios for all investigated countries in 2040. A positive difference shows that a capacity of the stronger policies scenario is greater than the corresponding capacity of the current policies scenario. Countries in grey have no projections. Δ is the mean absolute difference of all countries.



SUMMARY

The projected median capacity of solar photovoltaics (PV) grows to around 3 GW by 2040. A change in policy efforts that affect profitability, technology phase-outs, and national targets on greenhouse gas emissions and renewable energy shares shows no considerable effect on the projected capacity compared to policy efforts as of 2024.

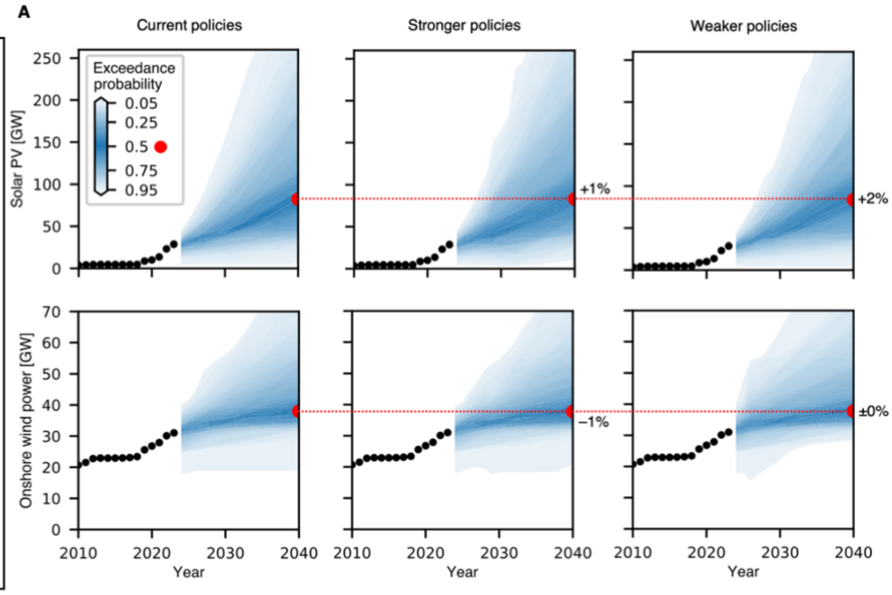
Note: *The impact of policies depends both on the policy design of the scenarios and the projection models used. Conclusions must only be drawn under consideration of the overall study design.*

Supplementary Figure 43. Factsheet comparing the probabilistic projections of solar PV between the scenarios of current, stronger, and weaker policies for Slovenia. Geographical data to visualize country boundaries comes from references[1–3]. Related to Figures 4-5.

SPAIN

A. Probabilistic projections for solar PV and onshore wind power in Spain for 2024 – 2040 in scenarios of current, stronger, and weaker policies that affect profitability, technology phase-outs and targets on greenhouse gas emissions and renewable energy shares. The probabilistic density intervals show the probability that a capacity level will be reached or exceeded. The color gradient describes the quantiles of the projected capacities: the darker the color, the closer is the capacity to the median. The black dots show historical capacities. The red dot in 2040 marks the projected median capacity and the red line the level under current policies. Training data ranges from the years 2000 – 2023.

B. Maps showing the difference between the projected median capacities in the scenarios for all investigated countries in 2040. A positive difference shows that a capacity of the stronger policies scenario is greater than the corresponding capacity of the current policies scenario. Countries in grey have no projections. Δ is the mean absolute difference of all countries.

