

# Vindkraftsutbyggnad



Svk Drifråd  
2020-06-03

# Agenda

- Statistik & prognos Q1 2020
- Scenario 2040
- Vad innebär 90 TWh vindkraft?
  - Utbyggnad 2017-2019
  - Utbyggnad 2020-2022
  - Utbyggnad 2022-2040
  - Förändrad marknad
  - Kapacitetsfaktor & tillgänglighet
- Utmaningar

# Installations in 2020

## Total by the end of 2019

Turbines: 4 099

Capacity: 8 986 MW

Actual production: 19,5 TWh\*

Annual production (estimated): 24,7 TWh\*\*

*\* Actual production is the real production and depends on wind conditions and when installations are made during the year.*

## Added capacity in 2020

1st quarter: 207,8 MW (actual)

2nd quarter: 187,0 MW (forecast)

3rd quarter: 604,7 MW (forecast)

4th quarter: 830,6 MW (forecast)

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**Total: 1830,1 MW**

*\*\* Estimated annual production is the annual production the turbines are expected to produce when in operation during a whole year with normal wind conditions.*

## Total by the end of 2020 - forecast

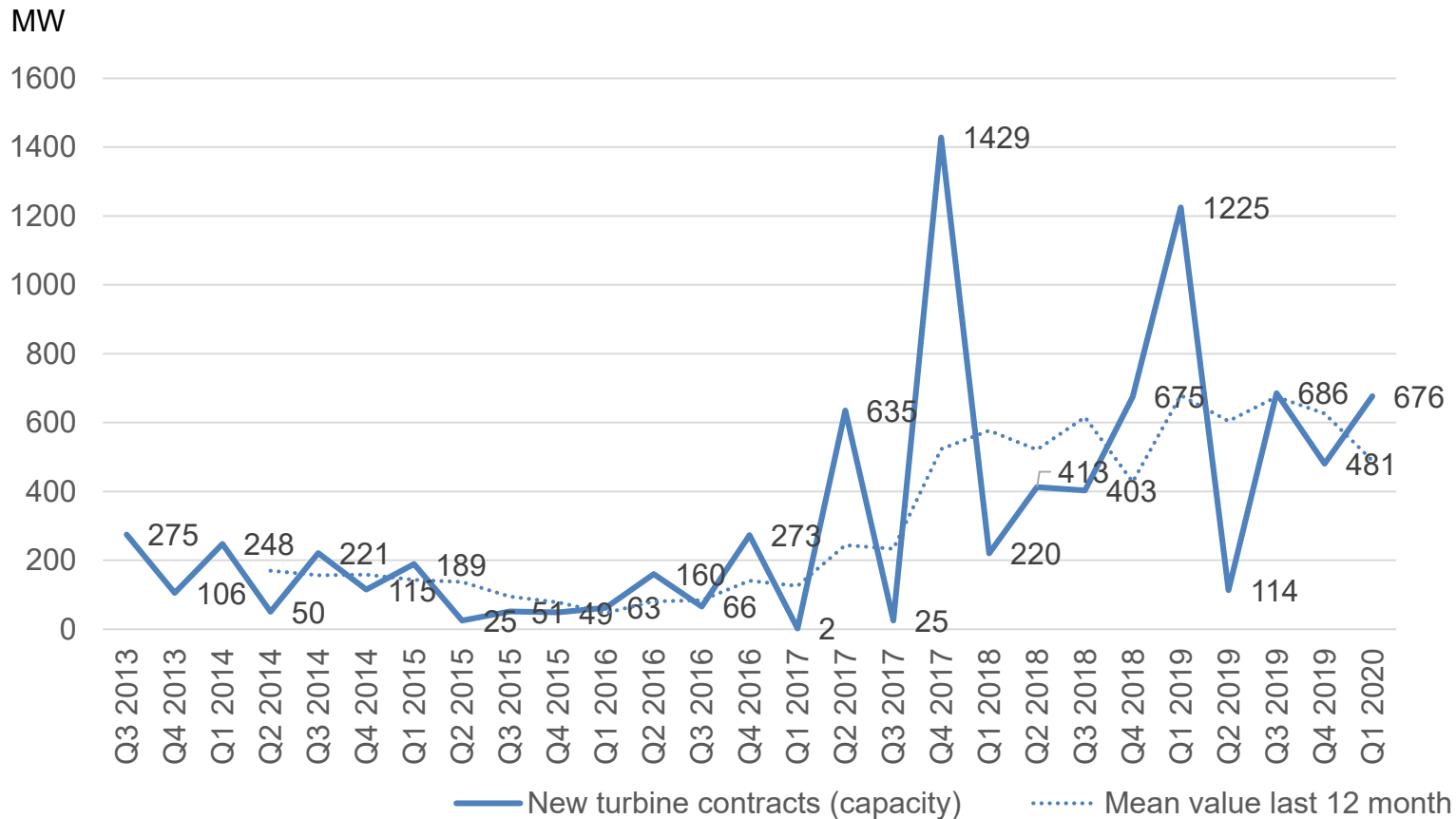
Turbines: 4 540

Capacity: 10 816 MW

Actual production: 26,6 TWh\*

Annual production (estimated): 30,9 TWh\*\*

# New turbine contracts\* (firm and binding)



\* Figures from all turbine manufacturers acting on the Swedish market

# Order books

Time plan according to turbine manufacturers for wind power installations during year (MW) \*

