Global
Marshall Plan
Initiative

Lokalgruppe
München

EU-27 – Development path for climate protection

(Translation from original publication in German language)

Study:	Global Marshall Plan Initiative Lokalgruppe München
Objective:	Awareness raising
Revision:	08 / 2021
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Translators:	Stefan Otto, Robert Faul
Review:	Prof. Dr. Gerhard Berz

Abstract:

This study first offers a reminder of the past international climate change consensus and thus addresses the question of what the transfer path for European countries should look like, if a climate-neutral Europe is taken as serious target. Thus, what does the transformation of the EU-27 countries mean in concrete numbers?

Based on data consistent in 2018 the parameters GDP, number of inhabitants and emissions of the 27 European states are used for this study. For fact checking a „Gross Emissions Quota“ (GEQ) is defined. The GEQ represents a measure that relates a country´s GDP to its emissions targets. This can illustrate the specific challenges for each country.

As a result this study points out clearly that no country in the EU-27 faces a moderate challenge, but that all countries are facing a very demanding transformation. The appendix of the study contains graphs for all EU-27 countries that visualize the development path.

Fundamentals

The period of discussion about the limits of the carrying capacity of the planetary biotope earth has been going on for about 50 years. Politics and science debated almost endless which emission amounts may still be released by mankind without causing a fatal escalation of climate change. As a reminder of the former climate protection consensus, reference is made to the budget approach. It was developed by a large number of experts assuming that in the period from 1990 to 2050 there will be a global residual volume of emissions of approximately 1100 billion tons that must not be exceeded. That is to limit climate change to 2° global warming with a probability of 0,75. Thus the scientific community has largely adopted the approach that probability values for maintaining the biotopic state of planet earth are associated with a residual amount of emissions. As a result of the Paris Climate Conference a limitation of climate warming was named to a corridor of 1.5° to 2° average global warming. The Intergovernmental Panel on Climate Change (IPCC) currently estimates the probability of meeting the 1.5° target with 0.5. This means that mankind is in a kind of game of roulette, where the probability of red or black is nearly 50%. The real situation however is that we have only 1 earth and thus we see the ball fall only once. The consequence should be that all development paths would have to be fixed at a very high value of probability, so that nearly certain no disaster will occur.
In a publication by German Advisory Council on Global Change (Wissenschaftliche Beirat der Bundesregierung Globale Umweltveränderungen WBGU) from 2009 [1], a global residual volume for 2008 to 2050 of approx. 600 billion tons emissions is quantified. According to this budget approach the situation in 2010 was as follows:

EU-share in world population in1990 [%]	EU-budget 1990-2050 [billion t]	EU-emissions 1990-2009 [billion t]	EU-residual budget 2010-2050 [billion t]	Range of budget at 4,5 billion t/year
8,9	98	81	18	2013

The figures legitimize a grim estimation relative to a safe avoidance of disaster.
It is now known that the EU has thus made further emissions beyond 2013. In consequence one could end any discussion with a frustrated sentiment of „game over“. However, the study submitted here follows the fact that „game over“ is not a solution and starts facing the reality in 2018 again.
The measure for a „safe“ achievement of a transformation target is defined by 2 parameters. First parameter is the time limit with the year 2050. Second parameter is the climate neutrality threshold of 0.5 t emissions per person in 2050 with global validity for all people (budget consensus). It is not examined in this study how meaningful and how scientifically robust these two parameters are. In any case the year 2050 was mentioned in many strategy papers as a limit. The emission limit of 0.5 t per person was published by experts from German Federal Environment Agency.

The claim of this study is on citizen science project level and only aims to contribute with simple, well comprehensible thoughts for averagely informed people concerning the dimensions of challenges.

1. Gross Emissions Quota

The Gross Domestic Product (GDP) is a very significant ratio for assessing economic regions. Virtually the entire world economic system is skewed towards GDP and GDP growth. For many decades there has been a largely steady correlation between GDP and emissions. Consequently it is legitimate to relate GDP to the CO2e emissions of economic regions. Nevertheless there is literature that shows ways out of GDP correlation with emissions, e.g. [2] [3] [4] [5].

For the purpose of the study presented here, the statistical quantity „Gross Emissions Quota“ (GEQ) is formed:

$$\textbf{Gross-Emissions-Quota} = \frac{\text{GDP}}{\text{emissions quantity}}$$

For the EU-27 countries the GEQ values [€/t] are as follows:

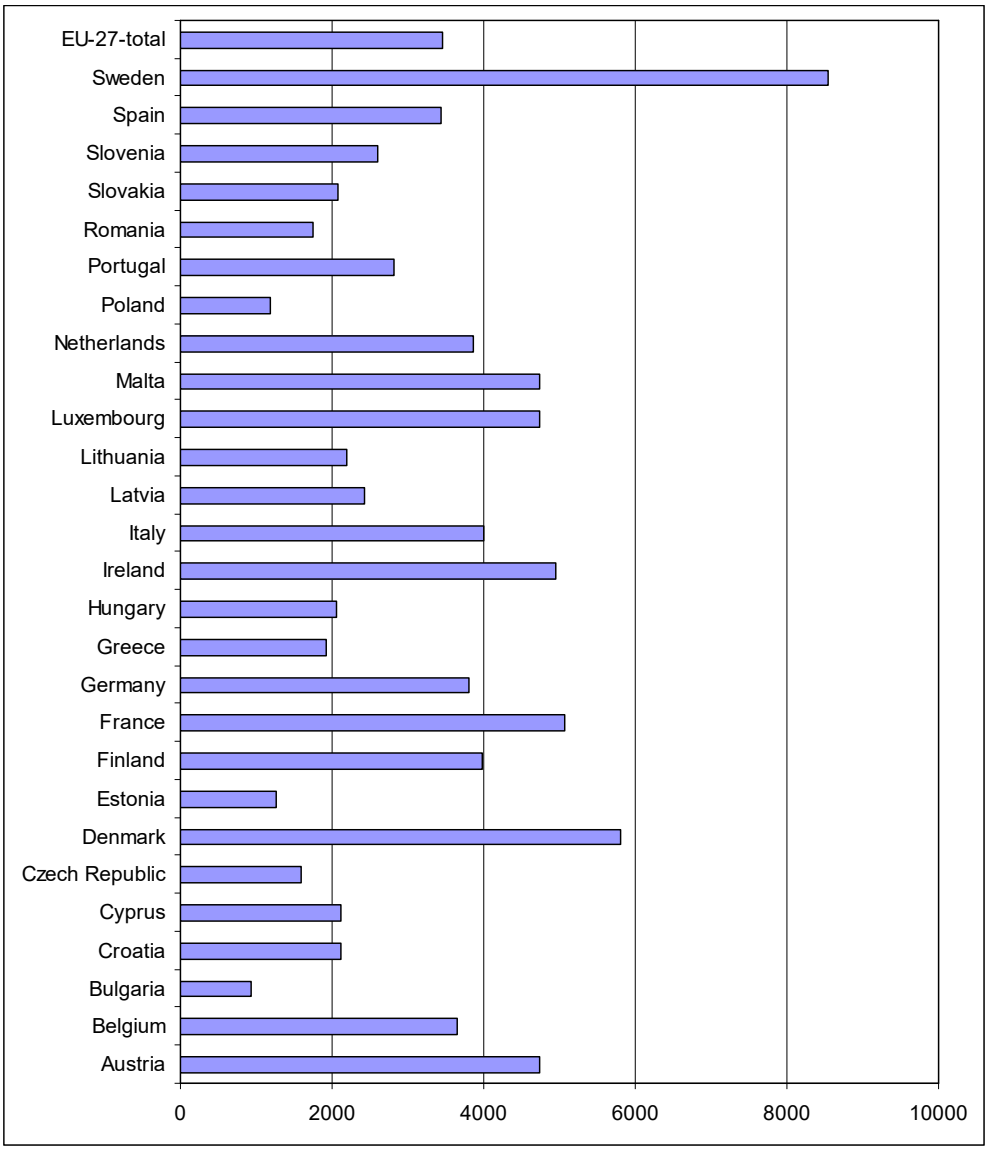

Fig. 1: GEQ-Overview for EU-27 (@2018)

Based on 2018, the GEQ average for EU-27 is € 3465 GDP per t emission. That means a value added transaction of 3465€ is associated with an emission of 1t CO2e. The highest and most climate-friendly GEQ value is achieved in Sweden.

(The GEQ factor was defined for this study to avoid conflicts with similar factors in other publications, e.g. „economic efficiency“)

CO2e = CO2eq = CO2-equivalent (cf. Wikipedia “global warming potential”)

2. Climate compatibility

Climate neutrality and climate compatibility are terms for which no worldwide valid definition and standard of determination exist. To define clarity for this study, the target state in 2050 is to have an average of only 0.5 tons of emissions per person per year as a climate compatible measure.

How can we visualize a transformation from the actual state in 2018 to the target state in 2050?

The procedure is deliberately kept simple, plausible and comprehensible, so that people who do not have extensive knowledge can be informed.

The starting point is the GEQ in 2018 (see Fig.1).
The modelling of the transformation to 2050 is based on 1% GDP growth per year and a constant number of inhabitants per state.
The GEQ target in 2050 is calculated as 0.5t of emissions per person per year multiplied by the number of inhabitants per state.
Several modelling approaches can be considered for the transformation from the starting to target point. Based on experience from change processes, the most reasonable modelling is likely to be in a constant percentage of emissions reduction per year. This model takes into account that at the beginning of the transformation – when the starting value is high – a large reduction is present due to the wide choice of relatively easy implementable options. Towards the end of the transformation, the choice is dominated by options that were relatively difficult to realize until then. Thus, only a numerically low reduction is achieved. The overall result of the modelling is the concrete percentage of emissions reduction which must be achieved in the respective country in order to reach the climate-neutral situation in 2050. In addition, a diagram showing the development of the GEQ for each EU-27 Country is documented in the appendix.

The transfer path for Europe is calculated from the development curves of the respective states.

3. Results

The 27 states in Europe have different GDPs and population sizes, yet the results show surprisingly similar percentages for emission reductions.