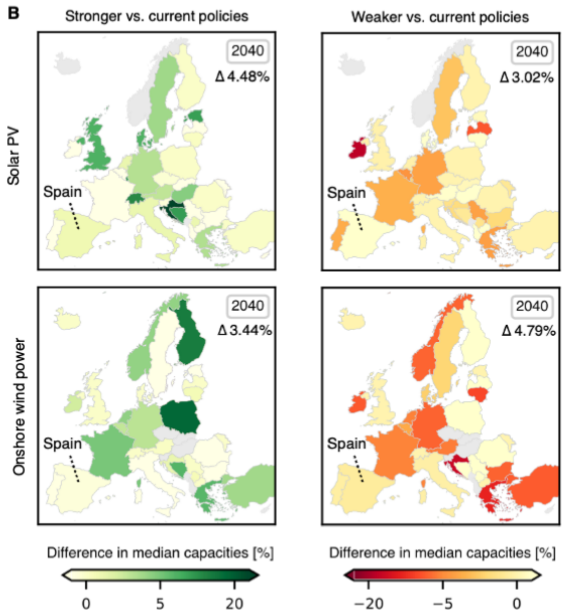


SUMMARY

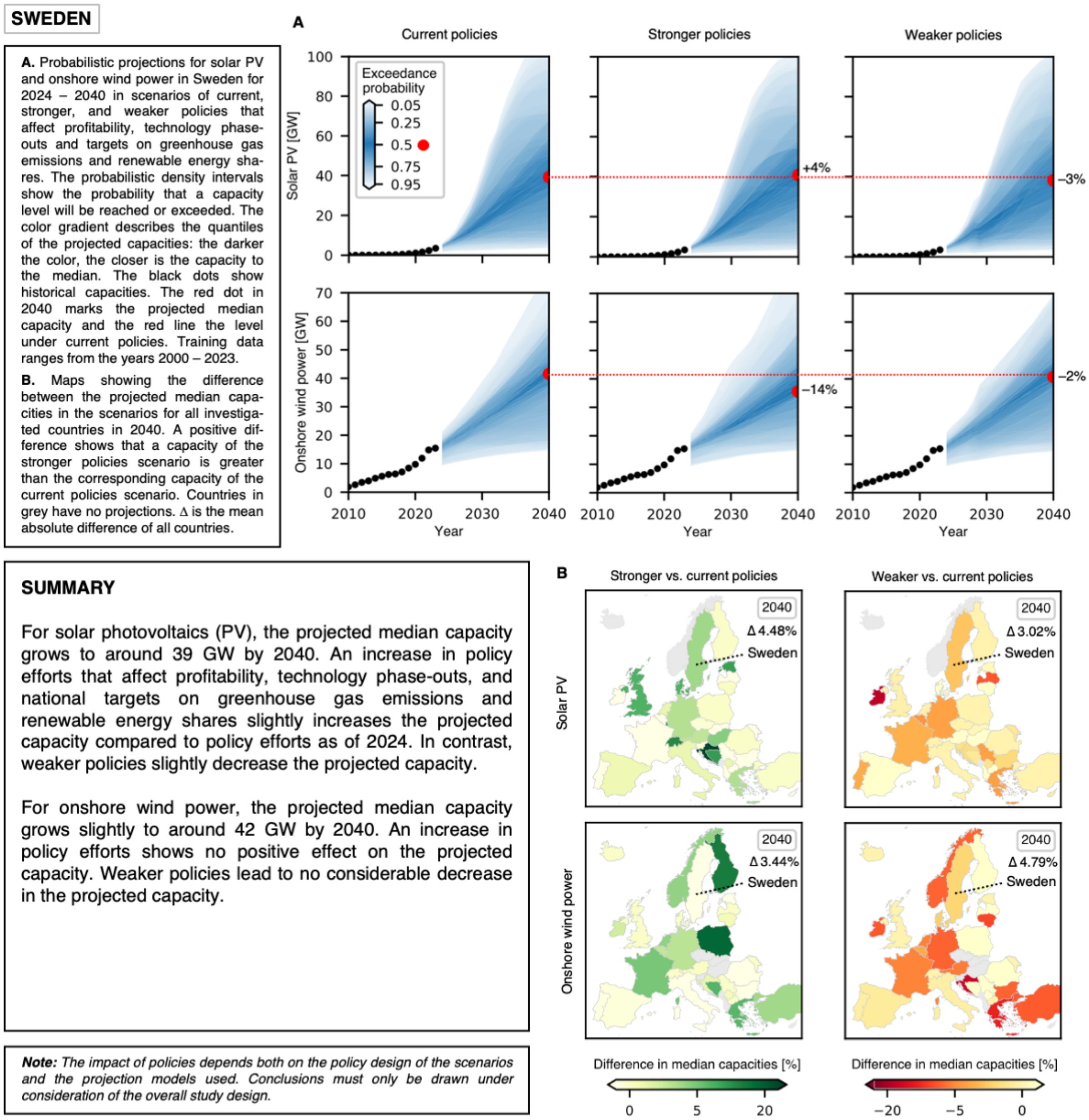
For solar photovoltaics (PV), the projected median capacity grows to around 82 GW by 2040. A change in policy efforts that affect profitability, technology phase-outs, and national targets on greenhouse gas emissions and renewable energy shares shows no considerable effect on the projected capacity compared to policy efforts as of 2024.

