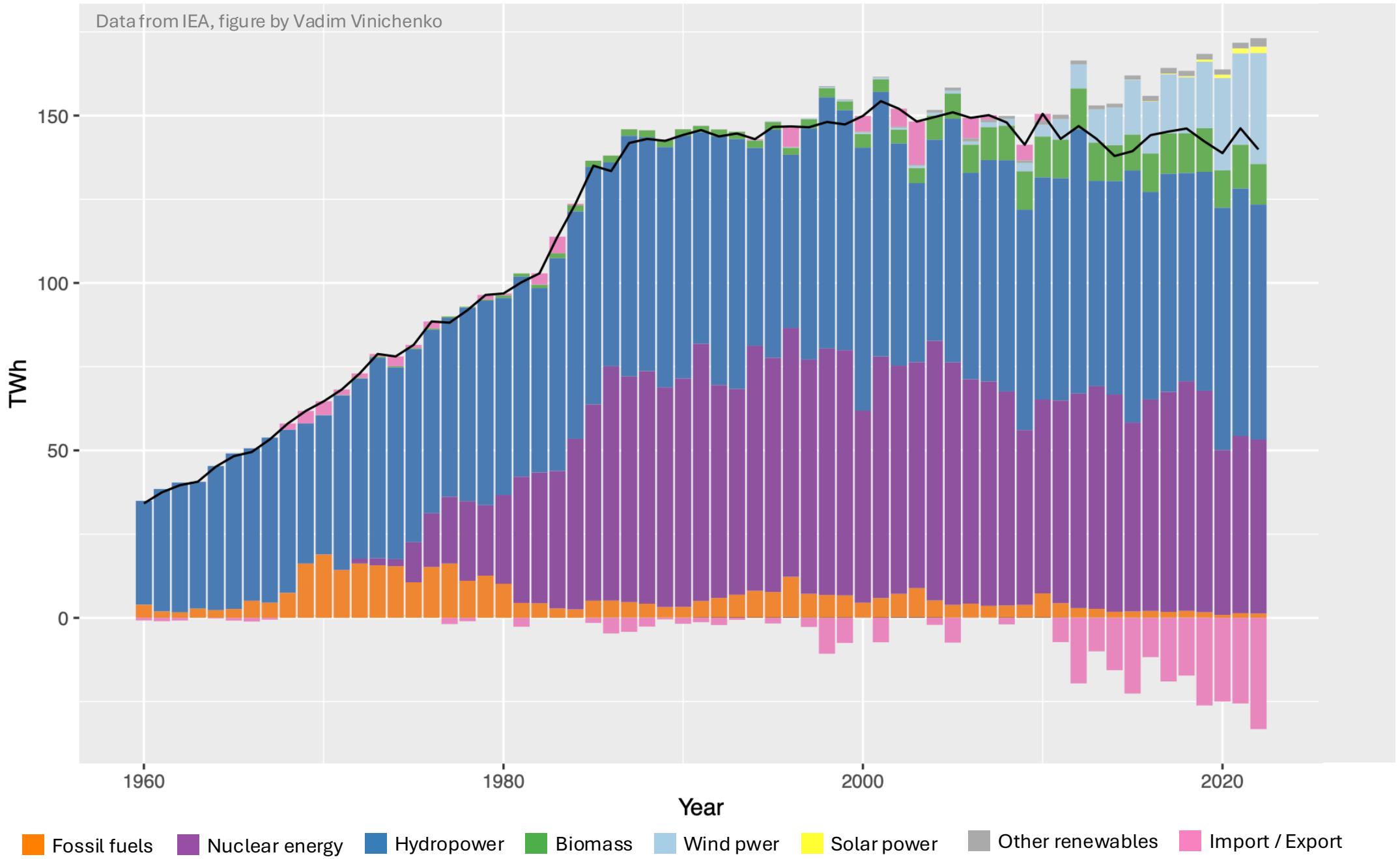
Pulsating growth patterns of onshore wind power in Sweden and Europe and its implications for future deployment

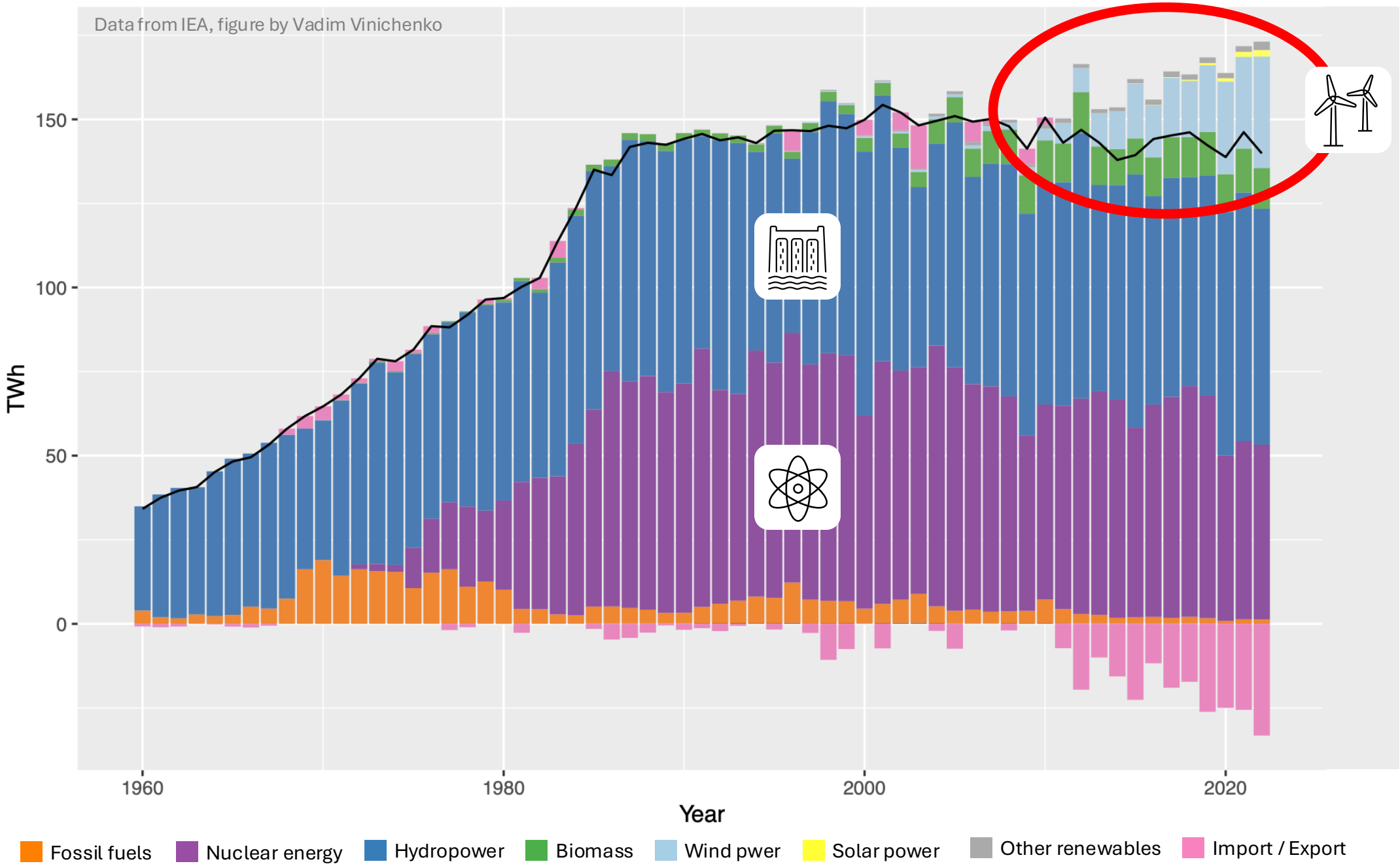
Marta Vetier | Postdoc | Chalmers University