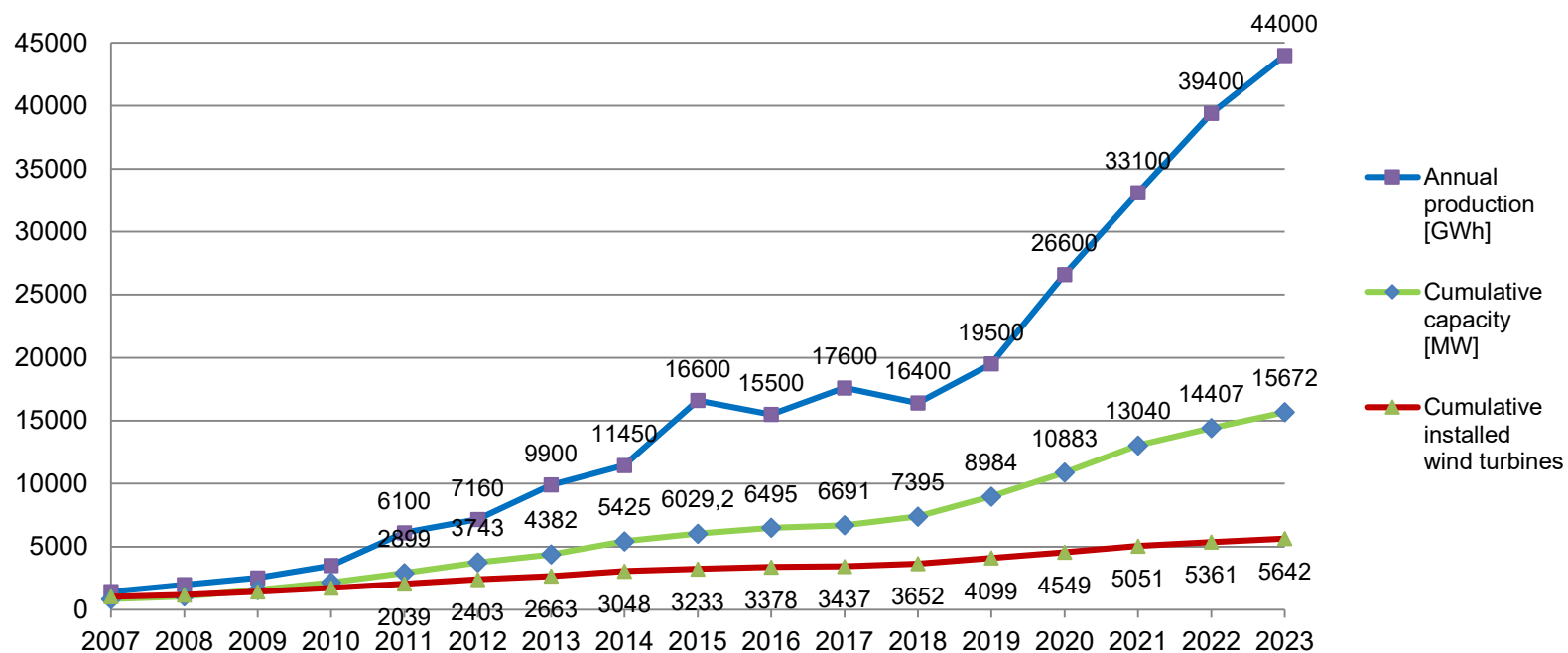
2019	2020 Q1	
1590	208	

\* Figures from all turbine manufacturers acting on the Swedish market

# Base case

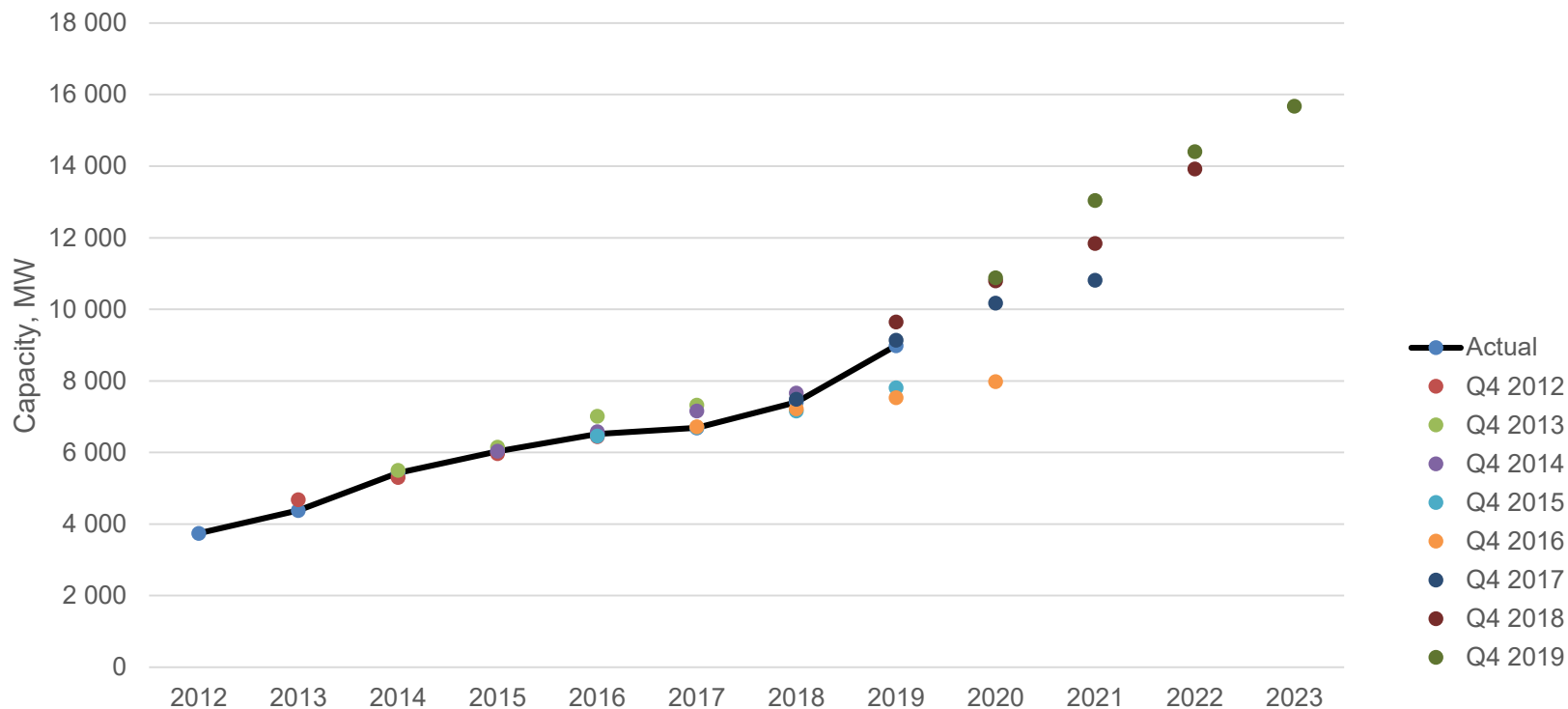
This scenario is the official forecast of Swedish Wind Energy Association

## Actual and forecast 2020-03-31



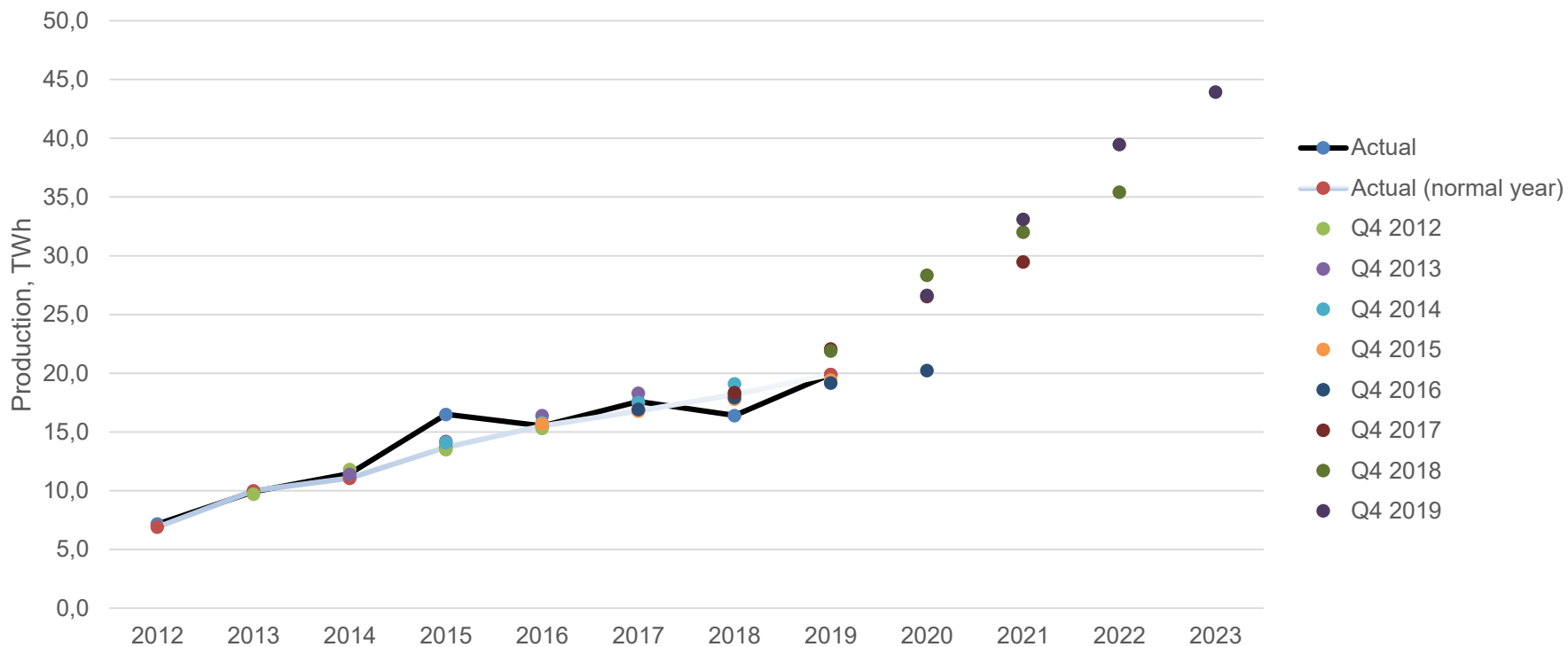
# Follow up

## Previous forecasts and actual installed wind power capacity



# Follow up

## Previous forecasts and actual annual wind power production





# Scenario 2040

The following slides are based on [SWEA's roadmap 2040](#).