For onshore wind power, the projected median capacity grows slightly to around 38 GW by 2040. A change in policy efforts shows no effect on the projected capacity.

***Note:** The impact of policies depends both on the policy design of the scenarios and the projection models used. Conclusions must only be drawn under consideration of the overall study design.*



Supplementary Figure 44. Factsheet comparing the probabilistic projections of solar PV and onshore wind power between the scenarios of current, stronger, and weaker policies for Spain. Geographical data to visualize country boundaries comes from references[1–3]. Related to Figures 4-5.

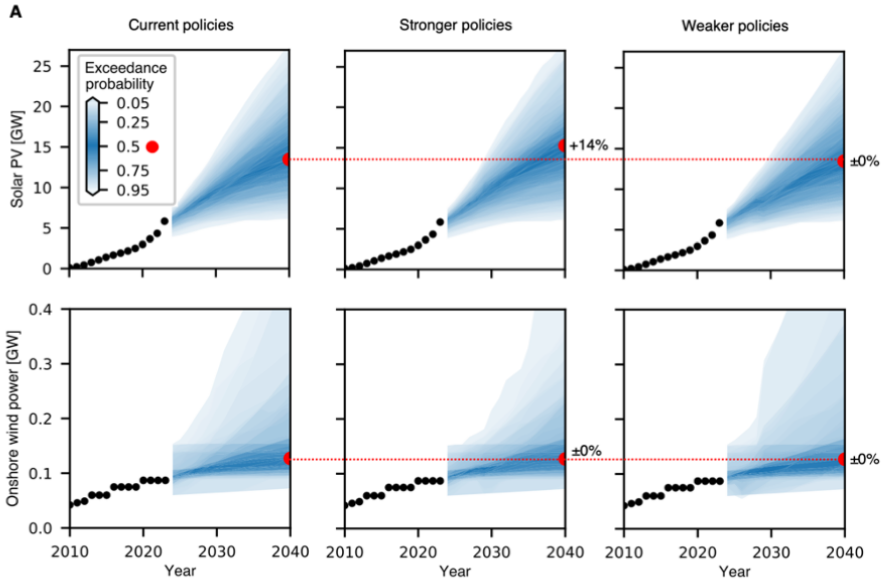


Supplementary Figure 45. Factsheet comparing the probabilistic projections of solar PV and onshore wind power between the scenarios of current, stronger, and weaker policies for Sweden. Geographical data to visualize country boundaries comes from references[1–3]. Related to Figures 4-5.

SWITZERLAND

A. Probabilistic projections for solar PV and onshore wind power in Switzerland for 2024 – 2040 in scenarios of current, stronger, and weaker policies that affect profitability, technology phase-outs and targets on greenhouse gas emissions and renewable energy shares. The probabilistic density intervals show the probability that a capacity level will be reached or exceeded. The color gradient describes the quantiles of the projected capacities: the darker the color, the closer is the capacity to the median. The black dots show historical capacities. The red dot in 2040 marks the projected median capacity and the red line the level under current policies. Training data ranges from the years 2000 – 2023.

B. Maps showing the difference between the projected median capacities in the scenarios for all investigated countries in 2040. A positive difference shows that a capacity of the stronger policies scenario is greater than the corresponding capacity of the current policies scenario. Countries in grey have no projections. Δ is the mean absolute difference of all countries.