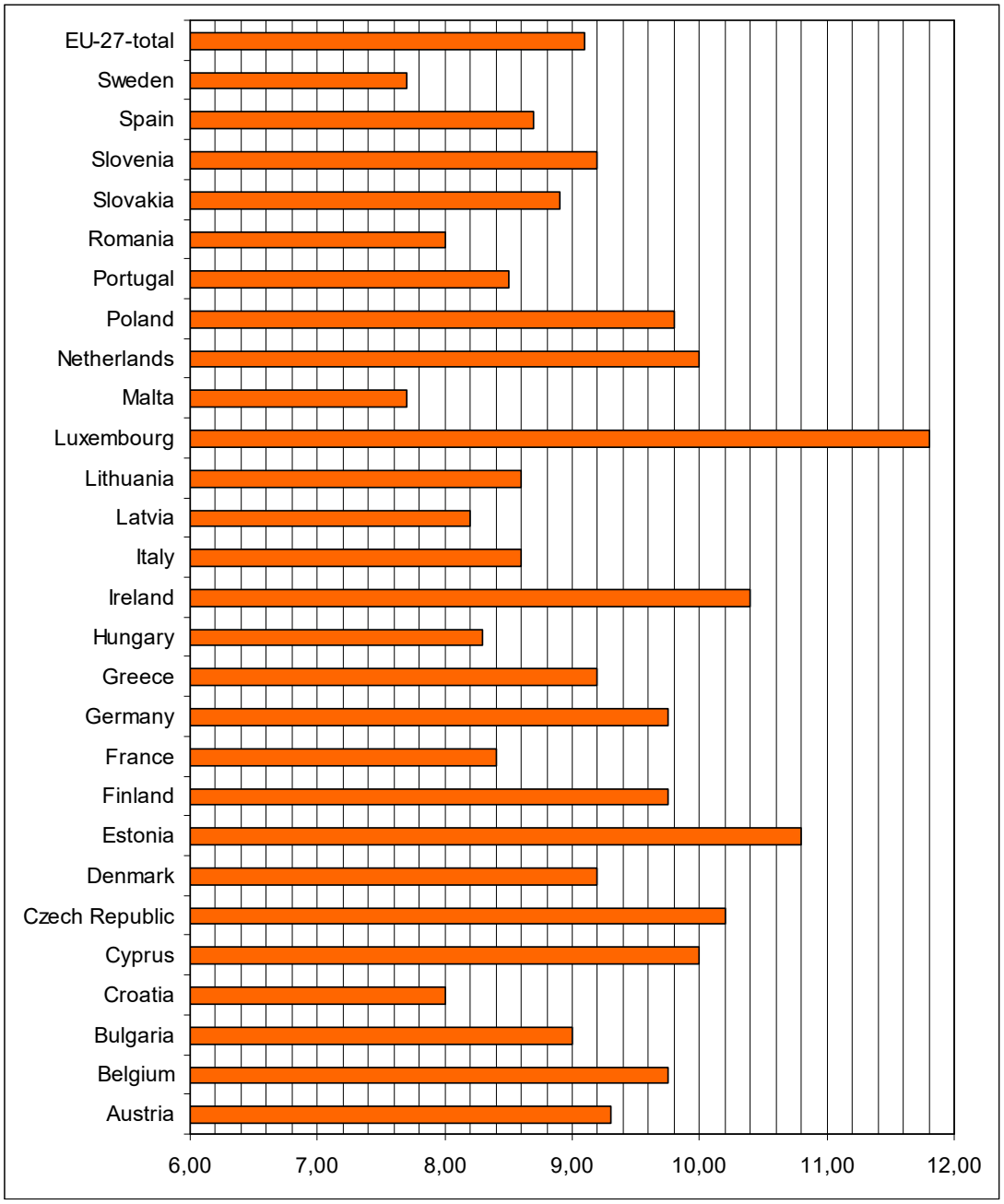

Fig. 2: Emission reduction percentages

The lowest rates and comparatively „moderate“ requirements for the transformation path are shown for Malta and Sweden with 7.7% per year. The greatest challenge is seen for Luxembourg at 11.8% per year.

The development curves for GEQ per EU-27 country (see Appendix) look similar on first sight. That is, because the transformation percentages are similar and the quotient of GDP and emissions results in a visually similar rising curve. Much more interesting than the basic shape of the graphs is the spread between the initial and final values of the GEQ. The final value varies significantly with currently partly unimaginably high requirements to the value creation per t of emission.

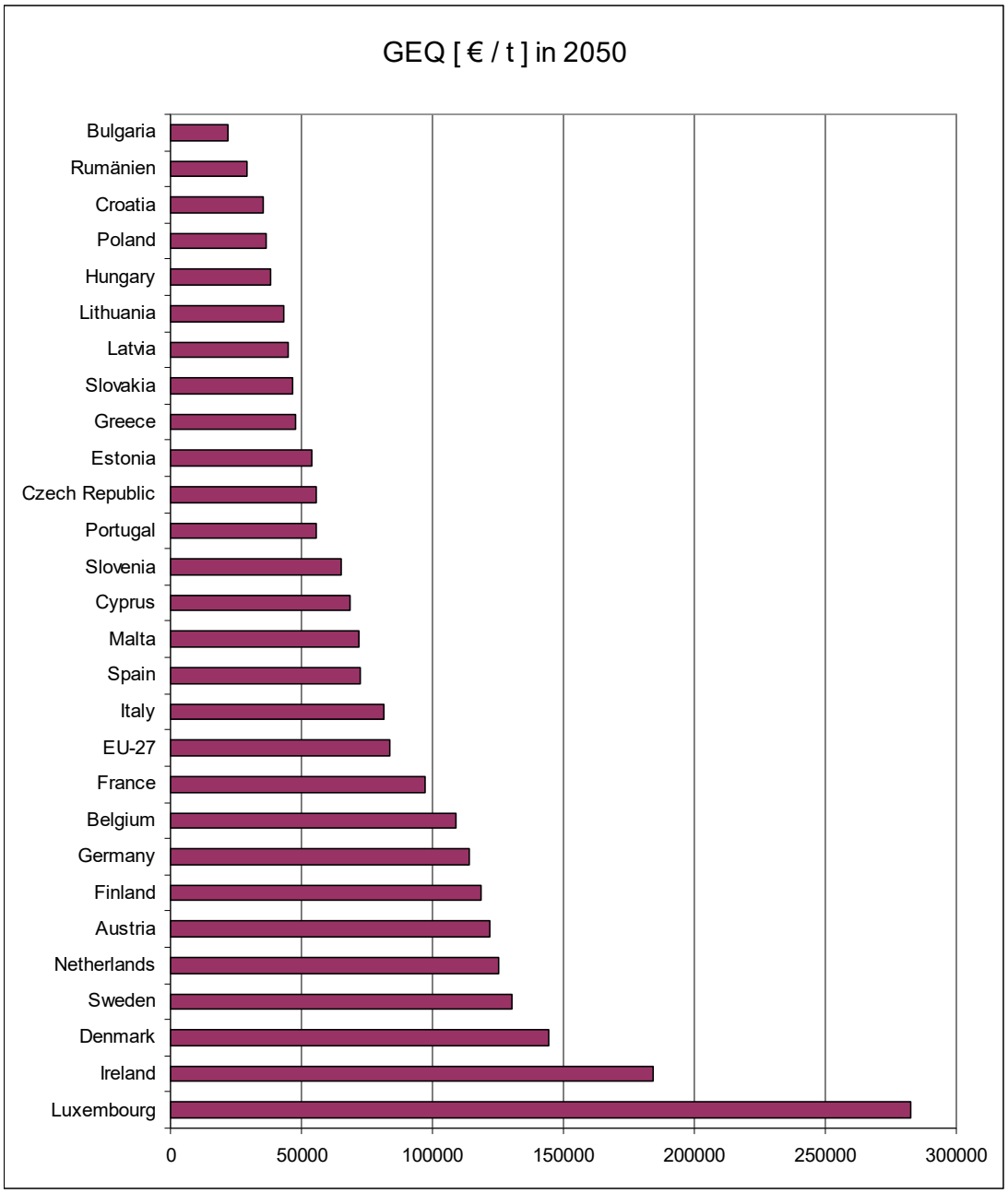

Fig. 3: GEQ – Target values for 2050

Some states will be exposed to stress by the transformation requirement for a climate-neutral status in 2050.