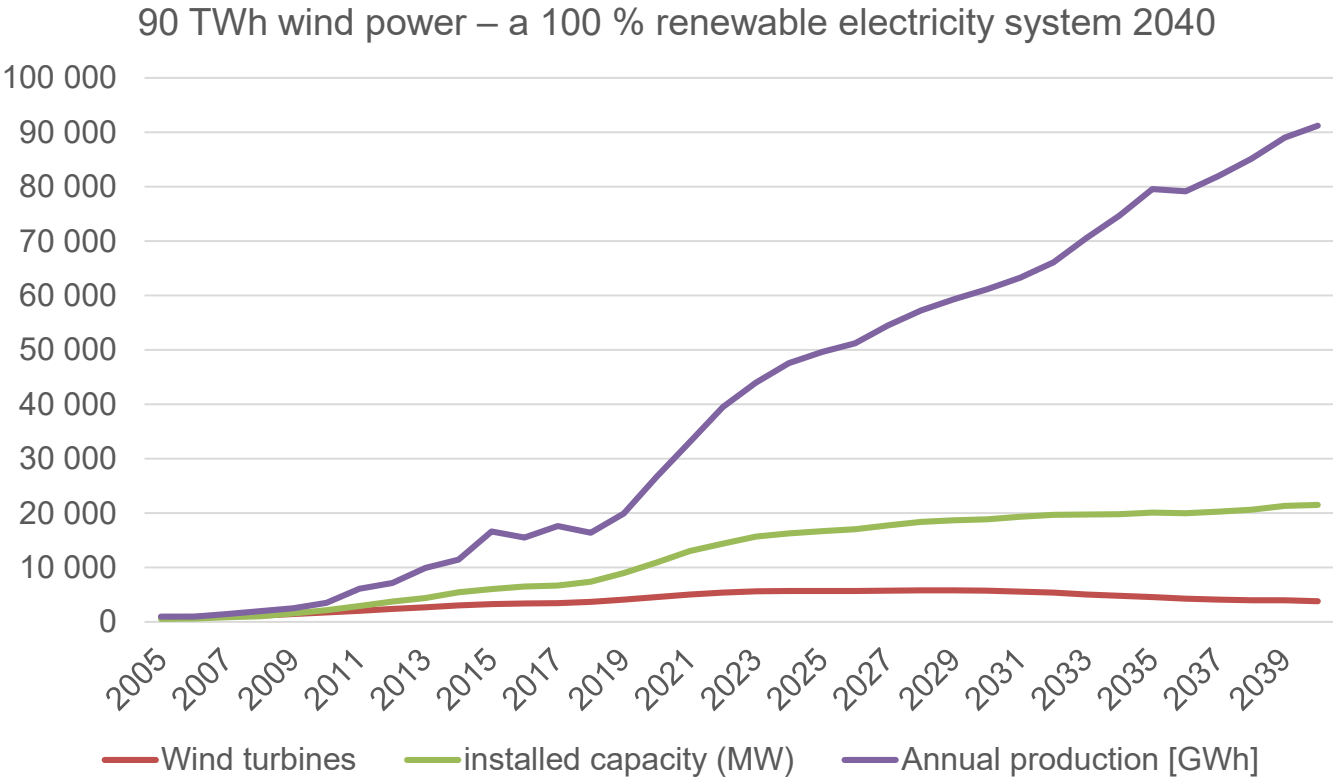
In recent years, most new wind power projects have been built in the north of Sweden. But, the expansion in the north might slow down. After 2023, it is possible that bottlenecks in the grid and price differences makes it more attractive to invest in small projects in the south.

In the medium term, repowering is starting to take place in the south, where also many of the new turbine orders are placed. Together with offshore wind power, which will have a central role in the Swedish electricity system in 2030-2040, the expansion can even out between north and south until 2040.

Even so, Swedish TSO (Svenska kraftnät) still need to strengthen the grid's transmission capacity from north to south. This will be even more critical if Finland does not remain a net importer of electricity.

Interestingly, due to technological development and repowering, the amount of wind turbines in Sweden will peak around 2027 (approx. 5 800 turbines) and then gradually decrease to below 4 000 turbines in 2040.

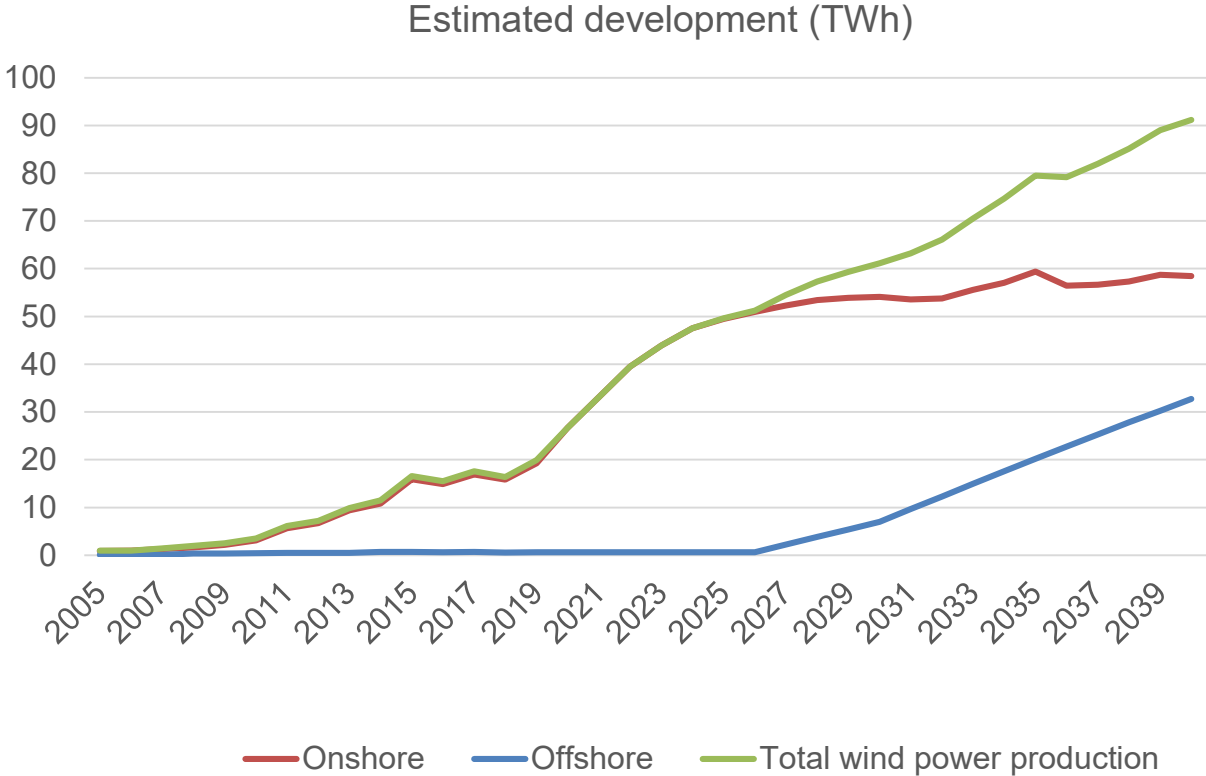
# Scenario 2040



Source: [SWEA roadmap 2040](#)