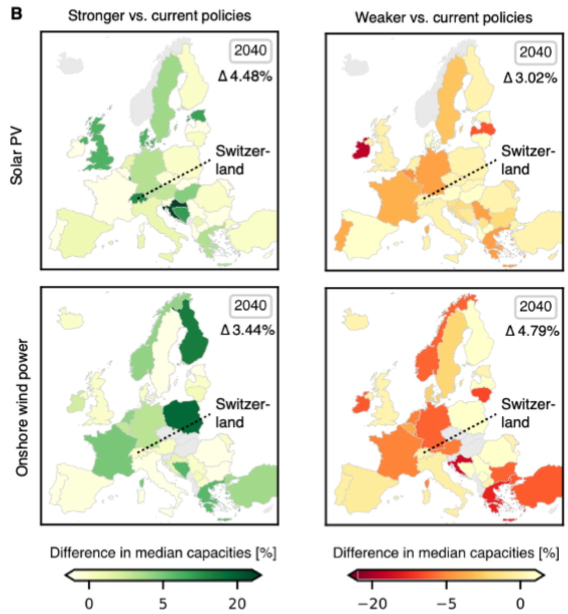


SUMMARY

For solar photovoltaics (PV), the projected median capacity grows to around 13 GW by 2040. An increase in policy efforts that affect profitability, technology phase-outs, and national targets on greenhouse gas emissions and renewable energy shares leads to a considerable increase in the projected capacity compared to policy efforts as of 2024 (+14%). Switzerland shows higher sensitivity of the projected solar PV capacity to stronger policies than most other European countries. In contrast, weaker policies show no effect on the projected capacity.

For onshore wind power, the projected median capacity grows slightly to around 130 MW by 2040. As there were almost no changes in capacity in previous years. Therefore, comparisons of policy efforts have limited meaning.

Note: The impact of policies depends both on the policy design of the scenarios and the projection models used. Conclusions must only be drawn under consideration of the overall study design.

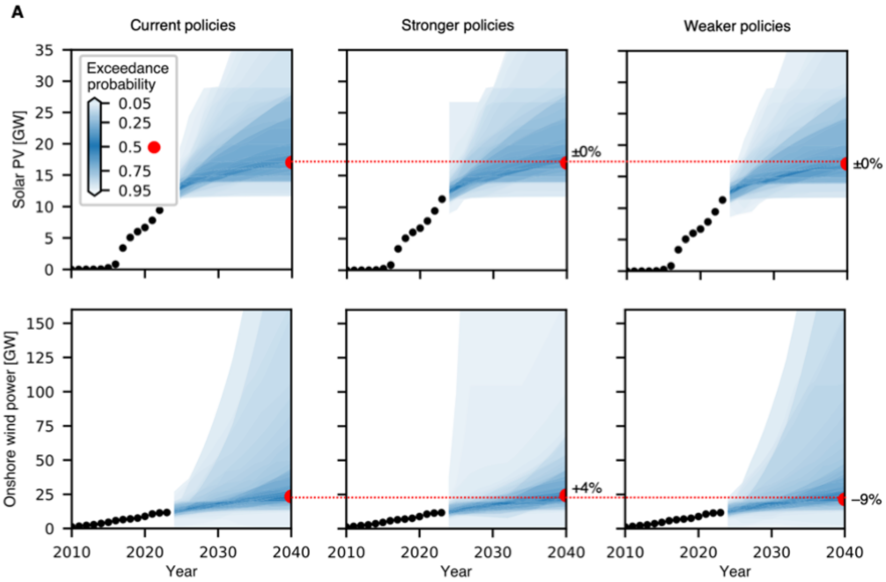


Supplementary Figure 46. Factsheet comparing the probabilistic projections of solar PV and onshore wind power between the scenarios of current, stronger, and weaker policies for Switzerland. Geographical data to visualize country boundaries comes from references[1–3]. Related to Figures 4-5.

TURKEY

A. Probabilistic projections for solar PV and onshore wind power in Turkey for 2024 – 2040 in scenarios of current, stronger, and weaker policies that affect profitability, technology phase-outs and targets on greenhouse gas emissions and renewable energy shares. The probabilistic density intervals show the probability that a capacity level will be reached or exceeded. The color gradient describes the quantiles of the projected capacities: the darker the color, the closer is the capacity to the median. The black dots show historical capacities. The red dot in 2040 marks the projected median capacity and the red line the level under current policies. Training data ranges from the years 2000 – 2023.

B. Maps showing the difference between the projected median capacities in the scenarios for all investigated countries in 2040. A positive difference shows that a capacity of the stronger policies scenario is greater than the corresponding capacity of the current policies scenario. Countries in grey have no projections. Δ is the mean absolute difference of all countries.