24 April 2025

Onshore wind power in Sweden

Historically and compared to other European countries


Data from IEA, figure by Vadim Vinichenko
150
100
50
0
TWh
1960
1980
2000
2020
Year
Fossil fuels
Nuclear energy
Hydropower
Biomass
Wind pwer
Solar power
Other renewables
Import / Export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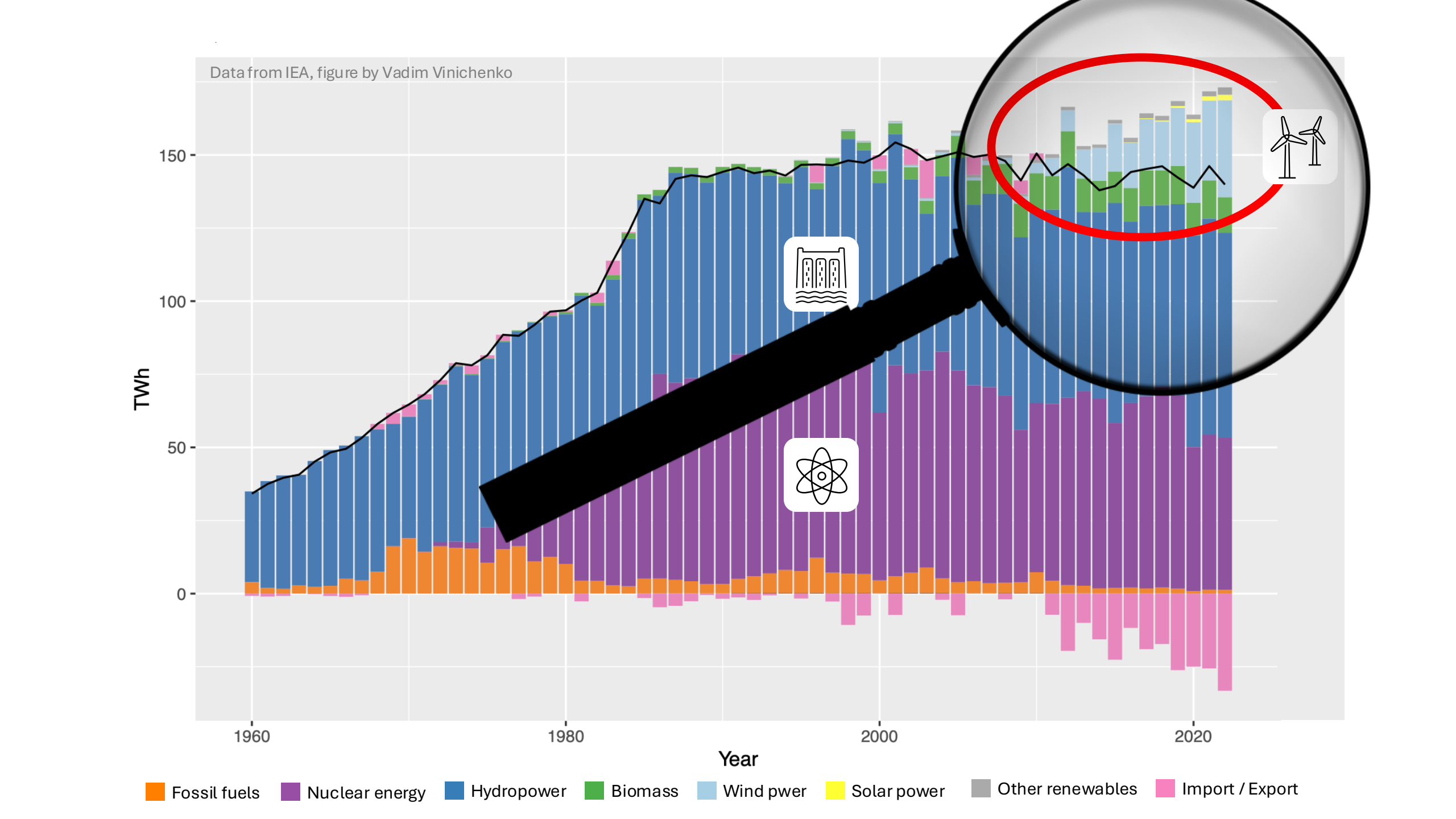
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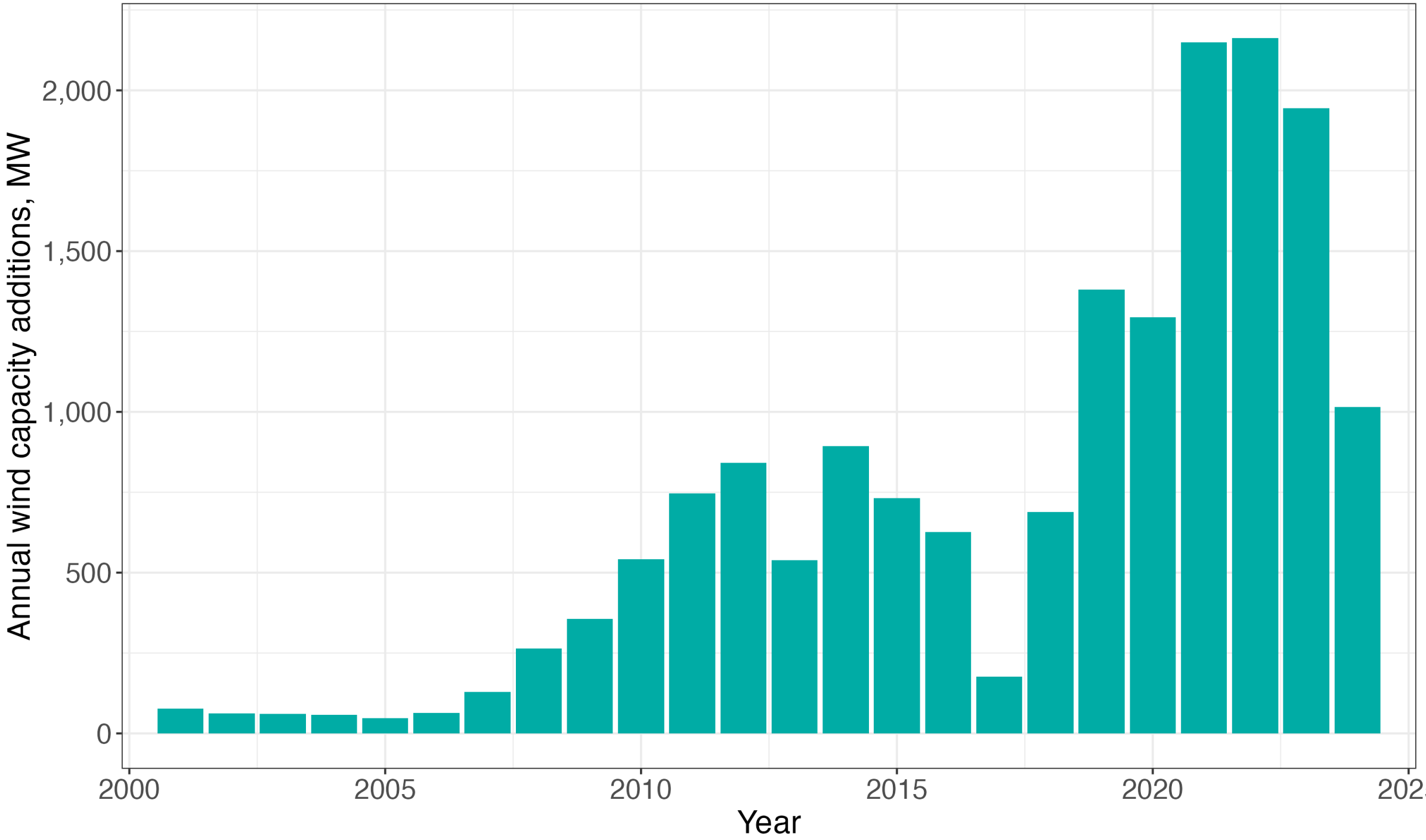
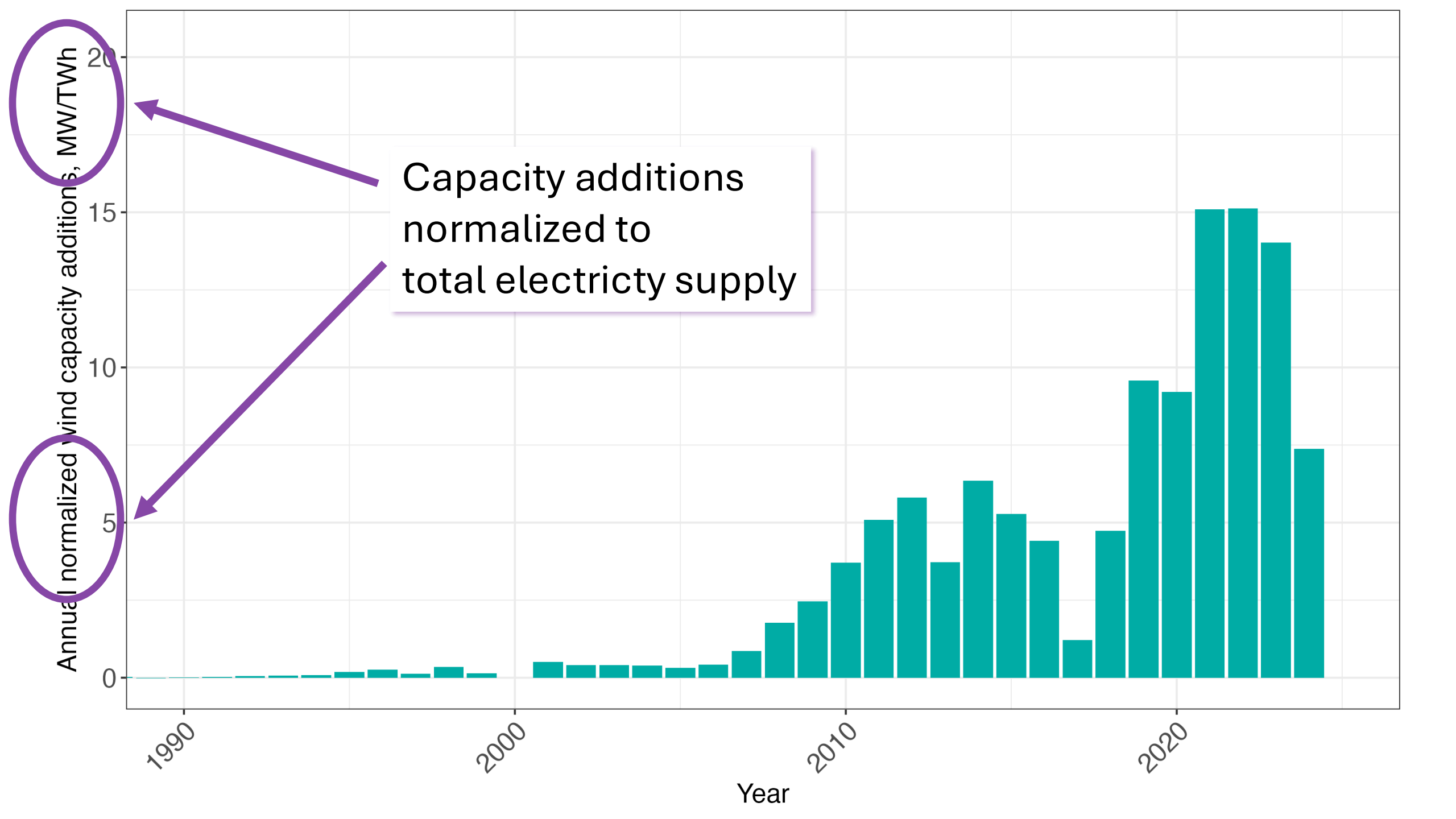
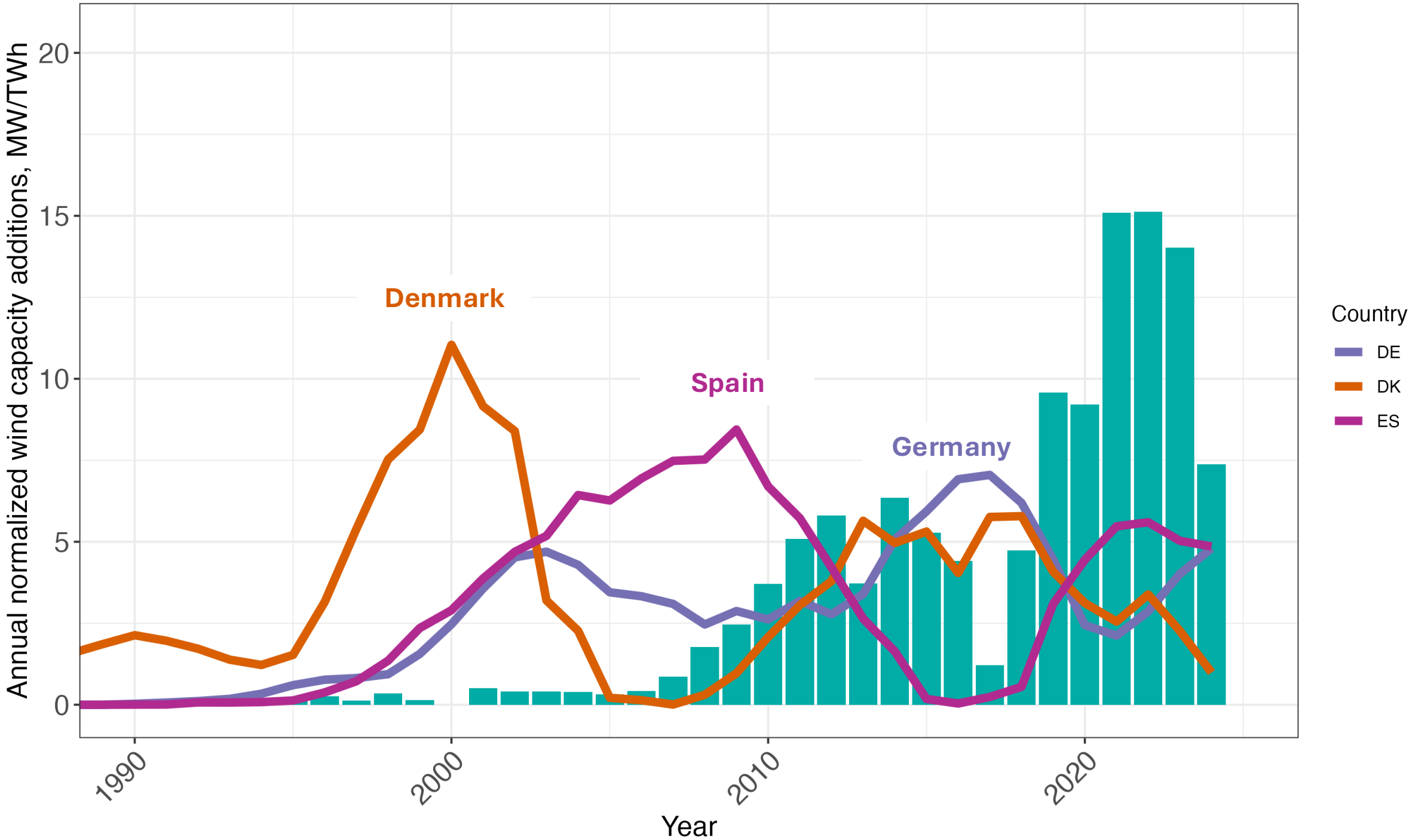
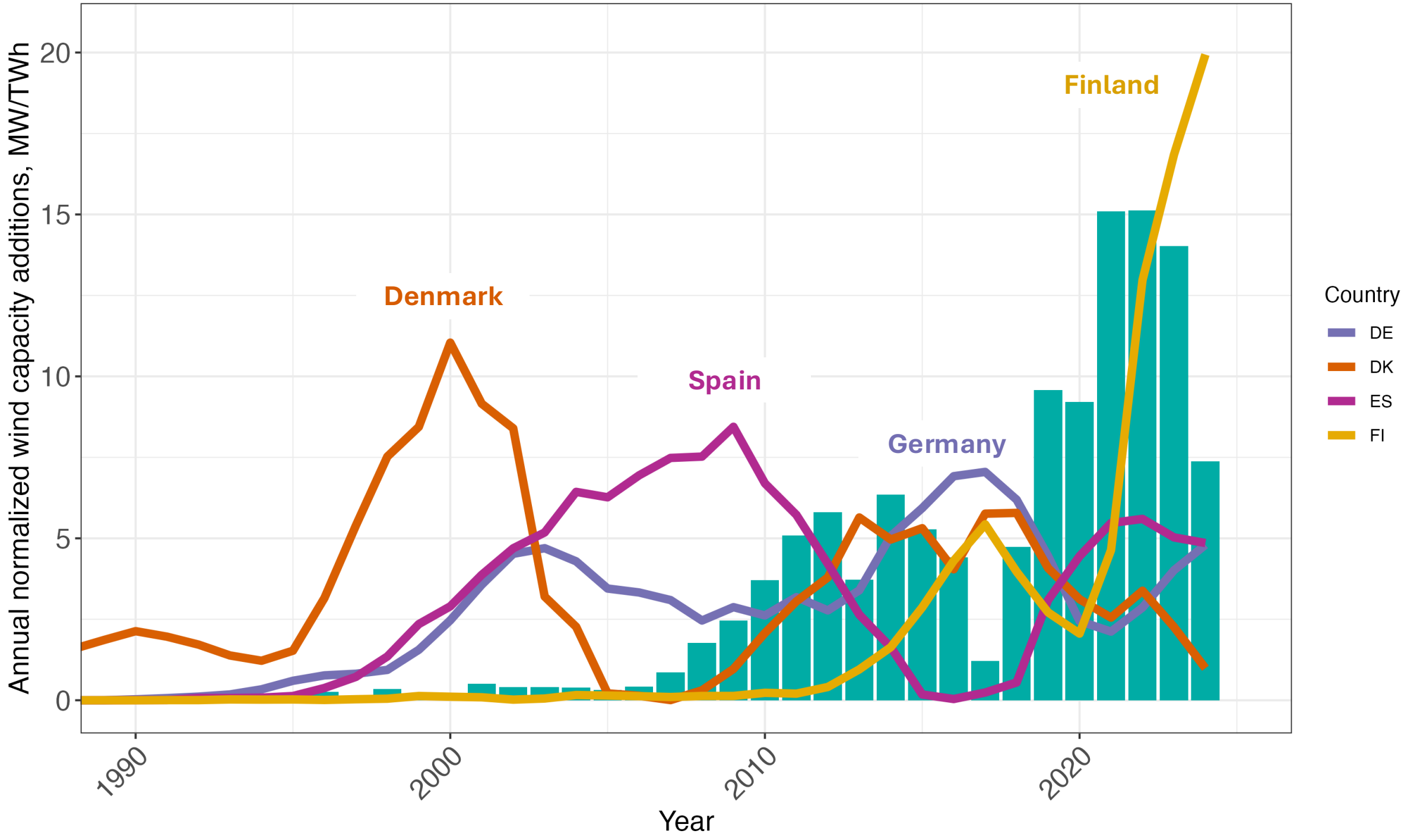