# Scenario 2040

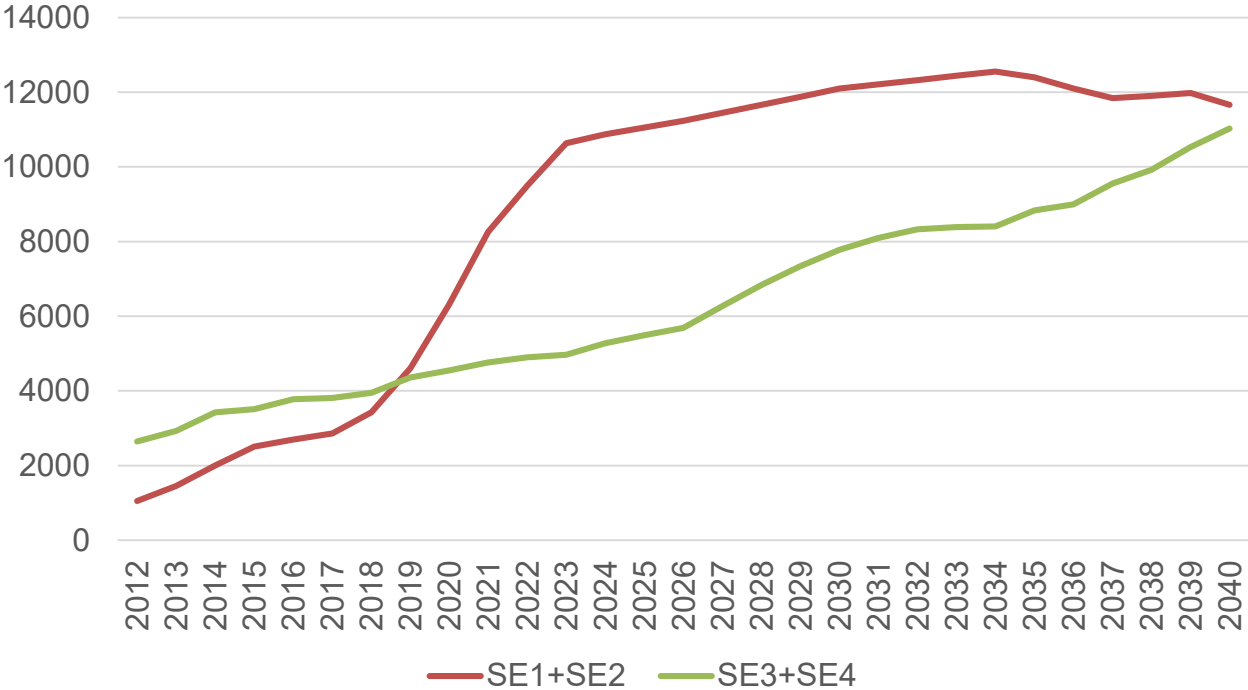


Source: [SWEA roadmap 2040](#)



# Scenario 2040

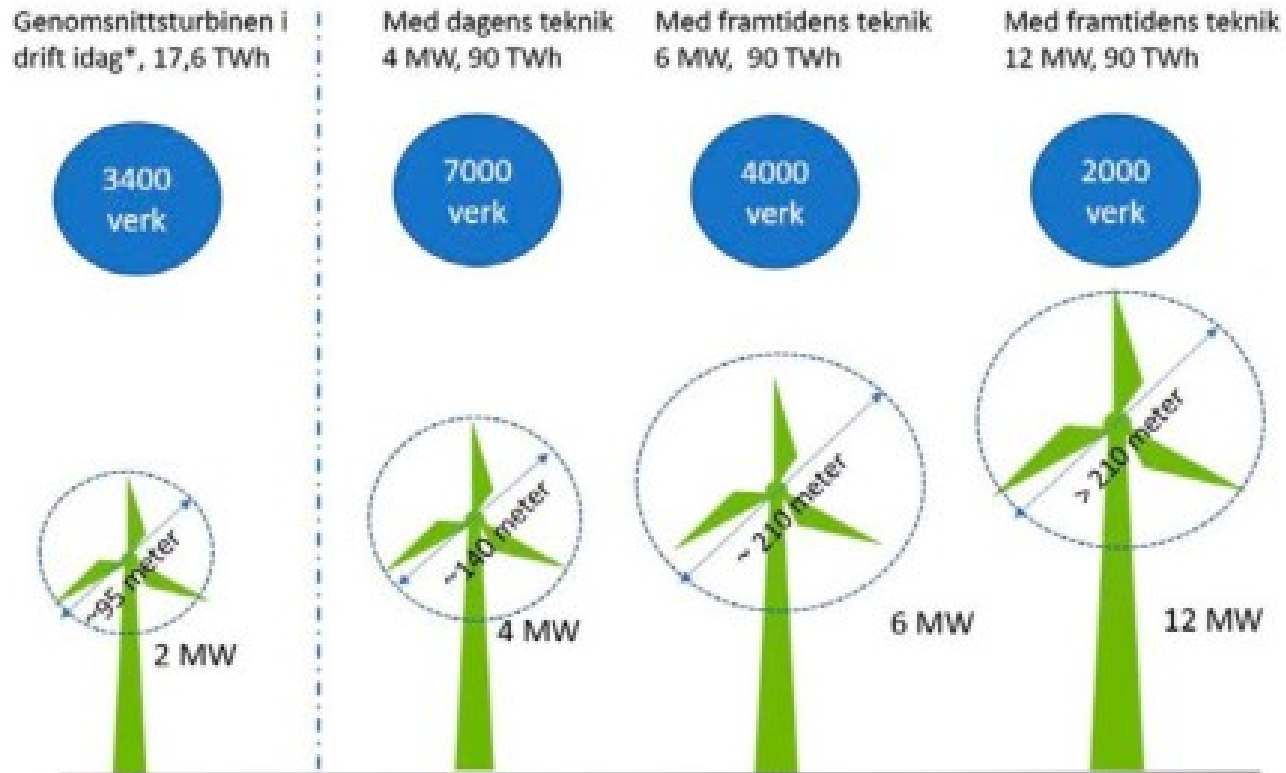
Installed capacity / price area (MW)



Source: [SWEA roadmap 2040](#)



# Vad innebär 90 TWh vindkraft?



Källa: Energimyndigheten – [100 procent förnybar el, delrapport 2, maj 2019](#)