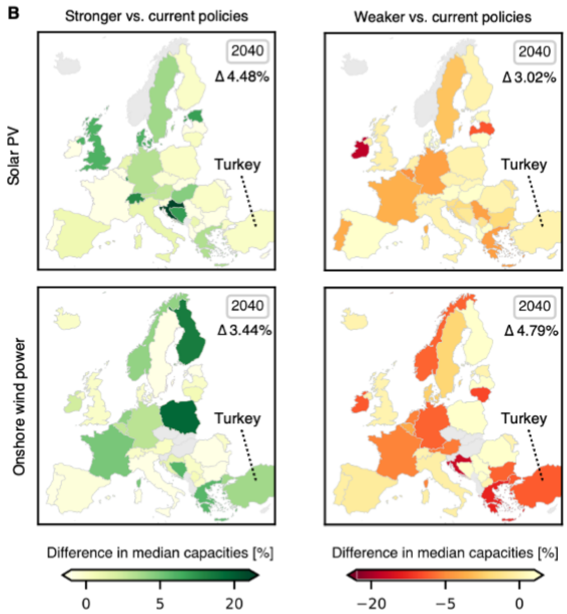


SUMMARY

For solar photovoltaics (PV), the projected median capacity grows to around 17 GW by 2040. A change in policy efforts that affect profitability, technology phase-outs, and national targets on greenhouse gas emissions and renewable energy shares shows no effect on the projected capacity compared to policy efforts as of 2024.

For onshore wind power, the projected median capacity grows slightly to around 23 GW by 2040. An increase in policy efforts leads to a slightly higher projected capacity (+4%) while weaker policies lead to a considerably lower projected capacity (-9%). Turkey shows higher sensitivity of the projected onshore wind power capacity to changes in policies than most other European countries.

__Note:__ The impact of policies depends both on the policy design of the scenarios and the projection models used. Conclusions must only be drawn under consideration of the overall study design.

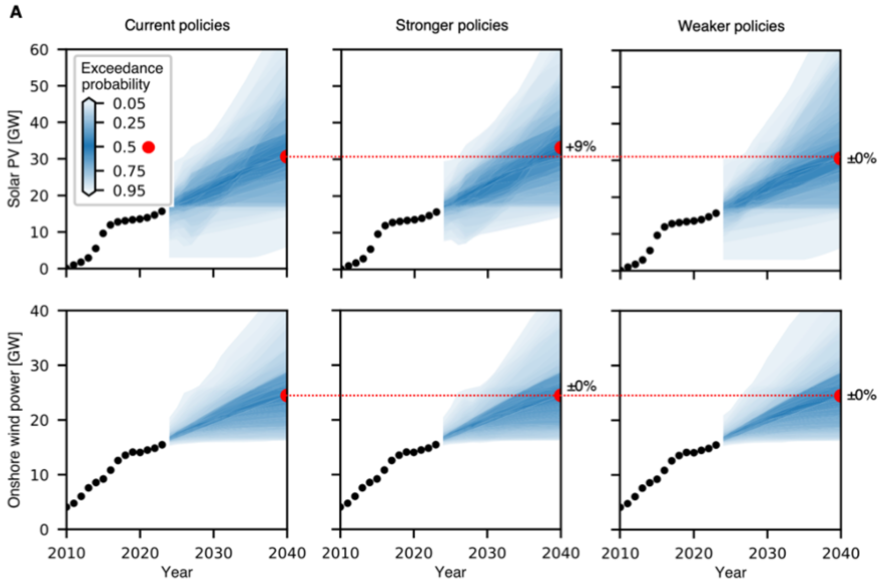


Supplementary Figure 47. Factsheet comparing the probabilistic projections of solar PV and onshore wind power between the scenarios of current, stronger, and weaker policies for Turkey. Geographical data to visualize country boundaries comes from references[1–3]. Related to Figures 4-5.