4. Discussion

The purpose of this section is to consider which conditions of this study are plausible / reasonable / realistic / sensible.

a) Data

The data for this study come from Eurostat and Statista as well as from European Environment Agency (EEA) and Wikipedia. Considering the variety of data which are generally available online, it is likely that some data can be found that do not exactly align with the samples used in this study. However, for the purpose of this study, the exact validity of data is immaterial.

b) Parameter time period

Using 2050 as a target date to achieve climate neutrality will certainly meet criticism of those experts or competent institutions who consider 2050 to bee too far in the future. Assuming an alternative target date of e.g. 2035 would result in a more demanding transformation process. It would be a more stringent timeline and the likelihood to reach climate neutrality is less feasible. For the purpose of raising awareness, it makes little sense to present facts that are immediately perceived as utopian.
In another view it is certainly not the intention of this study to spread fear and fright with provocative demands. This study provides just some recommendations for the comprehensible and likely safe avoidance of a global climate change disaster.

c) Parameter emission target value

The assumption of 0.5t emission volume per person per year (in global view of validity) represents a scenario, which initially seems to be useful for the purpose of visualizing the challenges. Of course, one could discuss the range of values (e.g. 0.2t or 0.8t per capita) that could also be considered with a lens of probability. Likewise, one could philosophize „long and wide“ whether the assumption of an identical emission quota for every person on our little blue planet is appropriate or would have to be modelled better by an unequal distribution of contingents. But, this study only wants to provide a narrative and showcase for the remarkable challenges that lie ahead. For this ambition the applied parameters are suitable.

It is essential in order to „safely“ avoid climate change disaster, a sufficient plausibility for the emission target is assumed. If one would use scenarios based on different emission contingents, the limits of the presented approach would become apparent by the fact that a conceivable emission target of 0t would result in infinitely high GEQ values. A scenario with negative emission target values could also be considered. It could become necessary to limit climate change by removing CO2e from atmosphere that has already been emitted. Concerning „global cooling“ there can be found papers online. They offer ideas as an impulse for critical reflection.

Remark:
The two parameter values „time period = up to 2050“ and „emission target = 0.5t/person“ do not fulfil, in the subjective opinion of the author, the necessary high safety standard to avoid a disaster. Some scientists are now critical of their own climate models because of dynamics of climate change are probably underestimated.

In addition experience has shown that plans for transformations on a global scale are often met with resistance from those forces who want to prevent the transformation. This means that a buffer timeframe would have to be considered to account for change management and for transformation progress. In this view the demand for „safe“ avoiding of climate change disaster still has to be taken into account.

d) Parameter GDP growth

The rationale for 1% growth as scenario for this study arises from the assumption that 1% GDP increase per year is more probable than 1% decrease per year. With respect to the result factors „percentage of emission reduction“ and „GEQ“ the parameter GDP growth (+/- 1%) has only a minor effect, so that it can be nearly neglected for the purpose of this study.

e) Percentage emission reduction

The calculated percentage for the necessary emission reductions signals how urgent the task for the EU-27 countries is. Tentative changes in the money circulation of government and businesses are highly unlikely to make a sufficient contribution to a solution. Taxation of CO2 emissions with e.g. 25€/t in the consumer sector for e.g. residential heating and hot water tends to be ineffective, if the taxes collected are not invested in a targeted and earmarked way in climate-neutral value chains.

For industries operating in energy, steel, chemical, mechanical engineering, automotive and construction [6], the percentages will probably mean a test of strength between European aspirations and global competition. Even for emission reduction in governmental facilities and institutions, the calculated percentages mean that massive efforts have to be started quickly. Each year of delay would lead to an escalation of challenges.
Government and industries are likely to need the cooperation of citizens, which can contribute to the overall solution by transforming their lifestyles. As a link [7] and [8] could be mentioned.

f) GEQ factor

The GEQ diagrams in the appendix are designed to visualize the challenge to achieve EU-27 climate neutrality. The amount of value adds per t emission in the economic region of a respective country covers a wide range of values, namely from about 22,000€/t in Bulgaria to about 280,000€/t in Luxembourg (each in 2050). The difference from the actual status to calculated target is considerable and ranges from approx. 25-fold to 60-fold of 2018.
Attentive perception of these ranges is essential to strengthen awareness that meet criteria like plausible / reasonable / realistic / sensible.

g) Probability of target achievement

25-fold to 60-fold value added per t of emission in 2050 hopefully initiates many discussions about the probability of achieving such a transformation in time. To keep in mind, the probability has to stay oriented to the fact that there will be certainly no disaster for the living conditions of humans in the planetary biotope earth.

An especially challenging question would probably be whether the global doctrine of competition fundamentally allows European economy to emerge with e.g. 100,000€ value added per t of emission. Would this mean competition or „free trade“ must be redefined?

Lastly, if one directs the view to the approx. 200 states on our small blue planet, the question arises as to what role Europe is allowed to play in global world affairs within the transformation demands for 2050. That is, Europe has an emissions share of around 10% (2018).

This is all very exciting and ultimately involves the big majority of people. Perhaps, this study will succeed in providing an impetus for constructive creativity to solution for the challenges.

5. Notes

All statements made in this study correspond to the exercise of the right to free expression of opinion and leave room for personal judgements by readers. Decisions or interpretation by readers on their own behalf remain open and their own responsibility.
The statements correspond to the researched state of knowledge without claiming completeness and exact correctness.
Results and diagrams are available according to the Creative Commons Rules „BY-NC-SA“.