# Ny vindkraft 2017-2019

Projekt	TWh	Driftstart	Elområde	Ägare	Effekt	Antal	MW	Län
Blaiken 4	0,068	2017	SE2	Skellefteå Kraft / Fortum	3,0	9	27	Västerbotten
Gunillaberg	0,026	2017	SE3	KGAL	2,2	4	9	Jönköping
Lunna	0,021	2017	SE3	KGAL	2,2	3	7	Örebro
Lyrestad	0,228	2017	SE3	Ardian	3,5	22	76	Västra Götaland
Långmarken	0,080	2017	SE3	Mirova	3,3	8	17	Värmland
Tågeröd	0,016	2017	SE3	H&M / Waros	1,5	4	6	Skåne
Täppeshusen	0,015	2017	SE4	Flera	2,2	2	4	Skåne
Vilseberga	0,015	2017	SE3	Flera	2,2	2	4	Östergötland
Väsberget	0,080	2017	SE2	Mirova	3,5	8	28	Västra Götaland
Öljersjö 3:16	0,007	2017	SE4	Fr Ramström Vind	2,4	2	5	Blekinge
Össjö	0,018	2017	SE4	Öresundskraft Kraft & Värme	2,1	3	6	Skåne
Lehtirova	0,490	2018	SE1	CGN & Hermes (80/20)	3,6	41	148	Norrbottnen
Höggölen	0,194	2018	SE2	CGN & Hermes (80/20)	3,6	18	65	Gävleborg
Ränsliden	0,085	2018	SE3	Prime Capital	3,4	7	24	Västra Götaland
Erstråk etapp 1, Markbygden, fas 2	0,293	2018	SE1	TRIG & Enercon (75/25)	3,4	26	88	Norrbottnen
Bockstigen (Repowering)	0,011	2018	SE3	Momentum Gruppen	0,6	5	3	Gotland
Olofsfält 2	0,006	2018	SE3	Olofsfält Vind	2,3	1	2	Skåne
Skålsparken Väst	0,015	2018	SE3	Slitevind	2,2	3	7	Gotland
Slottsbol	0,044	2018	SE3	Slottsbol Vind	2,2	6	13	Örebro
Stor-Blåtiden, Pilot 1, Markbygden	0,068	2018	SE1	Svevind	3,0	6	18	Norrbottnen
Anneberg	0,040	2018	SE3	KGAL	3,6	3	11	Västra Götaland
Västanby	0,033	2018	SE4	European Energy	2,0	5	10	Skåne
Zinkgruvan	0,176	2018	SE3	CEE Group	3,8	14	53	Örebro
Grimsås	0,140	2018	SE 3	Marguerite / Element	3,6	13	47	Västra Götaland
Jenåsen	0,237	2018	SE2	MEAG, Munich Re	3,5	23	79	Västernorrland
Privatperson	0,018	2018	SE3	Privatperson	0,9	1	1	Östergötland
Solberg	0,253	2018	SE2	Credit Suisse & Fortum (80 / 20)	3,5	22	76	Västernorrland
Svartnäs	0,397	2019	SE2	BlackRock	3,6	32	115	Dalarna
Åskälen- Österåsen	0,930	2019	SE2	APG	3,6	80	288	Jämtland
Laxåskogen	0,090	2019	SE3	Wirtgen Wind Invest	3,6	7	25	Örebro
Markbygden ETT	2,200	2019	SE1	CGN & GE Wind (75/25)	3,6	179	644	Norrbottnen
Stigshöjden	0,062	2019	SE2	Frontavis	3,6	6	22	Västernorrland
Stor-Blåtiden, Pilot 2, Markbygden	0,018	2019	SE1	Svevind	5,3	1	5	Norrbottnen
Munkflohöjden	0,190	2019	SE2	APG	2,1	23	49	Jämtland
Orrberget	0,096	2019	SE3	Frontavis	3,7	9	33	Dalarna
Sötterfällan	0,130	2019	SE3	KGAL	3,6	10	36	Jönköping
Kråktorpet	0,570	2019	SE2	CGN & Hermes (80/20)	3,8	43	163	Västernorrland
Nylandsbergen, Getås, Rödsjöåsen	0,240	2019	SE2	CGN & Hermes (80/20)	3,8	18	68	Västernorrland
Fjällberget / Saxberget	0,036	2019	SE2	Stena Renewable	3,6	3	11	Dalarna
Kronoberget	0,200	2019	SE3	Stena Renewable	3,8	16	61	Örebro
Enviksberget	0,122	2019	SE3	BlackRock	4,1	9	37	Dalarna
Dalby	0,007	2019	SE4	Ledsjö Vind / xxx (50/50)	2,4	1	2	Skåne
Elico 1	0,008	2019	SE4	Elico AB	2,0	1	2	Skåne
Hannas 2	0,014	2019	SE4		2,3	2	4,6	Skåne
<b>Sverige 2017-2022</b>	<b>7,99</b>					<b>701</b>	<b>2 400</b>	

# Ny vindkraft 2020-2022

Projekt	TWh	Driftstart	Elområde	Ägare	Effekt	Antal	MW	Län
Erstråk etapp 2, Markbygden, fas 2	0,556	2020	SE1	TRIG & Enercon (75/25)	4,0	42	168	Norrbottnen
Valhalla (Tönsen & Åmot-Lingbo)	1,100	2020	SE2	CGN & Hermes (80/20)	4,2	85	357	Gävleborg
Liden (Brattmyrliden & Åliden)	0,421	2020	SE2	Falck Renewables	3,9	31	121	Västernorrland
Spjutåsberget	0,024	2020	SE2	HEMAB	3,6	2	7	Västernorrland
Råmmarehemmet	0,036	2020	SE3	EnBW	3,7	3	11	Västra Götaland
Överturingen - Länsterhöjden & Storflötte	0,780	2020	SE2	Green Investment Group	4,2	56	235	Västernorrland
Bröcklingberget	0,155	2020	SE2	re:cap	4,1	11	45	Jämtland
Häjsberget & S Länsmansberget	0,180	2020	SE3	Tekniska Verken Vind	4,2	13	55	Värmland
Brännliden	0,160	2020	SE2	Marguerite	4,2	10	42	Västerbotten
Bäckhammar (Norra & Södra)	0,400	2020	SE3	KGAL	4,2	31	130	Värmland
Slageryd	0,071	2020	SE3	Taaleri Energia	3,9	6	23	Jönköping
Högaliden	0,365	2020	SE1	Fred Olsen	4,2	25	105	Västerbotten
Gårdsshyttan	0,054	2020	SE2	Rabbalshede Kraft	3,3	5	16	Örebro
Aldermyrberget	0,240	2020	SE1	wpd Scandinavia	4,2	17	72	Västerbotten
Picasso (Målarberget)	0,374	2020	SE3	Enlight	4,2	27	113	Västmanland
Hornamossen	0,120	2020	SE3	Green Investment Group	4,3	10	43	Jönköping
Björkvattnet	0,600	2020	SE2	InfraVia Capital Partners	5,3	33	175	Jämtland
Stor-Skälsjön	0,862	2020	SE2	Enercon	4,2	62	260	Västernorrland
Trädet - Lundbyn	0,037	2020	SE3	SVEF	3,5	3	11	Västra Götaland
Maximus (Markbygden Etapp 2)	2,224	2021	SE1	Enercon	4,2	160	672	Norrbottnen
Blakliden & Fäbodberget	1,100	2021	SE2	Vattenfall & PKA & Vestas (40/30/30)	4,2	84	353	Västerbotten
Nysäter (Hästkullen & Björnlandshöjden)	1,572	2021	SE2	Credit Suisse & RWE (80/20)	4,2	114	475	Västernorrland
Ändberget	0,800	2021	SE2	Ardian	5,0	53	220	Jämtland
Önsberget (Markbygden etapp 3)	2,483	2021	SE1	Luxcara	5,3	142	750	Norrbottnen
Högen	0,042	2021	SE3	Rabbalshede Kraft	4,2	3	13	Västra Götaland
Sköllunga	0,042	2021	SE3	Rabbalshede Kraft	4,2	3	13	Västra Götaland
Lyngsåsa	0,315	2021	SE4	SUSI Partners	4,2	22	90	Kronoberg
Fjällboheden	0,160	2021	SE1	Abraxas Capital Management	4,2	10	42	Västerbotten
Stavro Blackfjället	0,299	2021	SE2	Prime Capital	4,1	22	90	Västernorrland
Stavro Blodrotberget	0,543	2021	SE2	Prime Capital	4,1	40	164	Västernorrland
Målajord	0,050	2021	SE4	Taaleri Energia	4,8	3	14	Kronoberg
Blåbergsliden	0,473	2021	SE1	Holmen Energi	5,5	26	143	Västerbotten
Skaftåsen	0,765	2021	SE2	Foresight, KLP, Arcano, BAE, Polhem Infra	6,6	35	231	Jämtland
Riskebo	0,129	2021	SE3	Stena Renewable	5,6	7	39	Dalarna
Ljungbyholm	0,150	2021	SE4	Octopus Renewables	4	12	48	Kalmar
Knöstad	0,152	2021	SE3	Eurowind Energy	5,8	8	46	Värmland
Hacksjön	0,600	2022	SE2	Jämtkraft & Persson Invest (75/25)	3,8	45	171	Jämtland
Åby-Alebo	0,500	2022	SE4	Stena Renewable	4,3	36	155	Kalmar
Frykdalshöjden - N Länsmansberget	0,139	2022	SE3	Tekniska Verken Vind	4,2	10	42	Värmland
Tvinnesheda-Badeboda	0,600	2022	SE4	Stena Renewable	4,2	47	210	Kronoberg
Rödene	0,284	2022	SE3	Mirova	6,6	13	86	Västra Götaland
<b>Sverige 2017-2022</b>	<b>19,96</b>					<b>1 366</b>	<b>6 056</b>	