Annual wind capacity additions, MW
2,000
1,500
1,000
500
0
2000
2005
2010
2015
2020
Year


Annual normalized wind capacity additions, MW/TWh
20
15
10
5
0
1990
2000
2010
2020
Year
Capacity additions normalized to total electricty supply


Annual normalized wind capacity additions, MW/TWh
20
15
10
5
0
Denmark
Spain
Germany
1990
2000
2010
2020
Year
Country
DE
DK
ES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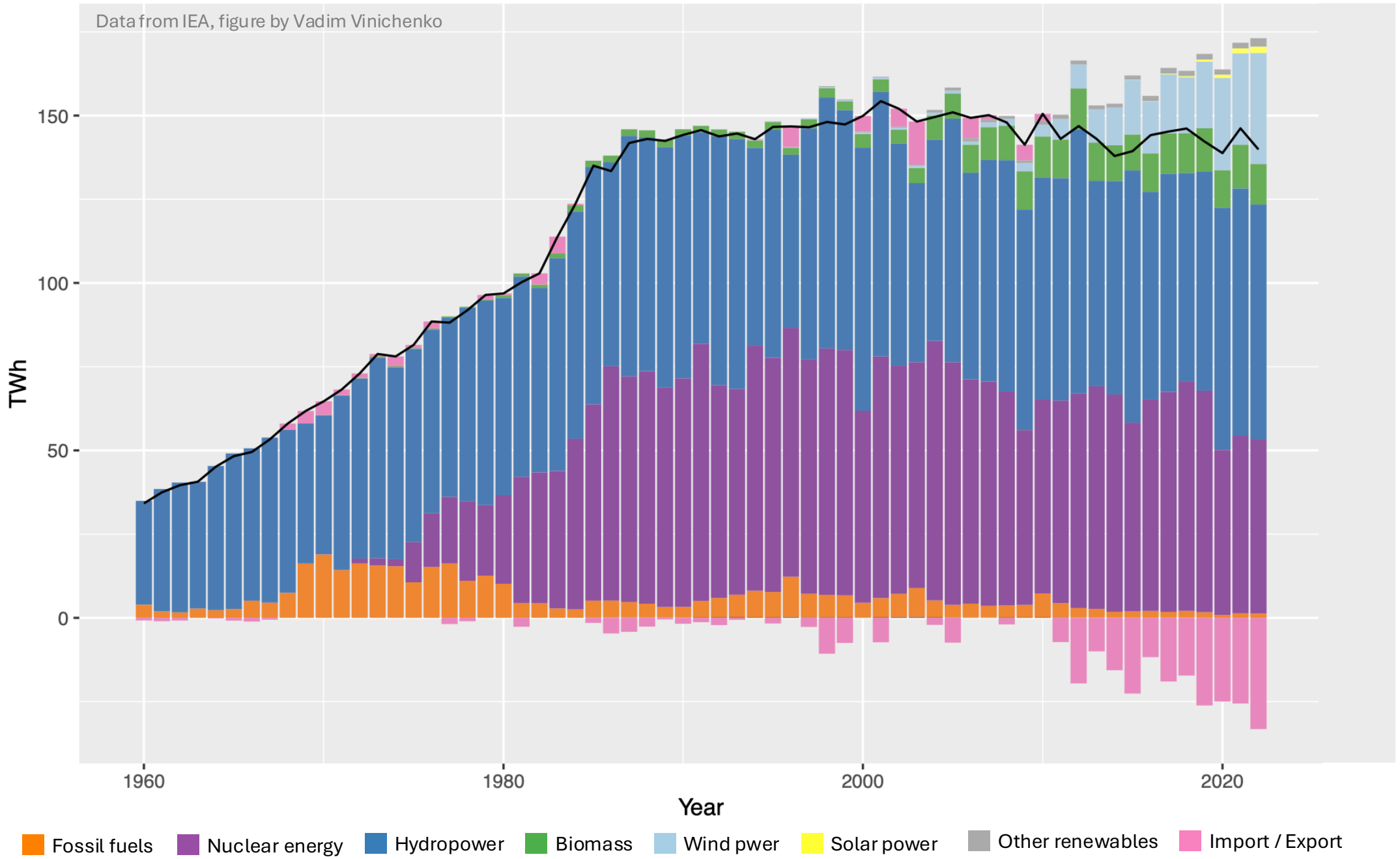
Finland
Country
DE
DK
ES
FI

Future of onshore wind power

Scenarios and forecasts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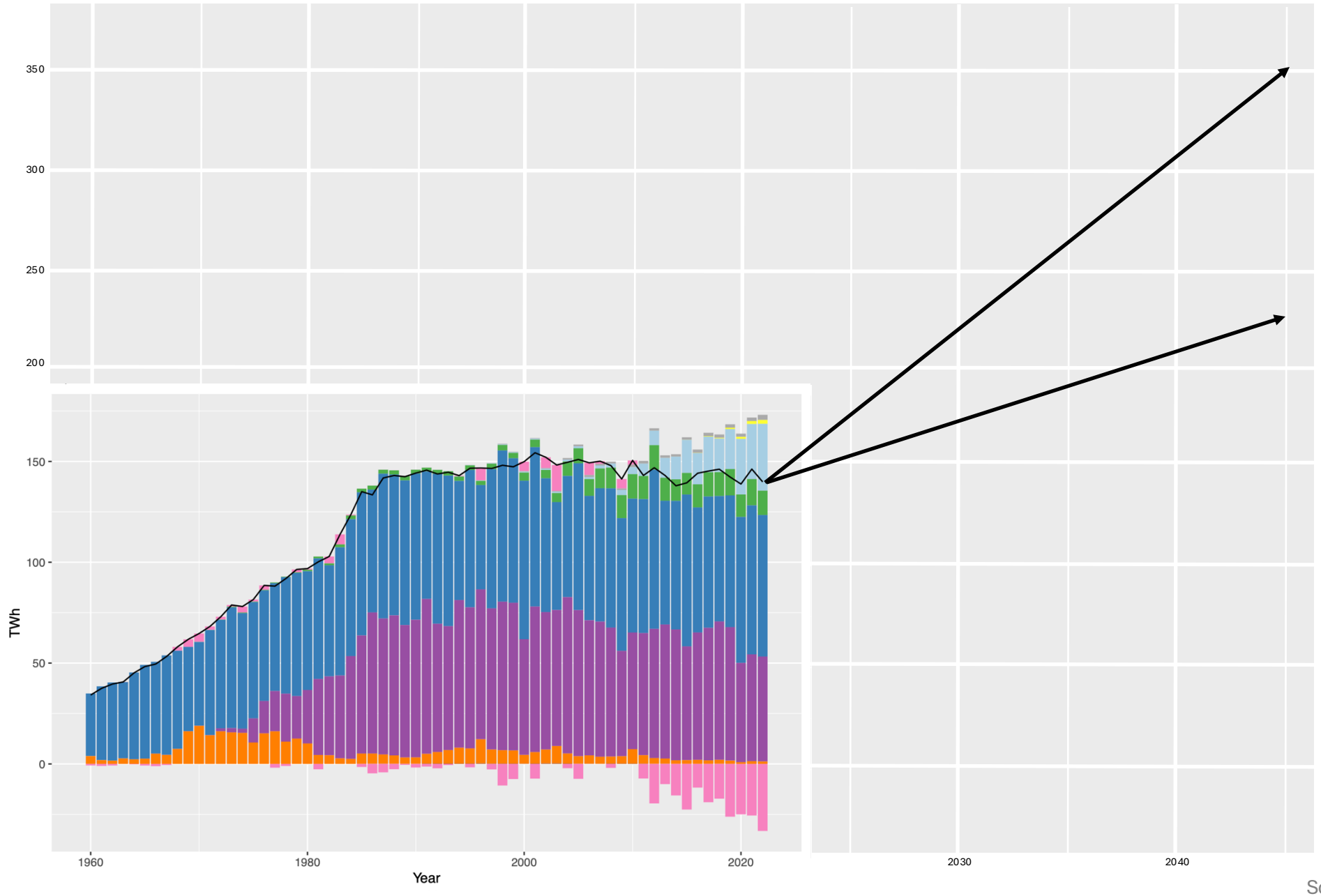
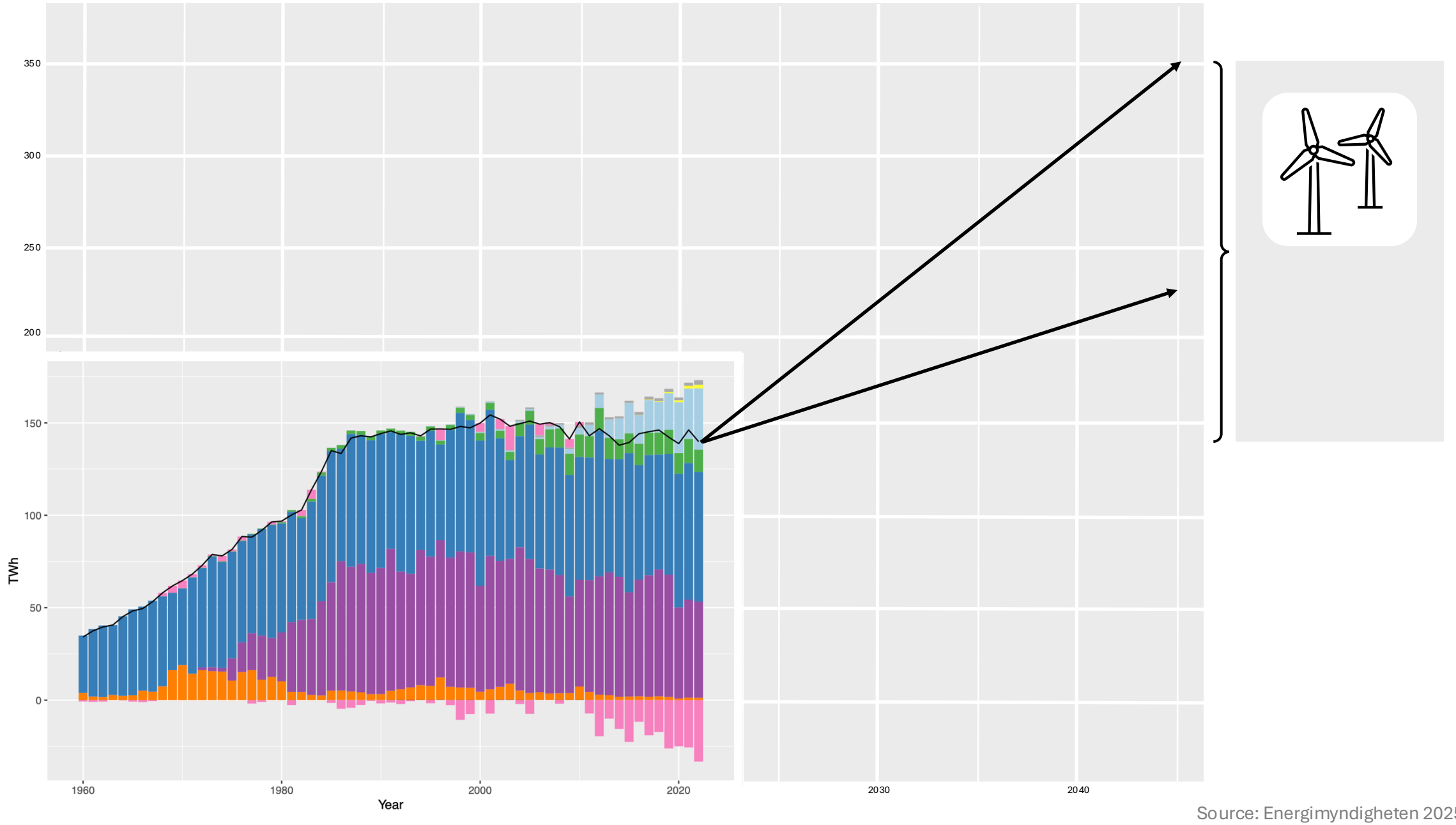