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Donation account	DE32 25120510 2124920080

6. References

[1] www.wbgu.de/wbgu_sn2009_en.html
[2] E.U.v.Weizsäcker et al; Faktor 4 doppelter Wohlstand – halbierter Naturverbrauch
[3] E.U.v.Weizsäcker et al; Faktor 5 Die Formel für nachhaltiges Wachstum
[4] Dr. Dirk Solte; Wann haben wir genug? (ISBN 978-3-902991-38-6)
[5] Giacomo D´Alisa et al; Degrowth Handbuch für eine neue Ära (ISBN 978-3-86581-767-9)
[6] Heinrich-Böll-Stiftung; Wirtschaft im Zukunftscheck (ISBN 978-3-96006-008-6)
[7] M. Pauli et al; Tu was! Jeder kann die Welt verändern (ISBN 978-3-944222-13-4)
[8] Nottebohm, König, Faul; Exposé in www.globalmarshallplan.org/lokalgruppe-muenchen

Review

Comments by Professor Dr. Gerhard Berz

The considerations set out in the study "EU27 - Development Path for Climate Protection" are plausible and clearly formulated. The data base is taken from official, generally accessible sources (e.g. Eurostat). The method is described comprehensively and is appropriate in relation to the purpose of the study (promotion of awareness raising).

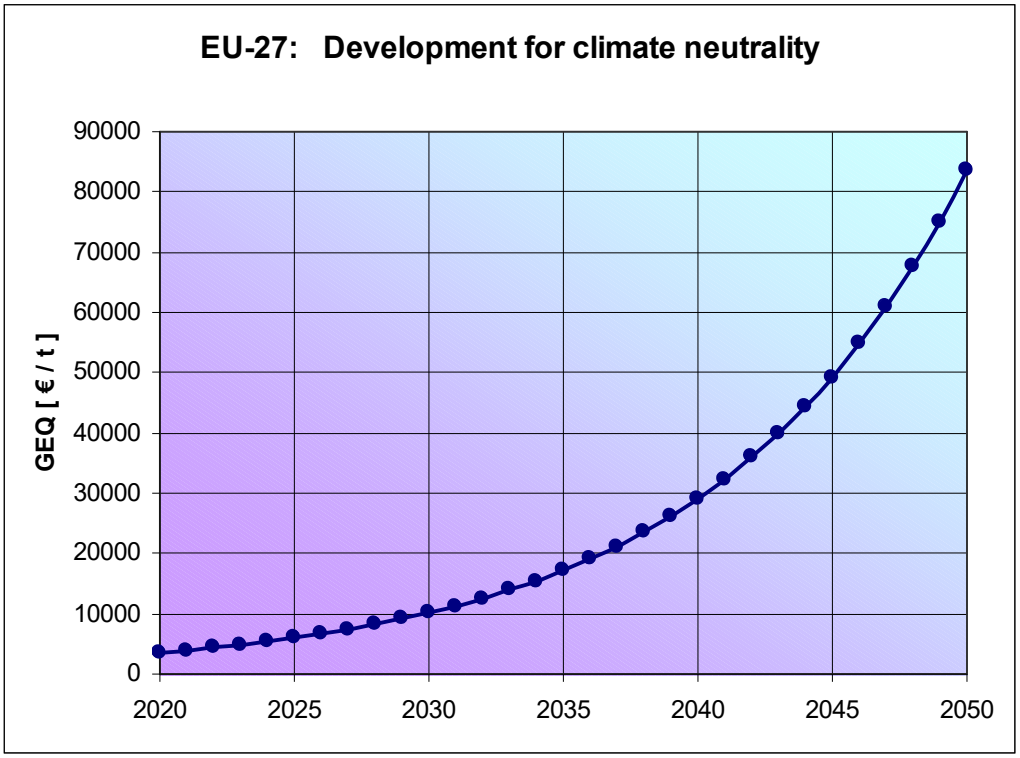
I can also endorse the publication in view of the relevance of the subject. The discussion of a target achievement by 2045 means that the modeled percentage of the emission reduction according to the comparative calculation of the author, e.g. for the FRG, would increase by approx. 1.8%, compared to the time horizon of 2050, which is the basis for the study. Already, the present diagrams impressively illustrate the considerable challenges.

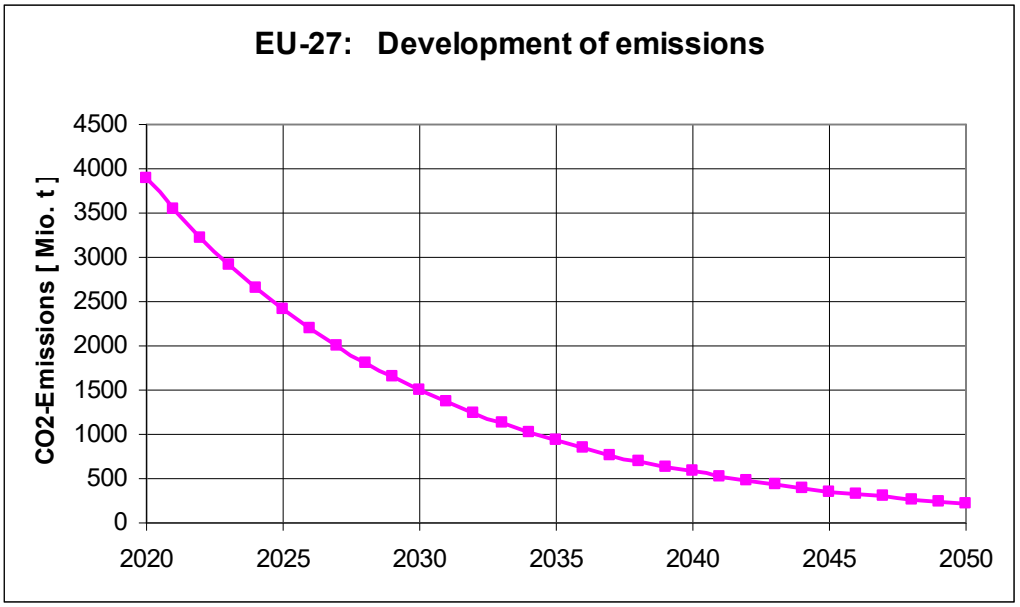
I wish the publication every success.