UNITED KINGDOM

A. Probabilistic projections for solar PV and onshore wind power in United Kingdom for 2024 – 2040 in scenarios of current, stronger, and weaker policies that affect profitability, technology phase-outs and targets on greenhouse gas emissions and renewable energy shares. The probabilistic density intervals show the probability that a capacity level will be reached or exceeded. The color gradient describes the quantiles of the projected capacities: the darker the color, the closer is the capacity to the median. The black dots show historical capacities. The red dot in 2040 marks the projected median capacity and the red line the level under current policies. Training data ranges from the years 2000 – 2023.

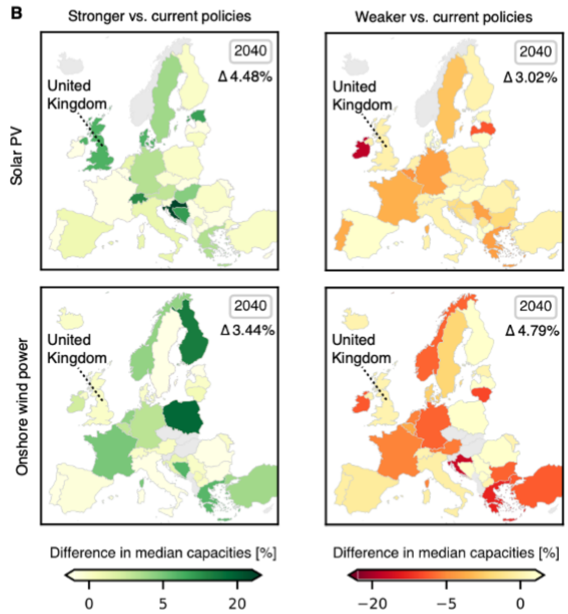
B. Maps showing the difference between the projected median capacities in the scenarios for all investigated countries in 2040. A positive difference shows that a capacity of the stronger policies scenario is greater than the corresponding capacity of the current policies scenario. Countries in grey have no projections. Δ is the mean absolute difference of all countries.



SUMMARY

For solar photovoltaics (PV), the projected median capacity grows to around 31 GW by 2040. An increase in policy efforts that affect profitability, technology phase-outs, and national targets on greenhouse gas emissions and renewable energy shares leads to a considerable increase in the projected capacity compared to policy efforts as of 2024. The United Kingdom shows higher sensitivity of the projected solar PV capacity to stronger policies than most other European countries. In contrast, weaker policies show no effect on the projected capacity.

For onshore wind power, the projected median capacity grows slightly to around 24 GW by 2040. A change in policy efforts shows no effect on the projected capacity.



***Note:** The impact of policies depends both on the policy design of the scenarios and the projection models used. Conclusions must only be drawn under consideration of the overall study design.*

Supplementary Figure 48. Factsheet comparing the probabilistic projections of solar PV and onshore wind power between the scenarios of current, stronger, and weaker policies for the United Kingdom. Geographical data to visualize country boundaries comes from references[1–3]. Related to Figures 4-5.

Supplementary Tables

Supplementary Table 1. Average absolute percentage errors of the projected median capacities of the probabilistic projections of the weighted multi-model ensemble for policy mix to historically observed values. Values show the average over all countries of the first quartile, second quartile (median), and third quartile of errors over hindcasting years 2014 – 2023. The diffusion stage is individual to each technology and country and describes the difference between the first year of out-of-sample testing in each hindcasting iteration and the last training year in the first hindcasting iteration, i.e., the first iteration for which the creation of projections is possible for a technology in a country. Years 2012 – 2013 are used for calculating the weights for the multi-model ensemble.

	Solar PV			**Onshore wind power**		
Diffusion stage	1st quartile	Median	3rd quartile	1st quartile	Median	3rd quartile
1	-	-	-	-	-	-
2	-	-	-	-	-	-
3	0.283	0.494	0.708	0.186	0.275	0.362
4	0.267	0.420	0.536	0.098	0.150	0.199
5	0.237	0.344	0.435	0.104	0.166	0.234
6	0.228	0.320	0.432	0.105	0.164	0.223
7	0.209	0.295	0.392	0.120	0.159	0.206
8	0.198	0.272	0.368	0.091	0.124	0.165
9	0.175	0.245	0.314	0.073	0.114	0.158
10	0.162	0.219	0.271	0.098	0.131	0.163
11	0.188	0.218	0.248	0.114	0.133	0.152
12	0.172	0.172	0.172	0.091	0.091	0.091
all	0.214	0.305	0.394	0.108	0.152	0.197

Supplementary Table 2. Projected median capacities in the stronger policy scenario for the year 2040 compared to required capacities estimated by the Ten Year Network Development Plan (TYNDP) scenario "National trends"[4] and the European Commission scenario "EU Reference Scenario 2020"[5] that are in line with European targets.