International growth
357 TWh | + 120%

Regional supply
223 TWh | + 40%

Source: Energimyndigheten 2025



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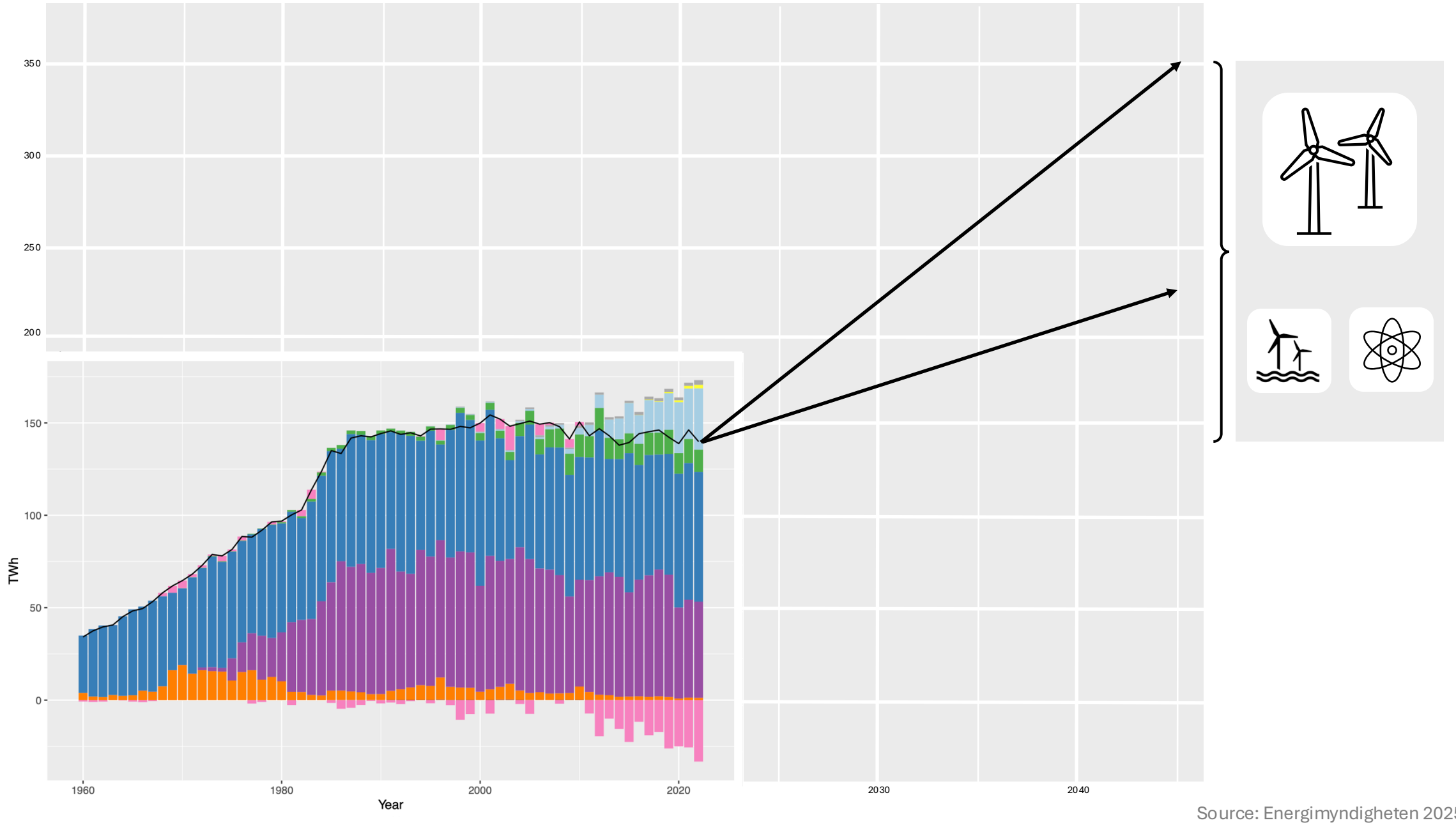
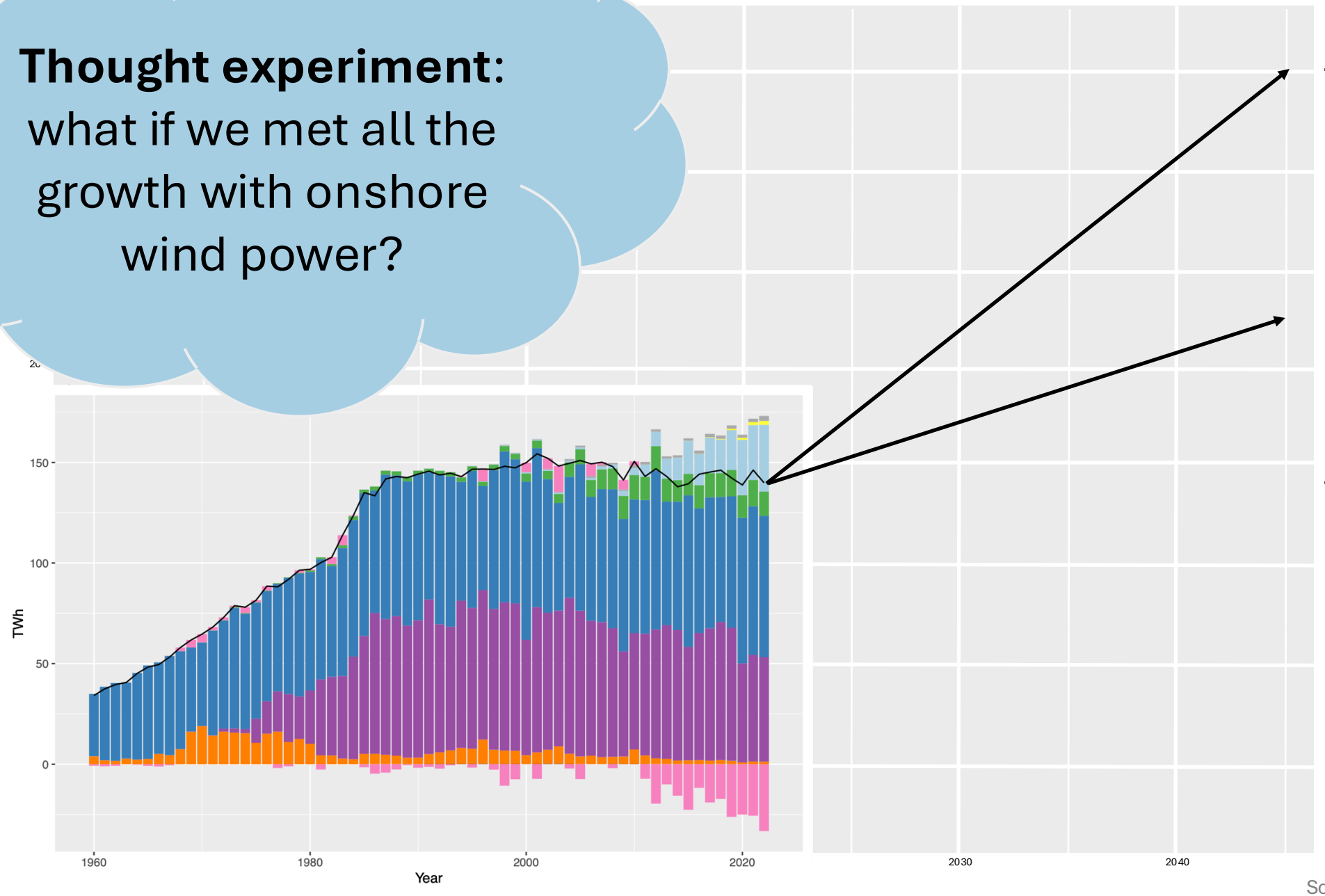


Source: Energimyndigheten 2025

Thought experiment: what if we met all the growth with onshore wind power?