sig. Prof. Dr. G. Berz 18. 5. 2021

Appendix

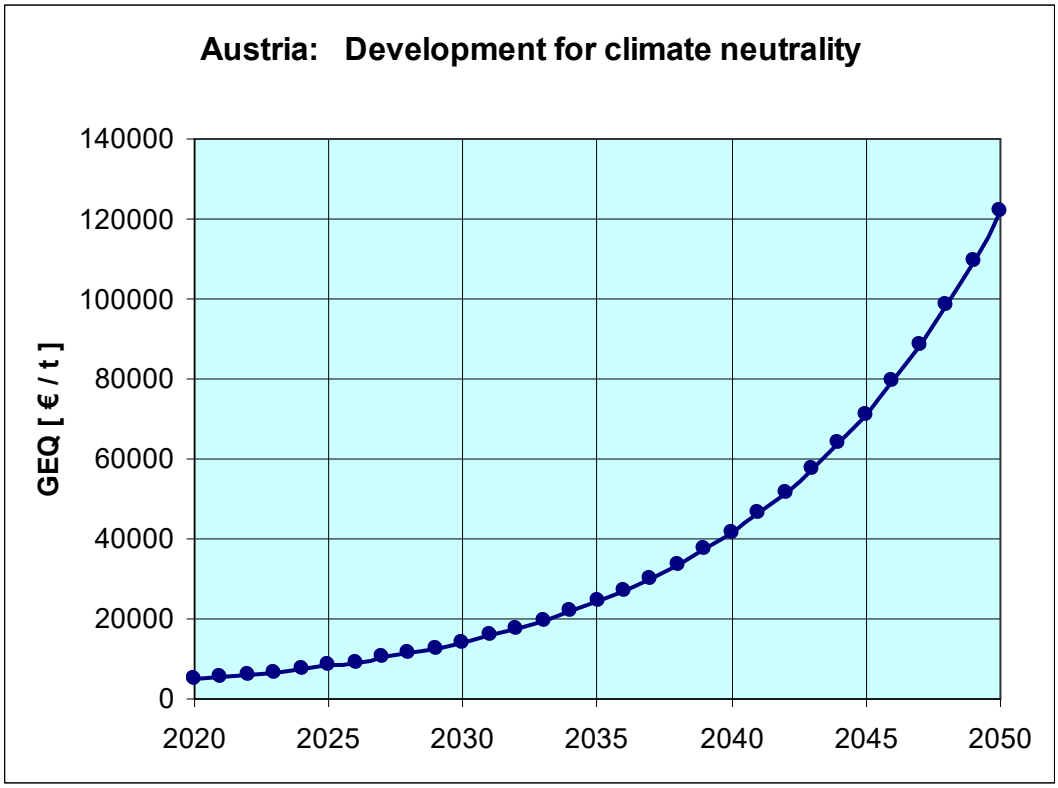
EU-27 (GEQ - visualisation starting on facts in 2020)





Sum of EU-27 emissions (if transformation is strictly processed) = 40.5 billion t

Austria


Austria: Development for climate neutrality
GEQ [€ / t]
140000
120000
100000
80000
60000
40000
20000
0
2020
2025
2030
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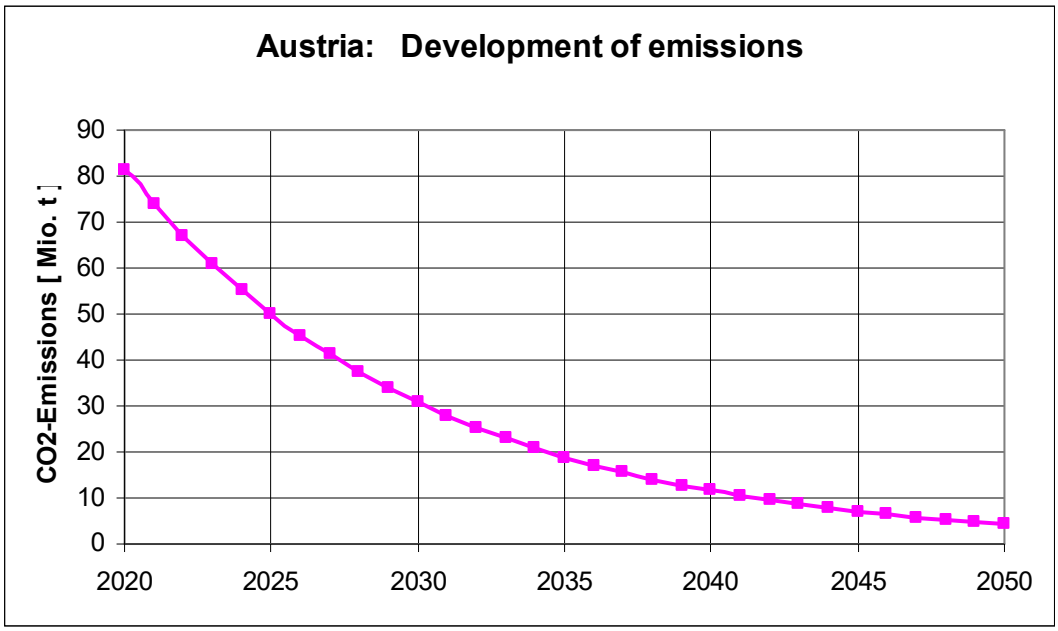
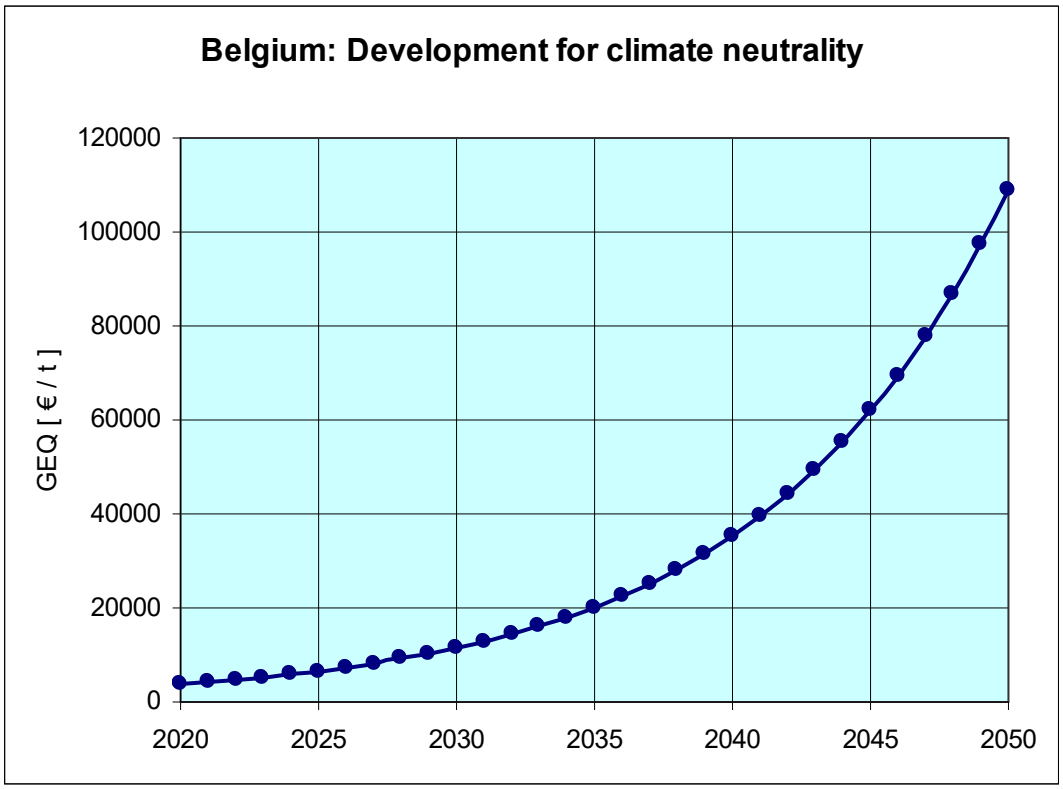
2040
2045
2050