# Vindkraftens miljardprogram

## Ny vindkraft 2017–2022

- 27,95 TWh
- 2 067 vindkraftverk
- 8 456 MW
  
- Investering 95 miljarder kr



# Elcertifikatsystemet – mål 46,4 TWh

	Bio	Sol	Vatten	Vind	Totalt
I drift - Sverige	4,615	0,325	1,118	20,020	<b>26,060</b>
I drift - Norge	0,000	0,010	5,575	5,160	<b>10,745</b>

## Under byggnation & investeringsbeslutat - Sverige

Sverige	0,250	0,016	0,117	17,927	<b>18,310</b>
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## Under byggnation & investeringsbeslutat - Norge

Norge	0,000	0,000	2,528	7,402	<b>9,930</b>
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Måluppfyllelse	Bio	Sol	Vatten	Vind	Totalt
Sverige	4,865	0,341	1,235	37,947	44,370
Norge	0,000	0,010	8,103	12,562	20,675
<b>Totalt</b>	<b>4,865</b>	<b>0,351</b>	<b>9,338</b>	<b>50,509</b>	<b>65,045</b>

Över-  
utbyggnad,  
TWh  
-11,170  
-7,475  
-18,645

Källa: [Energimyndighetens och NVE:s kvartalsrapport 1 2020](#)

# ..... men mycket återstår

Utbyggnad historiskt och idag

- 19,5 TWh vindkraft år 2019
- 44 TWh vindkraft år 2023

Utbyggnad till ett 100% förnybart elsystem år 2040

- 90 TWh vindkraft (enligt Energimyndigheten)
  - 15 TWh fasas ut 2020 - 2040
  - 61 TWh behöver tillkomma 2023 – 2040
- 3,6 TWh ny vindkraft per år 2023 – 2040

# Oligopolet luckras upp!

**1996** hade de tre stora producenterna (Vattenfall, Uniper och Fortum) en samlad marknadsandel på **90%**.

**2016** hade de fem stora producenterna (Vattenfall, Uniper, Fortum, Statkraft och Skellefteå Kraft) en samlad marknadsandel på **80%**.

2017 - 2022 tillkommer 27 TWh vindkraft medan kärnkraften minskar med 10 TWh  
Elproduktionen ökar från 152 TWh 2016 till 170 TWh år 2022.

**2022** kommer de fem stora producenterna (Vattenfall, Uniper, Fortum, Statkraft och Skellefteå Kraft) att ha en samlad marknadsandel på ca **67%**.

# Kapacitetsfaktor

Vindkraft 2014	11,5 TWh	5 425 MW	<b>24%</b>
Ny vindkraft 2017-2022	27 TWh	8 192 MW	<b>38%</b>
Vindkraft 2023	44 TWh	15 672 MW	<b>32 %</b>
Ny vindkraft 2030			ca <b>50%</b>

# Tillgänglighet

Vad levererar vindkraften vid effekttopparna?

- 9% - används i Svk:s analyser
- 16-32% - utfall de senaste tio vintrarna
- Tillgängligheten ökar i takt teknikutvecklingen

# Lokala förstärkningsbehov i norr

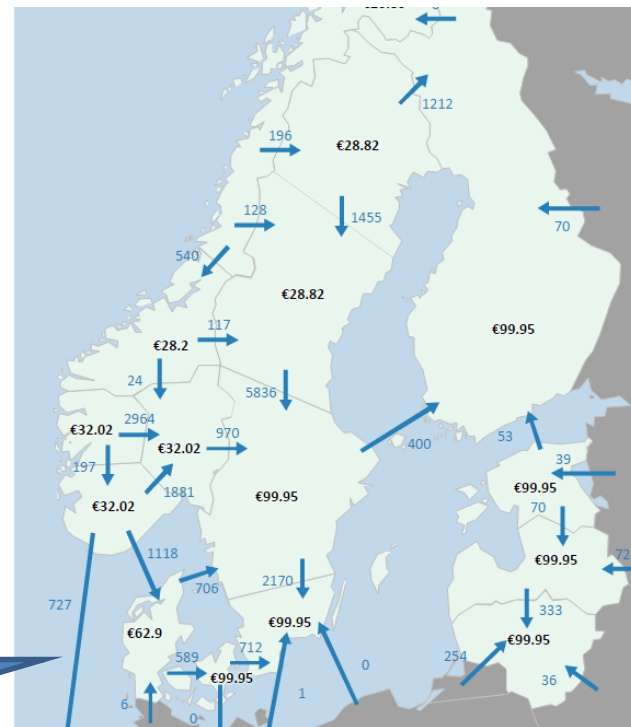
- Omfattande vindkraftsutbyggnad i norr
- Samtliga (för vindkraften intressant ledningar är fullbokade) i SE1
- Svk nätförstärkningsplaner ligger efter i processen
- Ledtider på över 10 år för nya ledningar