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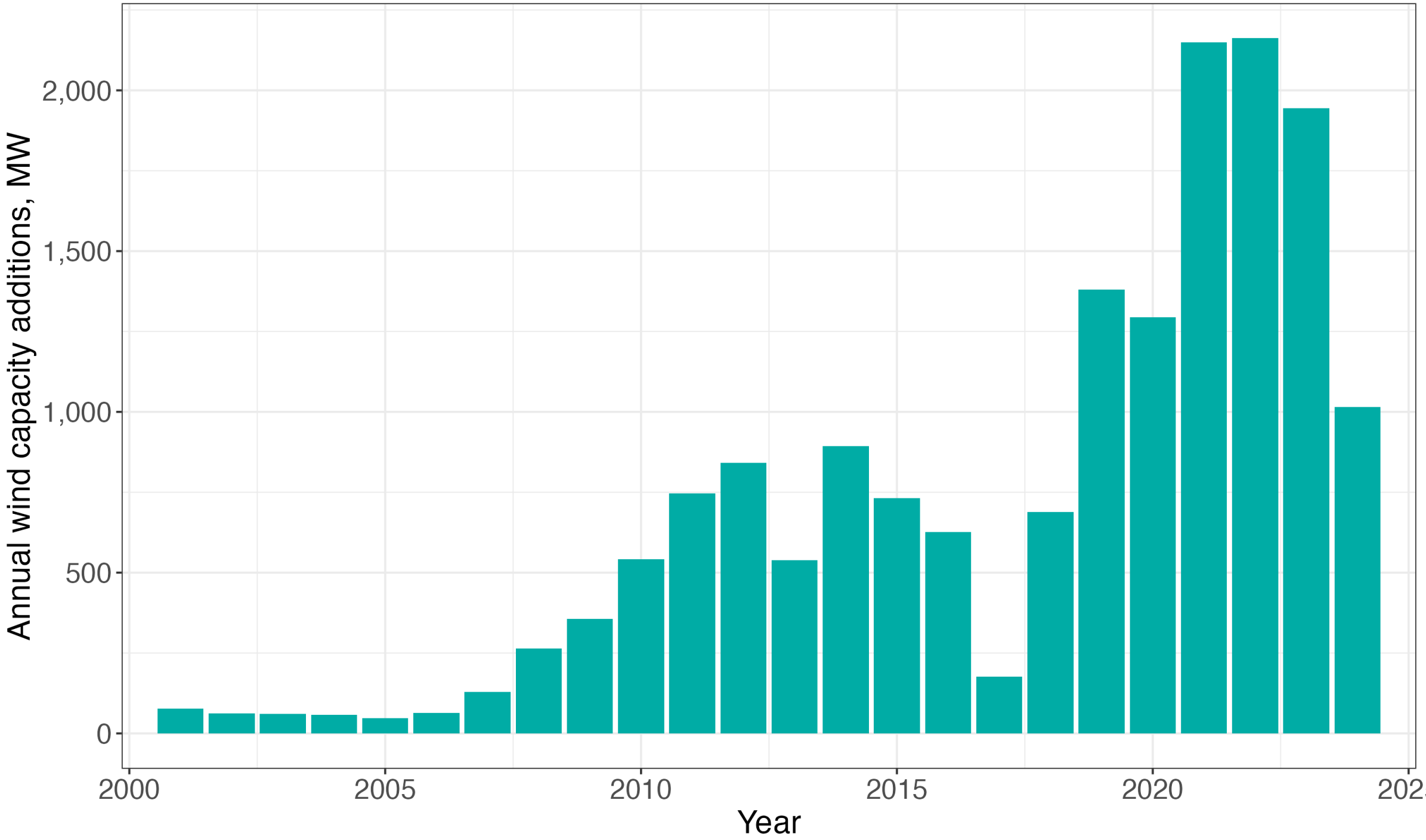
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1,500
1,000
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2005
2010
2015
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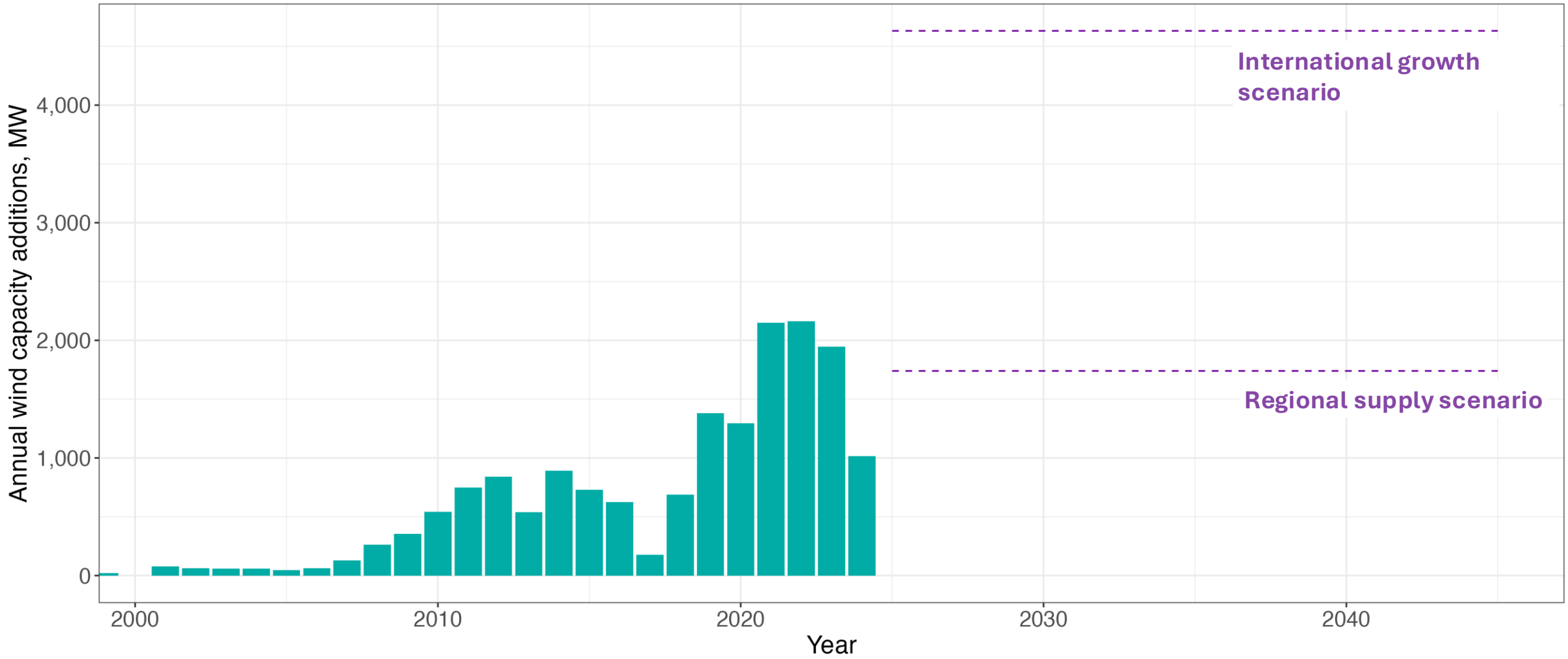
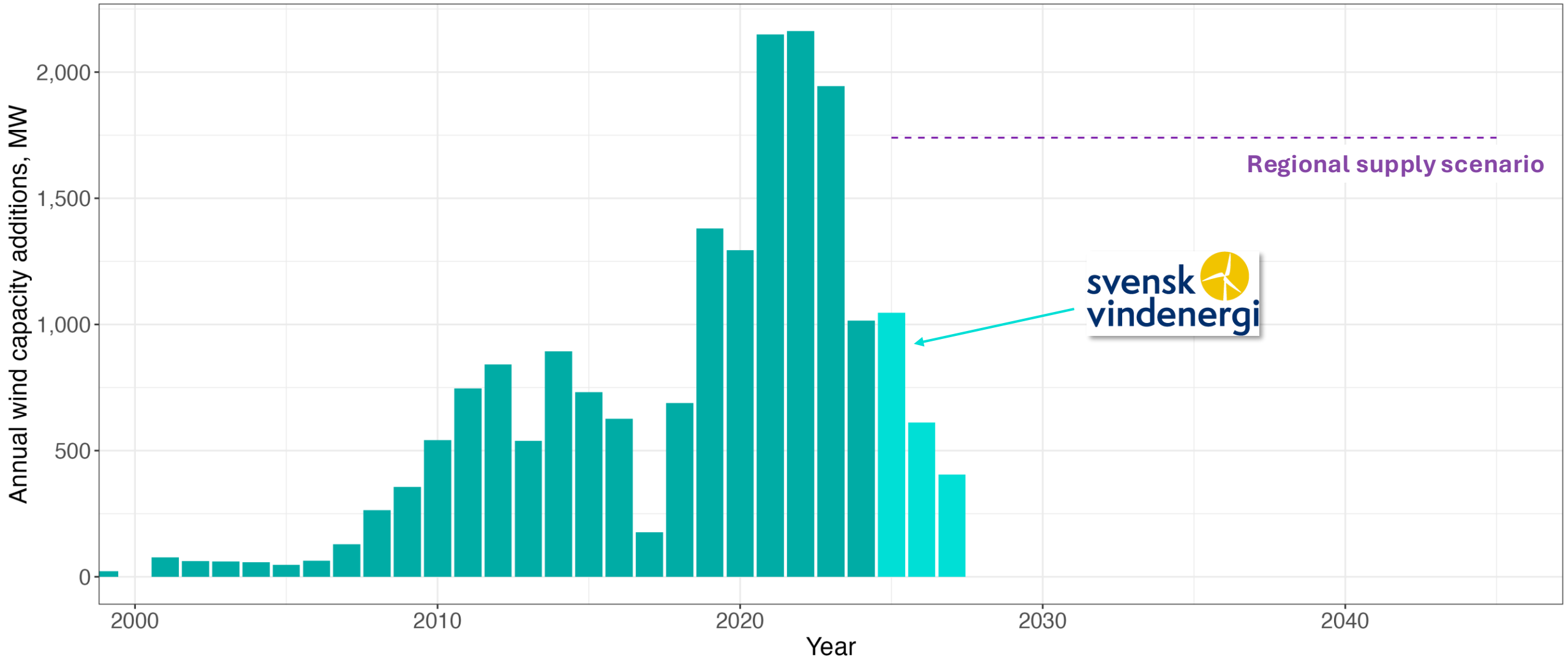
Year