Austria: Development of emissions
CO2-Emissions [Mio. t]
90
80
70
60
50
40
30
20
10
0
2020
2025
2030
2035
2040
2045
2050

Belgium


Belgium: Development for climate neutrality
GEQ [€ / t]
120000
100000
80000
60000
40000
20000
0
2020
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2030
2035
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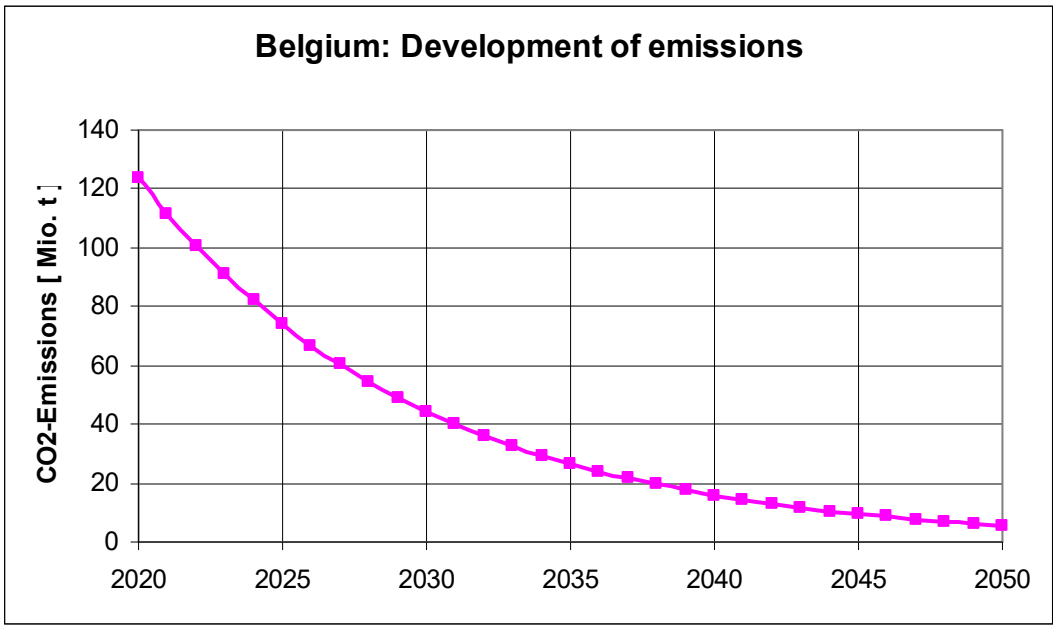
2045
2050


Belgium: Development of emissions
CO2-Emissions [Mio. t]
140
120
100
80
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20
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2020
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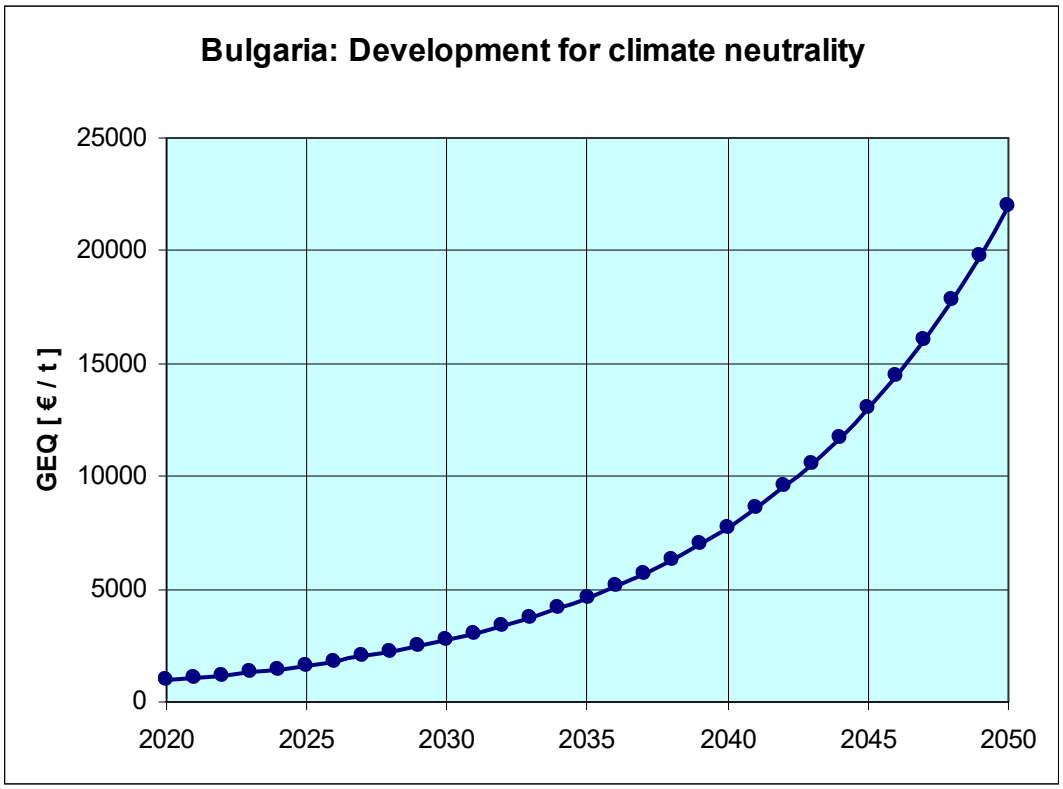
2050