**Risk för helt avstannad utbyggnad av vindkraft i SE1 i närtid och på sikt även i SE2.**

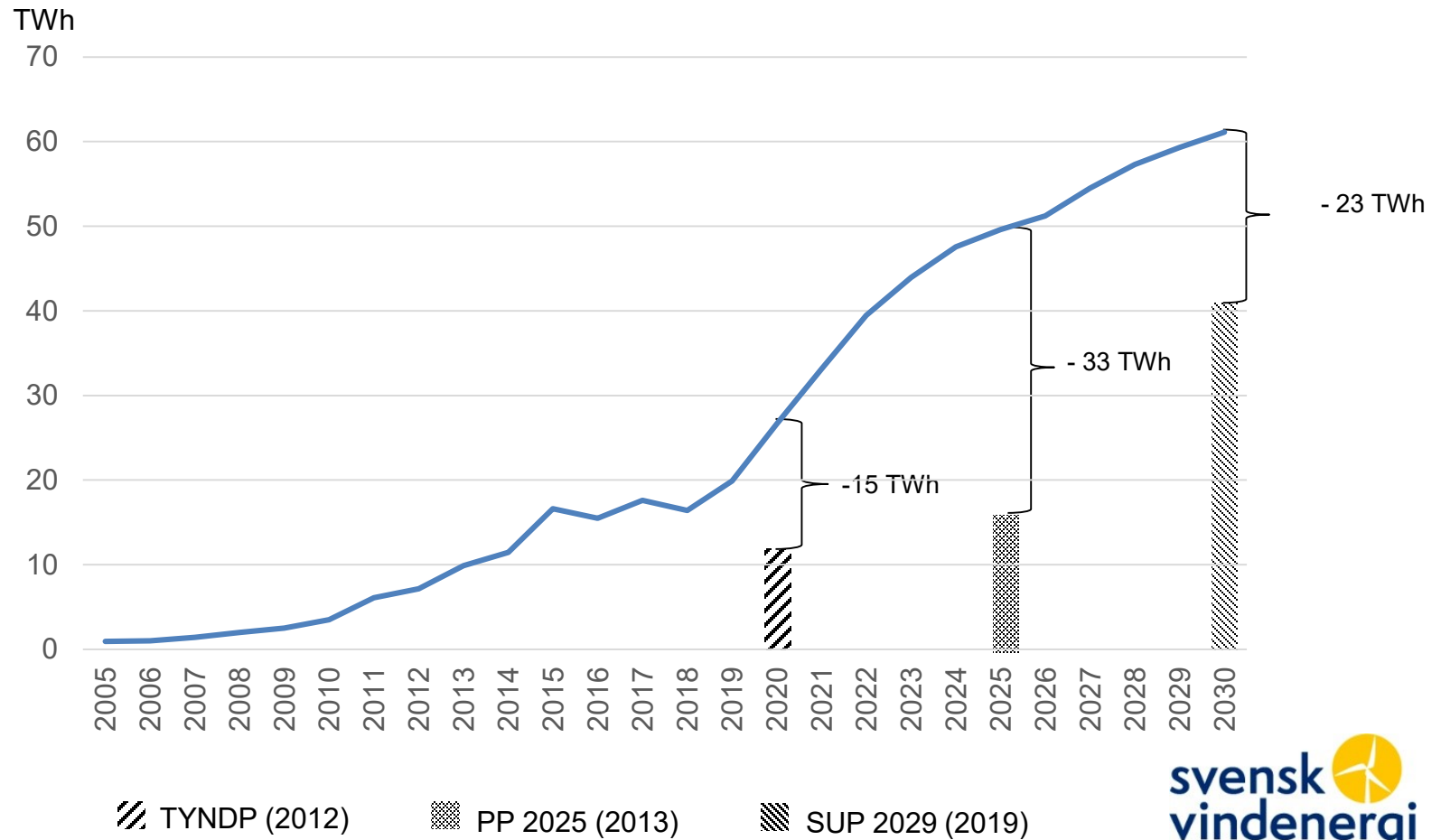
# Förstärkningsbehovet nord-syd

- Flaskhalsar i överföringskapaciteten (norr-söder)
- Behov av förnyelse av befintliga ledningar
- Omfattande vindkraftsutbyggnad i norr
- Nedstängning av kärnkraften i södra Sverige
- Elektrifiering av fordonssektorn
- Svk nätförstärkningsplaner ligger efter i processen
- Ledtider på över 10 år för nya ledningar



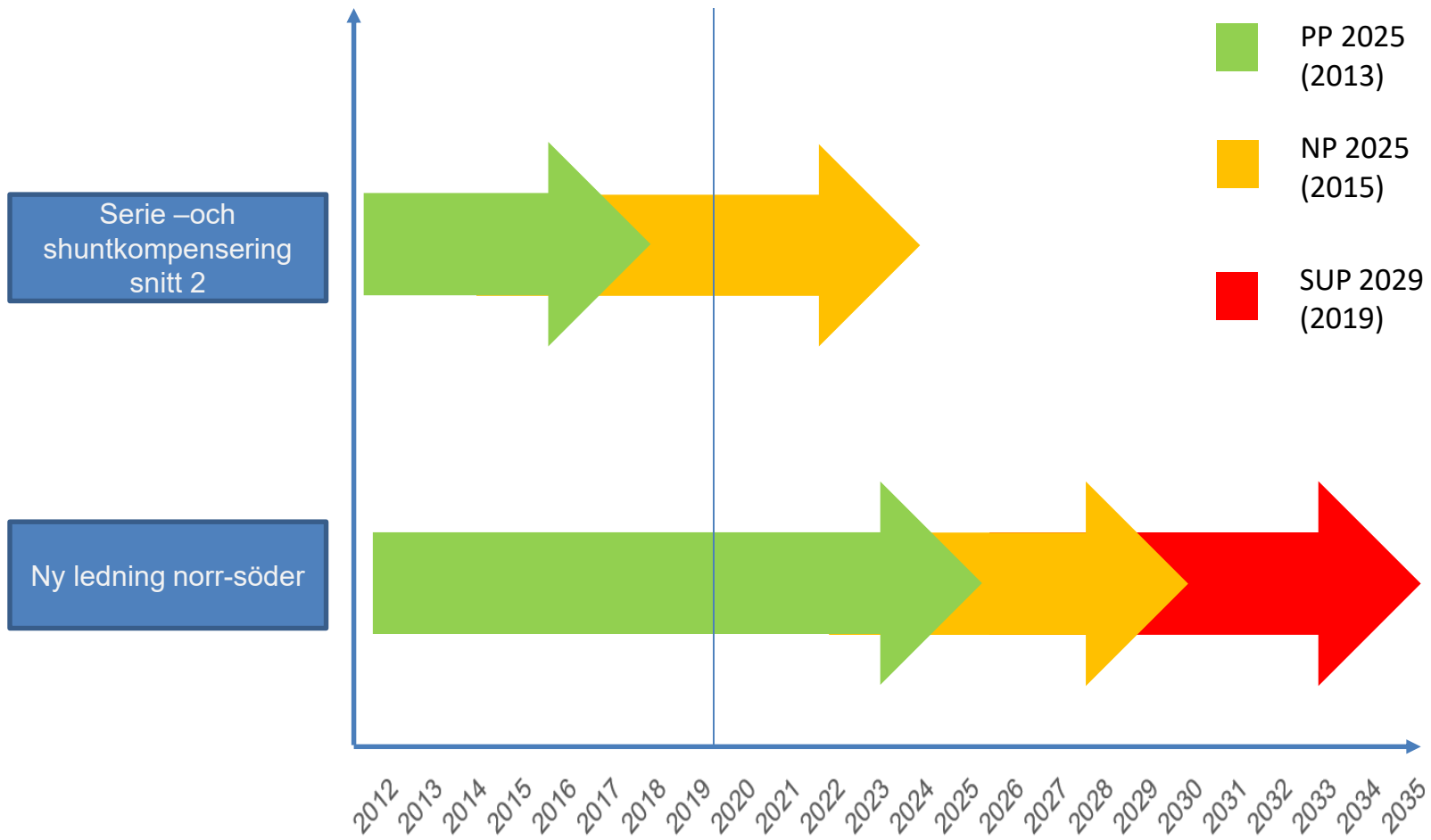
**Risk för inlåst kraft i norra Sverige och möjligheterna att nå de långsiktiga energi och klimatmålen**

# Svenska kraftnät har hittills (kraftigt) underskattat vindkraftsutbyggnaden





# Svks tidplaner tenderar att förskjutas





# Tack!

Tomas Hallberg  
[www.svenskvindenergi.org](http://www.svenskvindenergi.org)

# The statistics and forecast

- **The statistics** are based on the order books of the turbine manufacturers and project portfolios of the wind power developers presented at an aggregated level
- **The forecast** are based on current and future market conditions.
- **Base case:** Projects with turbine contracts (firm and binding), approximately 30 percent of permitted projects and 15 percent of projects under permission process will be realized. This is the most realistic scenario and is the official forecast.
- **Low case:** Only projects where turbine contracts (firm and binding) have been signed will be realized. In this scenario no further investment decisions are made. Thus, this scenario defines the lower limit of wind power growth in Sweden.
- **High case:** Projects with turbine contracts (firm and binding), around 60 percent of permitted projects and 30 percent of projects under permission process will be realized. This scenario is more optimistic and sets the ceiling for growth of wind power in Sweden.