Annual wind capacity additions, MW
4,000
3,000
2,000
1,000
0
2000
2010
2020
2030
2040
Year
International growth scenario
Regional supply scenario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1,000
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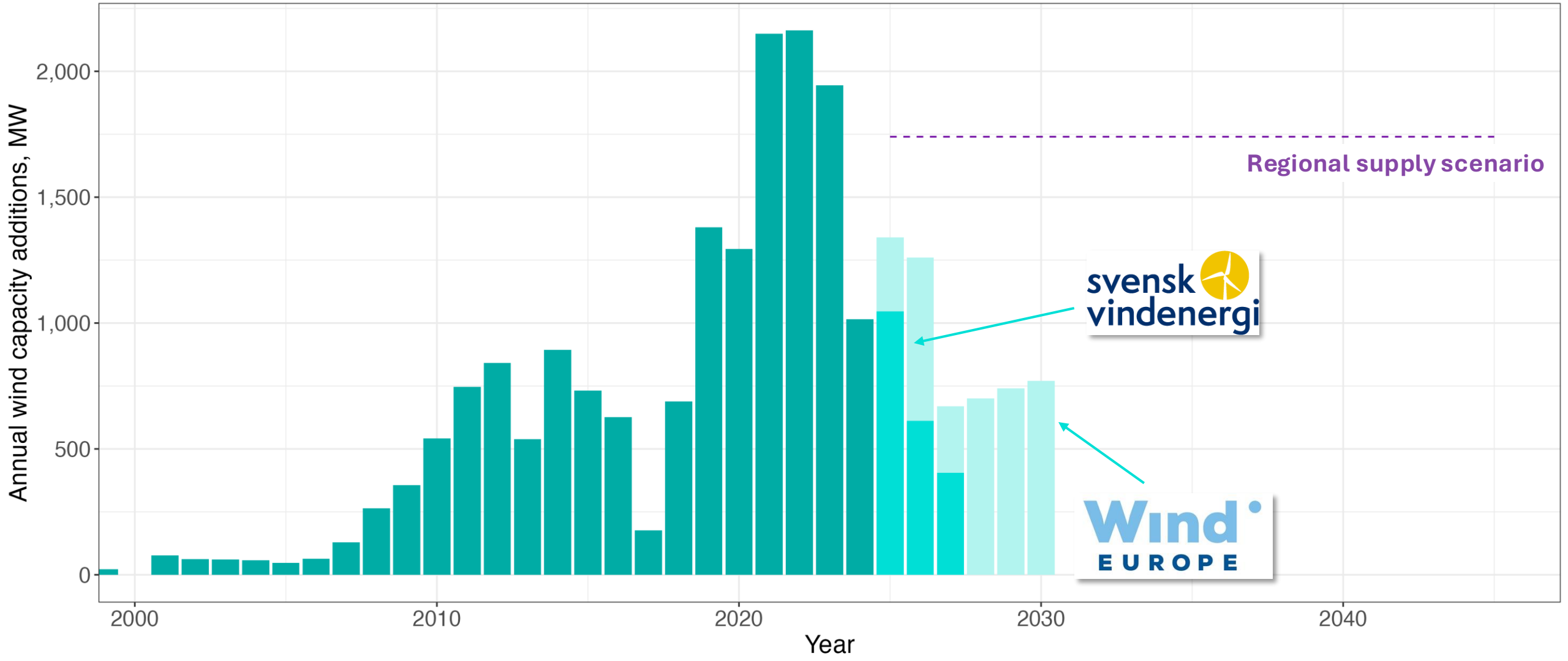
2030
2040
Year
Regional supply scenario
svensk vindenergi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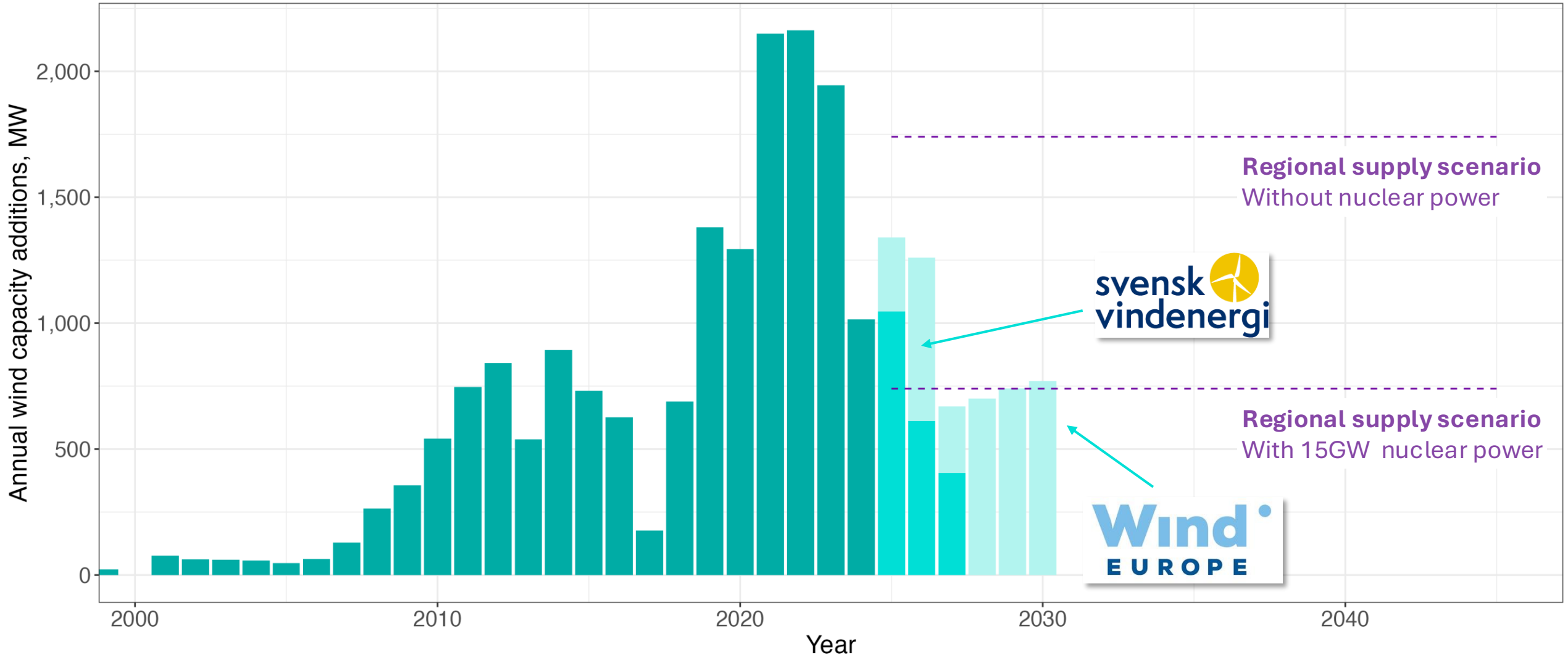
2030
2040
Year
Regional supply scenario
svensk vindenergi
Wind EUROPE


Annual wind capacity additions, MW
2,000
1,500
1,000
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0
2000
2010
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2030
2040
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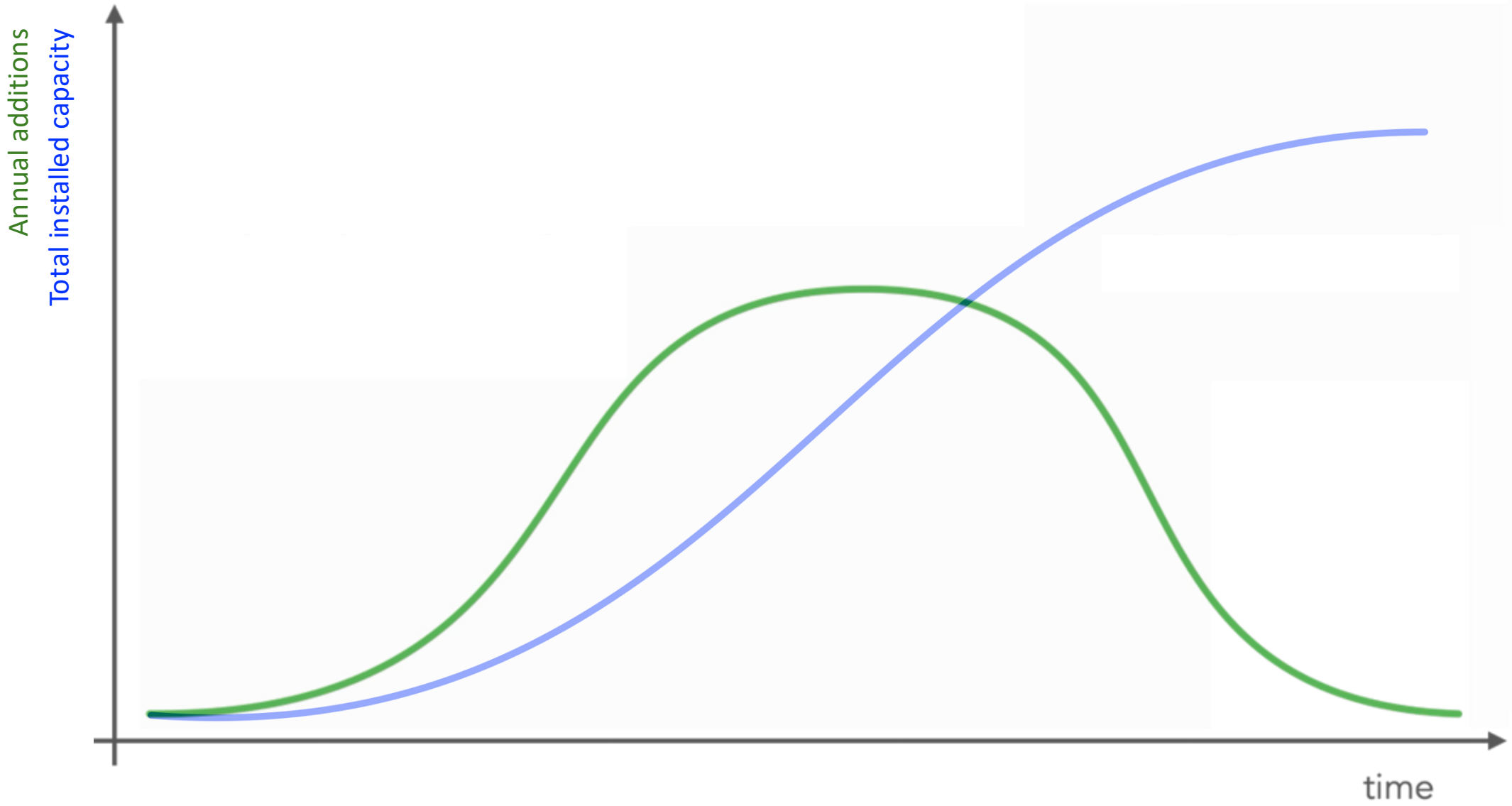
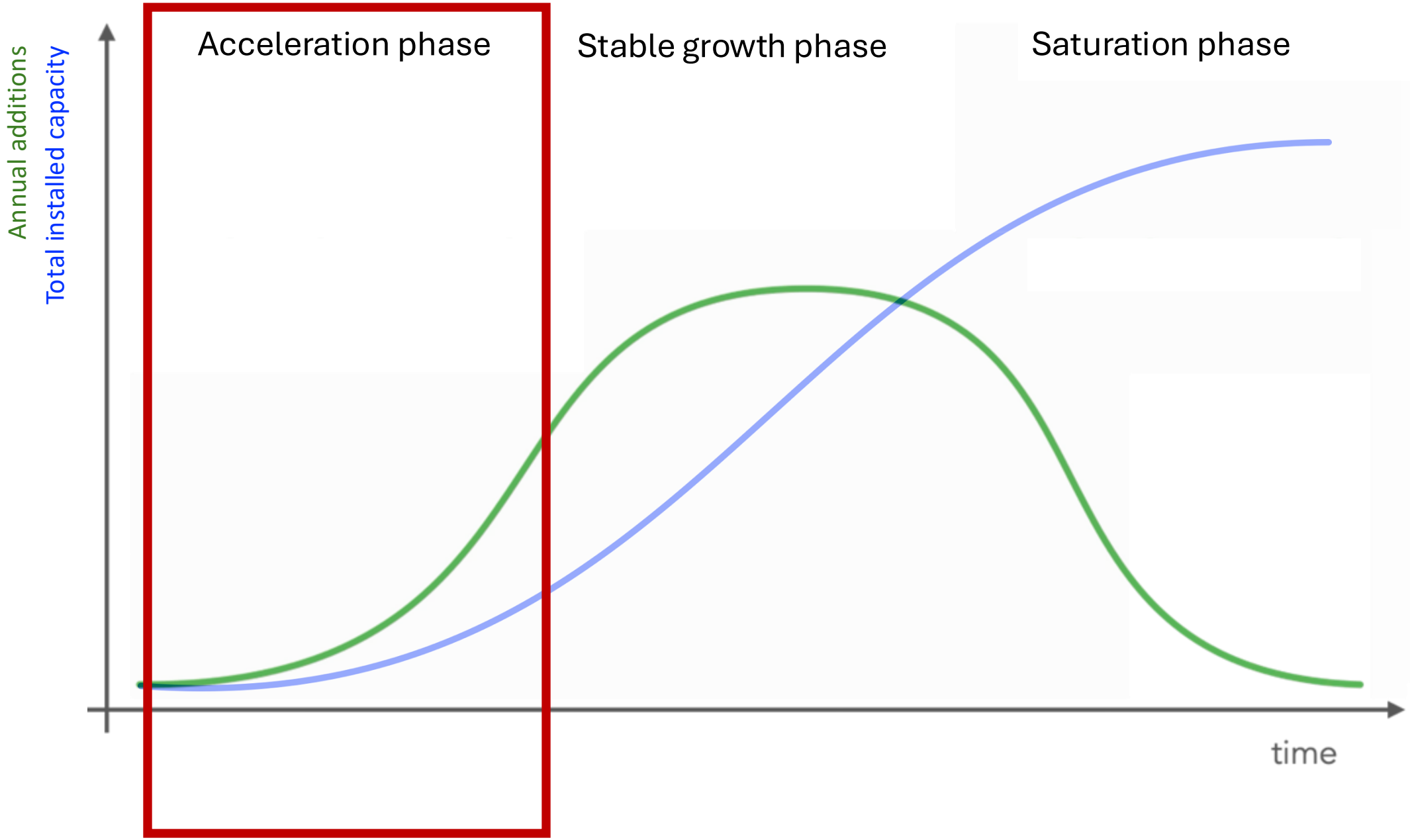
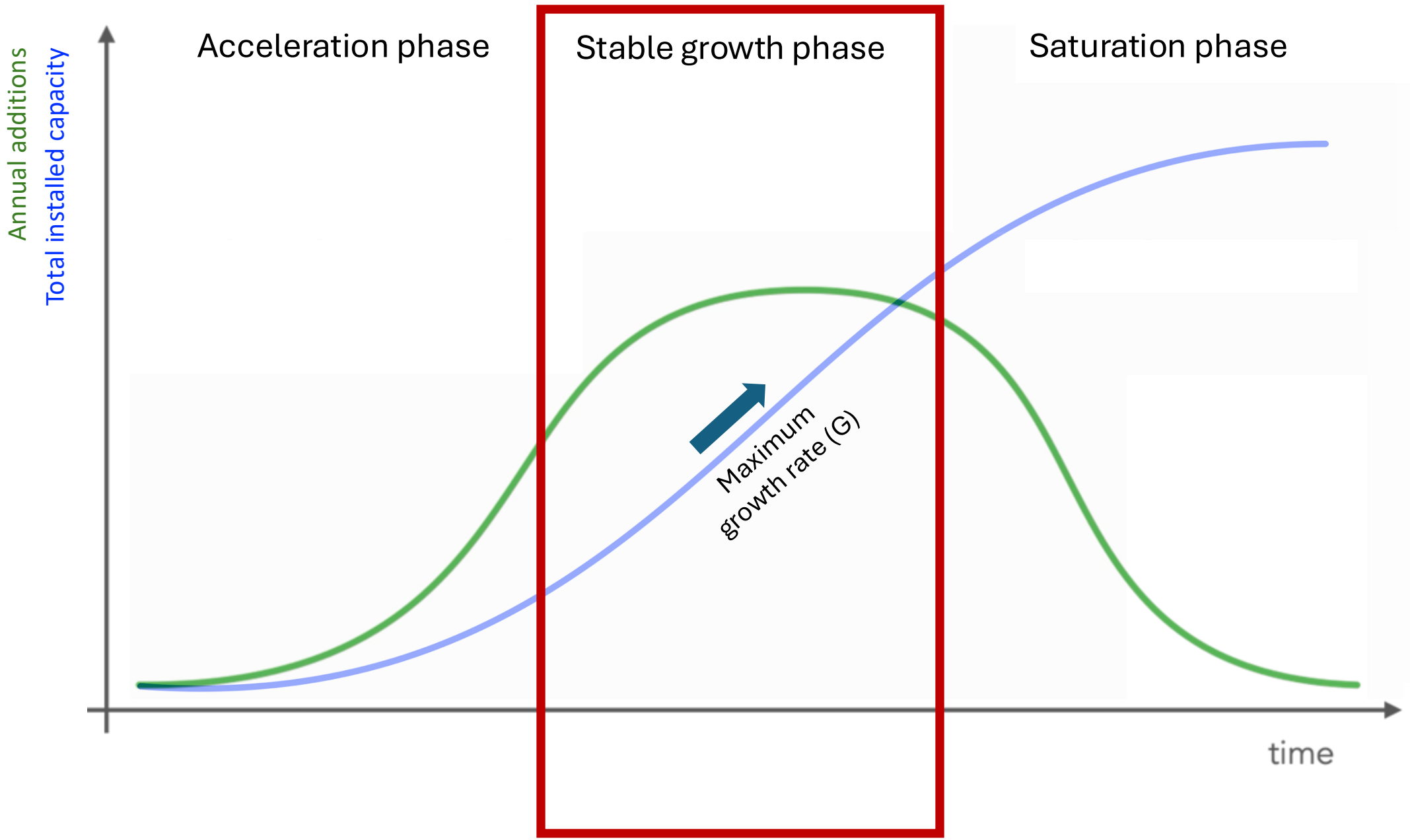
Regional supply scenario
Without nuclear power
Regional supply scenario
With 15GW nuclear power
svensk vindenergi
Wind EUROPE