	Solar PV in 2040 [MW]			**Onshore wind power in 2040 [MW]**		
Country	Projected median	TYNDP	European Commission	Projected median	TYNDP	European Commission
Albania	2,862	1,000	-	-	-	-
Austria	27,352	30,000	8,541	6,210	16,000	9,527
Belgium	19,415	16,400	14,518	6,251	6,893	6,634
Bosnia and Herzegovina	1,625	600	-	523	1,035	-
Bulgaria	5,052	3,390	5,575	804	948	2,529
Croatia	5,062	1,800	1,663	2,360	2,781	2,229
Cyprus	2,945	800	1,636	-	-	322
Czech Republic	4,414	10,022	4,788	-	-	3,310
Denmark	9,331	18,614	6,784	8,326	10,402	9,640
Estonia	3,463	897	1,506	557	938	892
Finland	4,453	3698	1,448	32,034	20,161	8,168
France	40,984	57,620	39,874	63,242	52,960	54,421
Georgia	-	-	-	-	-	-
Germany	152,283	125,786	113,553	102,809	88,800	94,170
Greece	15,791	-	9,321	14,578	-	9,089
Hungary	36,610	11,195	8,478	-	-	1,908
Iceland	-	-	-	2	-	-
Ireland	13,773	1,500	1,669	12,526	5,900	8,223
Italy	45,630	64,398	71,952	14,966	21,062	23,410
Kosovo	139	-	-	10,533	-	-
Latvia	17,423	250	189	281	450	951
Lithuania	11,342	1,250	2,282	2,272	2,100	1,805
Luxembourg	1,490	1,714	2,273	540	1,000	599
Malta	306	266	358	-	-	-
Moldova	1,225	-	-	349	-	-
Montenegro	-	-	-	-	-	-
Netherlands	70,527	41,918	31,411	14,313	10,488	13,451
North Macedonia	4,122	998	-	6,389	723	-
Norway	-	-	-	43,601	10,796	-
Poland	54,721	9,814	12,505	17,445	6,939	12,804
Portugal	18,458	10,860	6,947	6,335	12,924	10,694
Romania	3,210	6,000	8,059	3,484	6,500	7,846
Serbia	1,452	950	-	1,589	4,521	-
Slovakia	750	1,237	2,767	-	-	1,538
Slovenia	2,767	5,361	2,596	-	-	221
Spain	85,112	76,686	62,003	37,071	57,000	64,501
Sweden	40,794	29,341	2,734	35,554	36,709	13,197
Switzerland	14,952	24,100	-	127	1,200	-
Turkey	17,020	22,000	-	24,340	23,000	-
United Kingdom	31,289	44,083	-	24,475	37,488	-

Supplementary Table 3. Assumptions and sources for the included factors in the historical time series of each type of policies. Missing values for specific years are linearly interpolated or extrapolated. The Methods section describes assumptions and sources for the scenarios of future policies.

Type of policies	**Included factors**	**Assumptions**	**Sources**
P1 – profitability	Investment costs	-	[6,7]
	Subsidy rate	-	[8]
	Operation and maintenance costs	1.5 % of investment costs	[9,10]
	Discount rate	5%	[11]
	Technology lifetime	25 years	[9]
	Self-consumption share	30% (solar PV) 0 % (onshore wind power)	[12,13] -
	Annual electricity generation	-	[14]
	Electricity price	-	[15]
	Feed-in tariff	-	[16]
	Exchange rate EUR-USD	-	[17]
P2 – phase-outs and substitution potential	Electricity demand	-	[14]
	Annual electricity generation	-	[14]
P3 – targets	Target on greenhouse gas emissions	If multiple targets exist, the target for the closest year is active; target on net-zero greenhouse gas emissions in 2050 left out	[18–20]
	Target on renewable energy share	If multiple targets exist, the target for the closest year is active	[18,21,22]

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