# Assumptions

Part of wind power project portfolio capacity expected to be realized within given time frame depending on scenario (approximate figures)

Status	High	Base **	Low
Turbine contracts (firm and binding)	100 %	100 %	95 %
Permitted *	60 %	30 %	0 %
In permitting process *	30 %	15 %	0 %

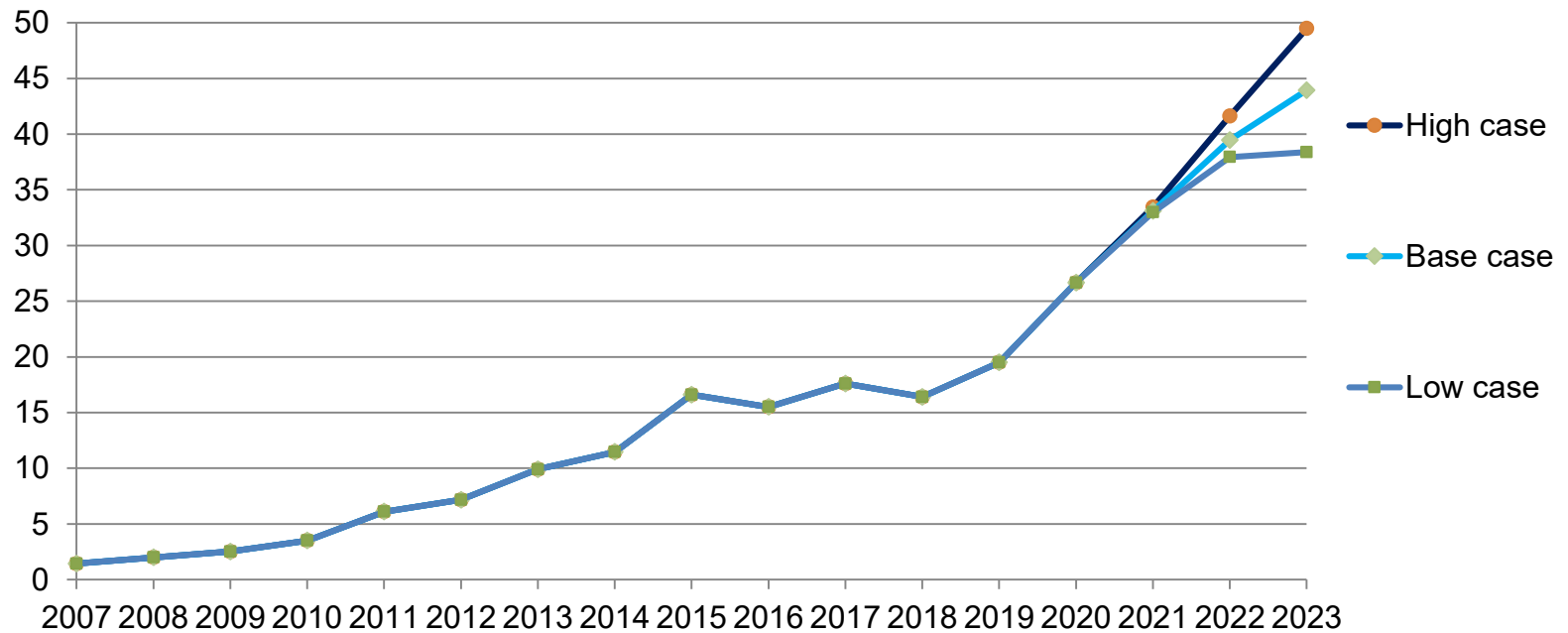
\* Only onshore wind power are expected to be built.

\*\* The base case reflects a possible scenario based on an assessment of current and future market conditions.

# Wind power production – all cases

Actual and forecast 2020-03-31

TWh



# Previous year

## Total by the end of 2018

Turbines: 3 652

Capacity: 7 395 MW

Actual production: 16,4 TWh\*

Annual production (estimated): 19,5 TWh\*\*

*\* Actual production is the real production and depends on wind conditions and when installations are made during the year.*

## Added capacity in 2019

1st quarter: 136,2 MW

2nd quarter: 140,8 MW

3rd quarter: 519,0 MW

4th quarter: 792,4 MW

**Total: 1588,4 MW**

*\*\* Estimated annual production is the annual production the turbines are expected to produce when in operation during a whole year with normal wind conditions.*

## Total by the end of 2019

Turbines: 4 099

Capacity: 8 984 MW

Actual production: 19,5 TWh\*

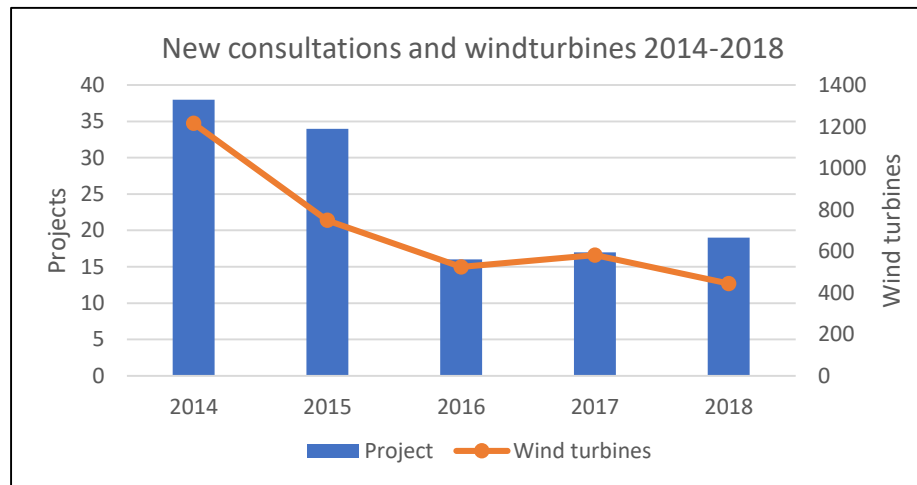
Annual production (estimated): 24,7 TWh\*\*

# Permitting – a serious obstacle

- The overall picture is that too few new projects are started, as it is very difficult to find new wind power projects in good locations where it is considered likely that a permit will be granted.
- Drawn-out and uncertain permit processes are currently the greatest obstacle to the development of wind power.
- To reach the target of 100 percent renewable electricity generation and at least 90 TWh of wind power by 2040, many new permits for wind farms are needed.
- The time from initial consultation to environmental permit can exceed 10 years. Meanwhile, technological progress is fast, and the terms of the permit seldom leave scope to use the best possible technology, as the Environmental Code instructs that it should.
- The process must adapt to rapid technological developments so that wind resources can be utilized as efficiently as possible.

# Fewer new permits and applications

- In 2019, only six wind power projects (135 turbines) received final approval.
- In 2019, only 11 new applications (140 turbines) were submitted.
- The number of new projects, where consultations has been started, has been halved during the period 2014-2018
- Decided cases have decreased from close to 50 parks in 2014-2015 to 25-35 parks in 2017-2018.



Source: *Nätverket vindkraftens klimatnytta* - [report](#)



# Permitting – a serious obstacle

- Drawn-out and uncertain permit processes are currently the greatest obstacle to the development of wind power.
- To reach the target of 100 percent renewable electricity generation and at least 90 TWh of wind power by 2040, many new permits for wind farms are needed.
- The time from initial consultation to environmental permit can exceed 10 years. Technological progress is fast, and the terms of the permit seldom leave scope to use the best possible technology, as the Environmental Code instructs.

SWEA:s suggestions to improve and speed-up the process:

- ✓ The municipal veto against wind power should be adjusted so that the municipality's decision comes early, concerns the location and is not allowed to be changed during the process.
- ✓ The municipalities, instead of the state, should be awarded the property tax on wind power.
- ✓ The Environmental Code should be adjusted so that climate benefits are more strongly prioritized when weighed against other interests.