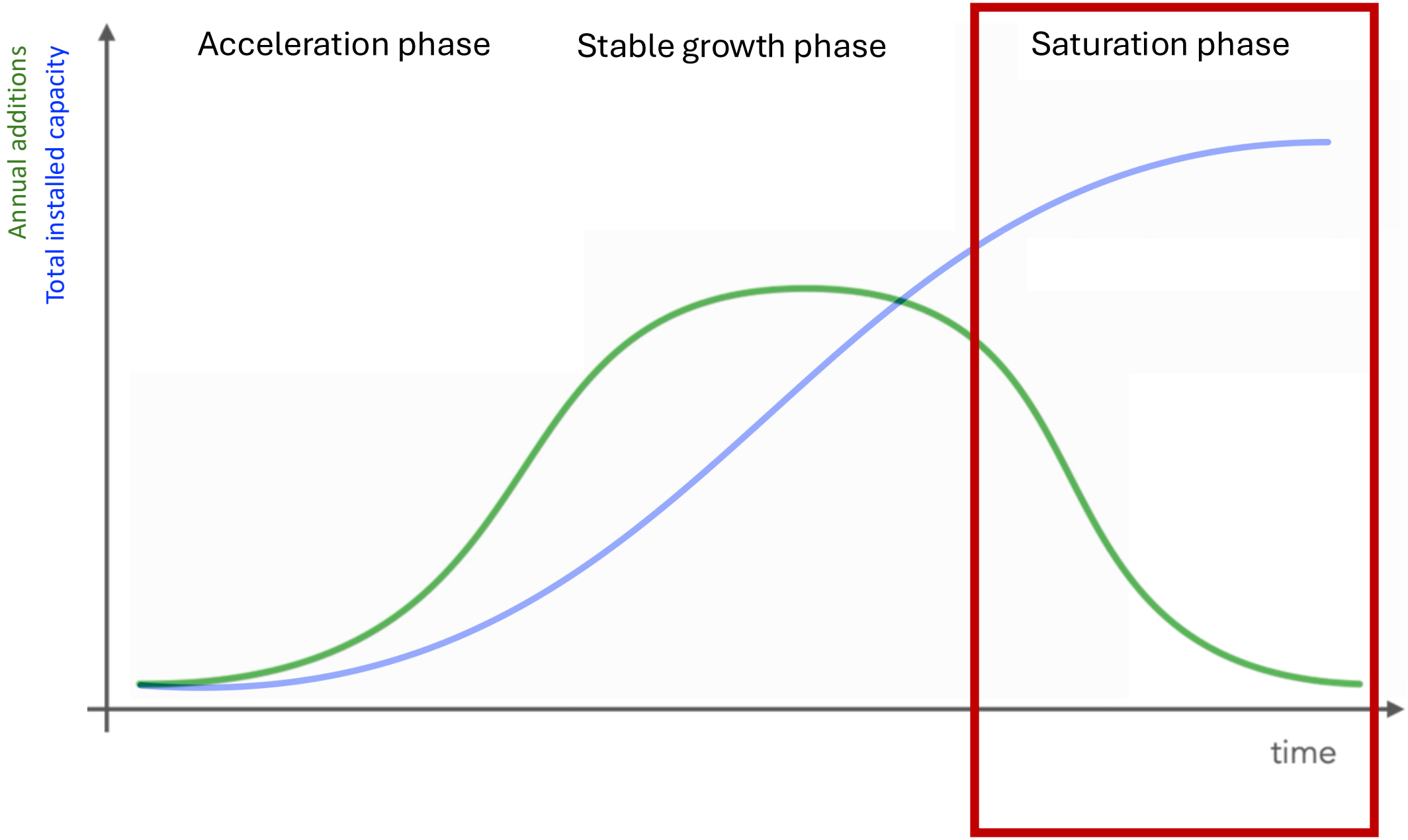
Technology growth

Growth pulses


Annual additions
Total installed capacity
time


Acceleration phase
Stable growth phase
Saturation phase
Annual additions
Total installed capacity
time


Annual additions
Total installed capacity
Acceleration phase
Stable growth phase
Saturation phase
Maximum growth rate (G)
time


Annual additions
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Saturation phase
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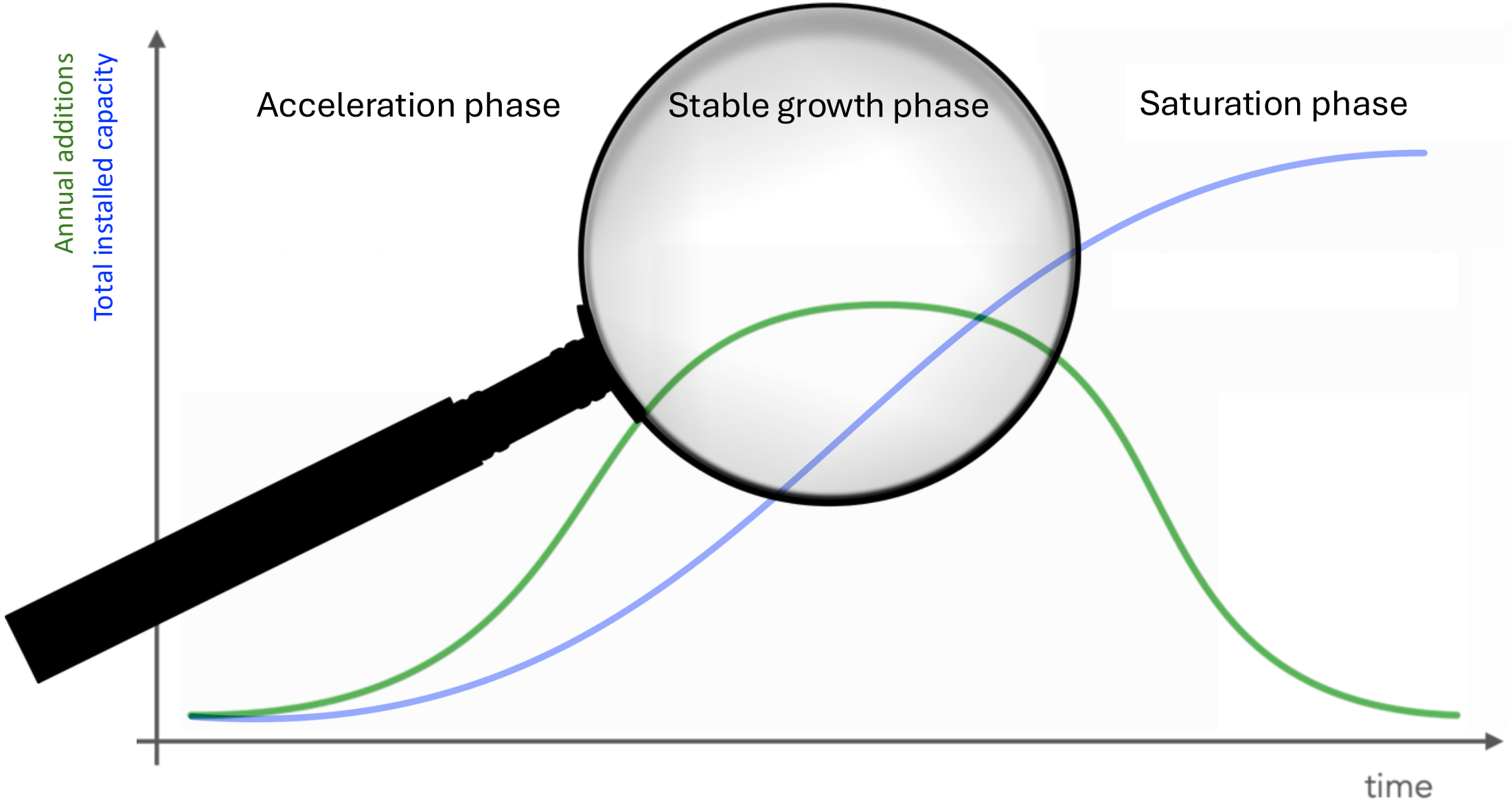
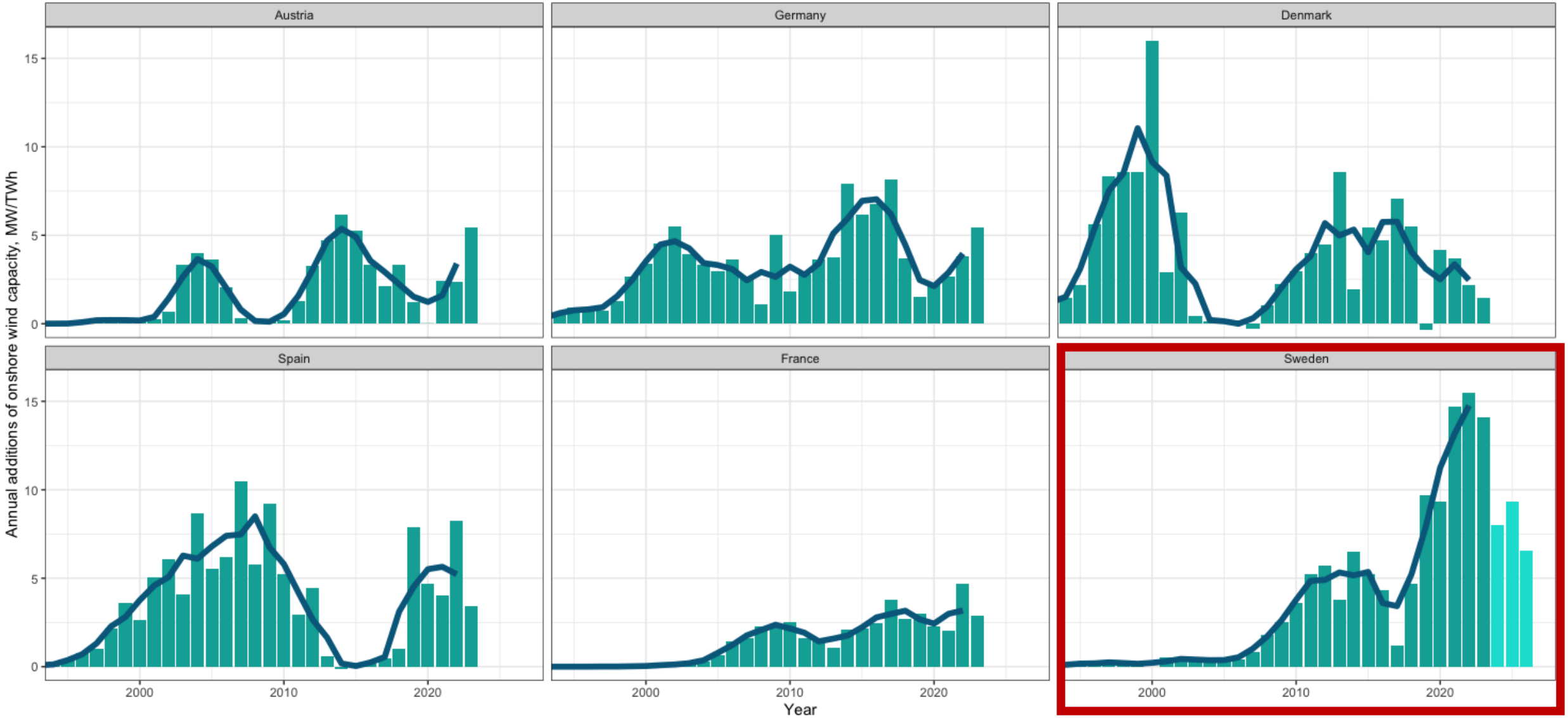
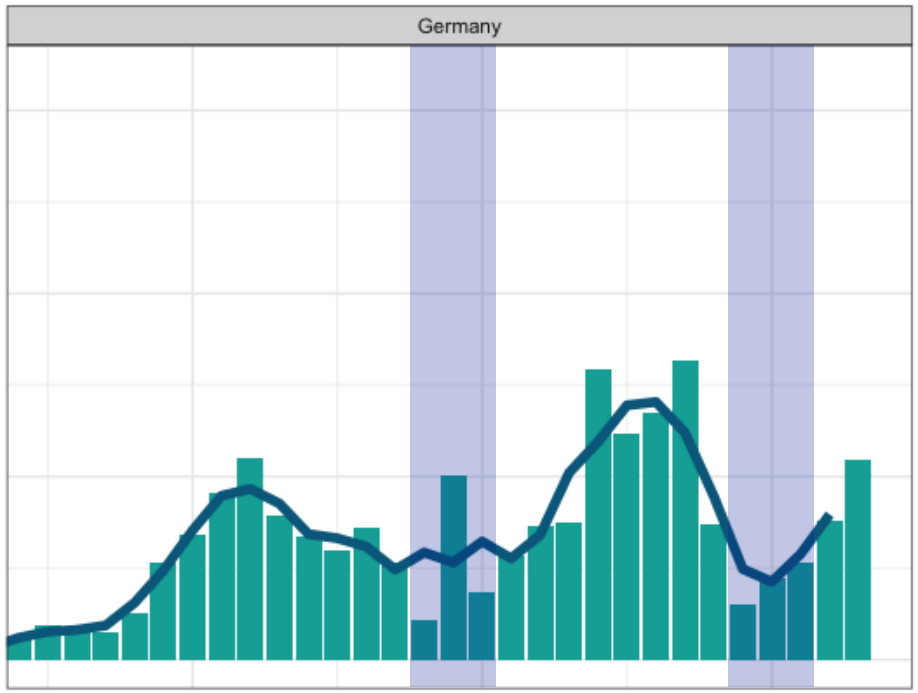

Annual additions
Total installed capacity
Acceleration phase
Stable growth phase
Saturation phase
time

Growth comes in pulses





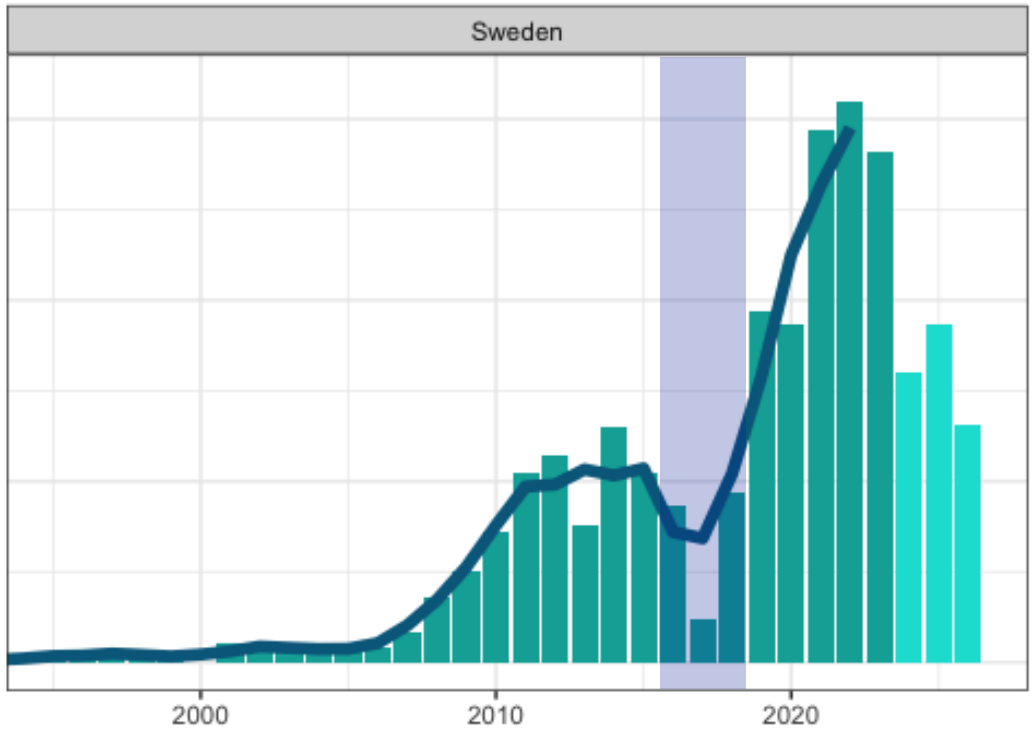
1st pulse

TP1

2nd pulse

TP2

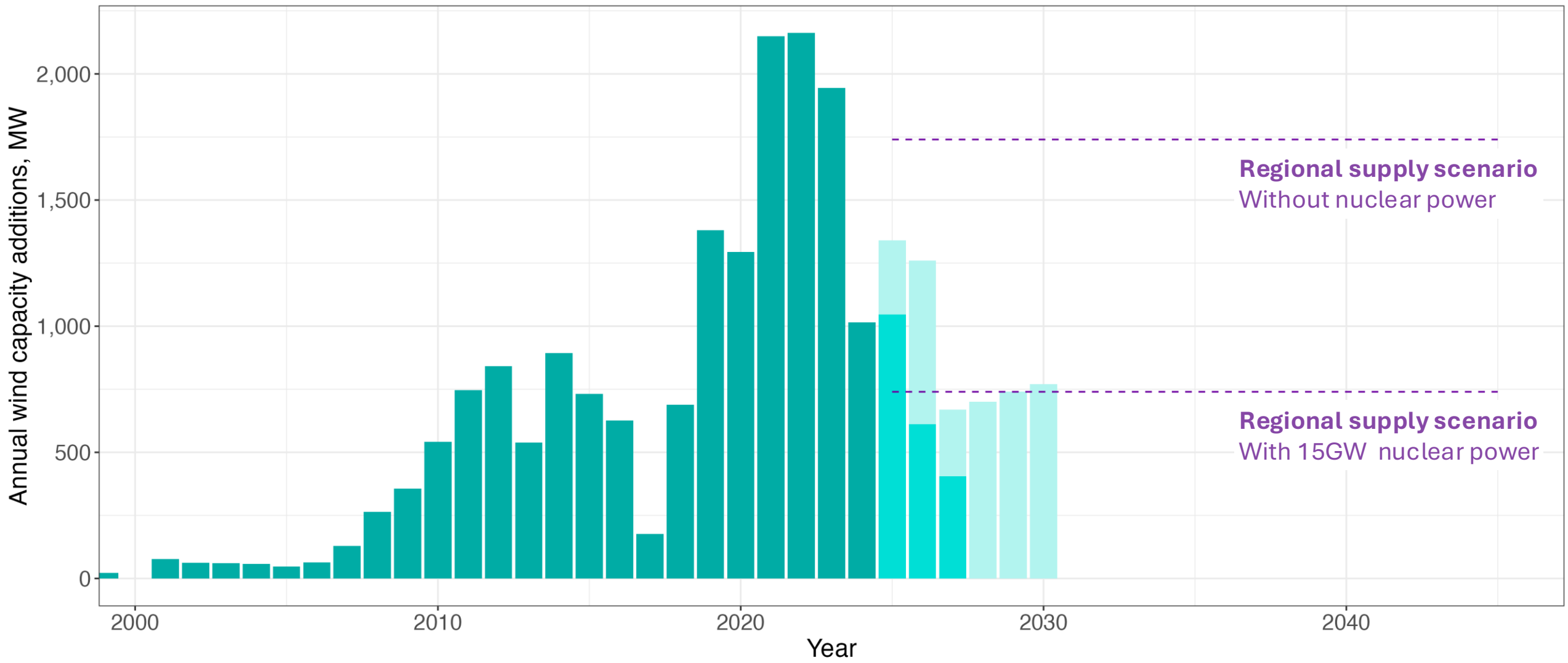
3rd pulse



1st pulse

Turning point

2nd pulse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Without nuclear power
Regional supply scenario
With 15GW nuclear power

Starting the next growth pulse

Policies for re-accelerating growth

Policies for re-accelerating growth

Challenges: public and incumbent opposition, increasing pressures on land use, labor market conditions, and system integration

Policy aims: re-accelerate growth and manage barriers

Instruments to tackle emerging challenges:

- Regulatory simplification
- Compensation measures
- Increasing land availability
- Revisions to the electricity market

Summary

- Sweden has added onshore wind power at record-fast rates in the last years
- Onshore wind power additions in the next decade(s) are needed to meet growth in electricity demand
- Forecasts show a slowdown in deployment
- End of the second growth pulse, but not the end of wind power in Sweden
- The mechanisms driving slowdown need to be addressed to allow re-acceleration

Thank you for your attention!

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