Bulgaria


Bulgaria: Development for climate neutrality
GEQ [€ / t]
25000
20000
15000
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5000
0
2020
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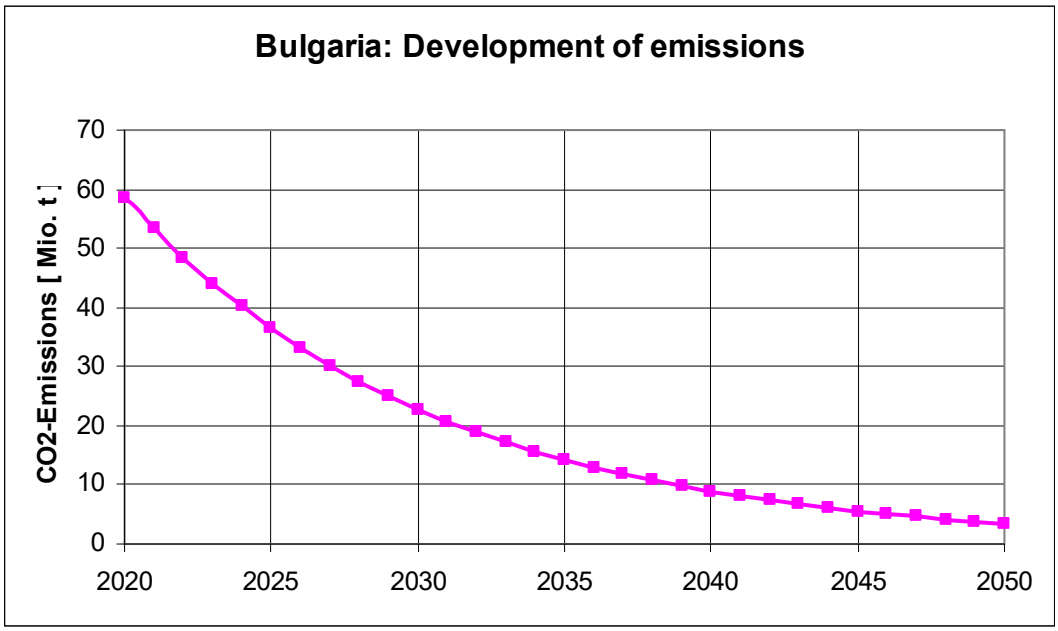
Bulgaria: Development of emissions
CO2-Emissions [Mio. t]
70
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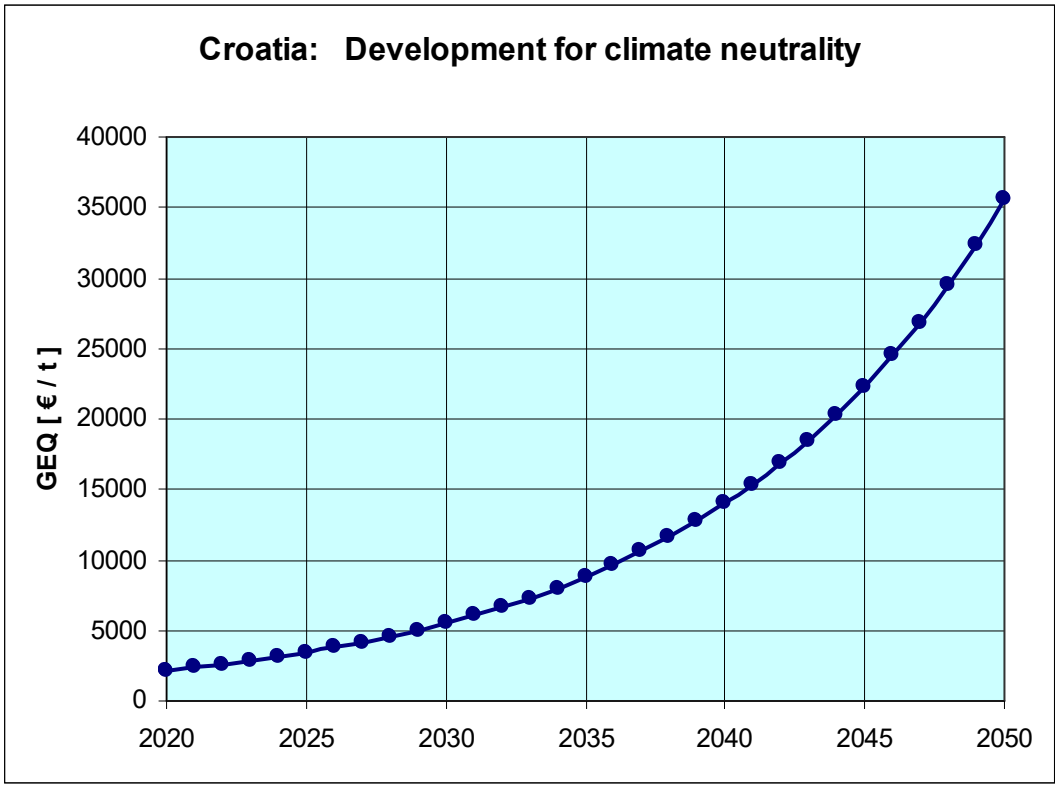
Croatia


Croatia: Development for climate neutrality
GEQ [€ / t]
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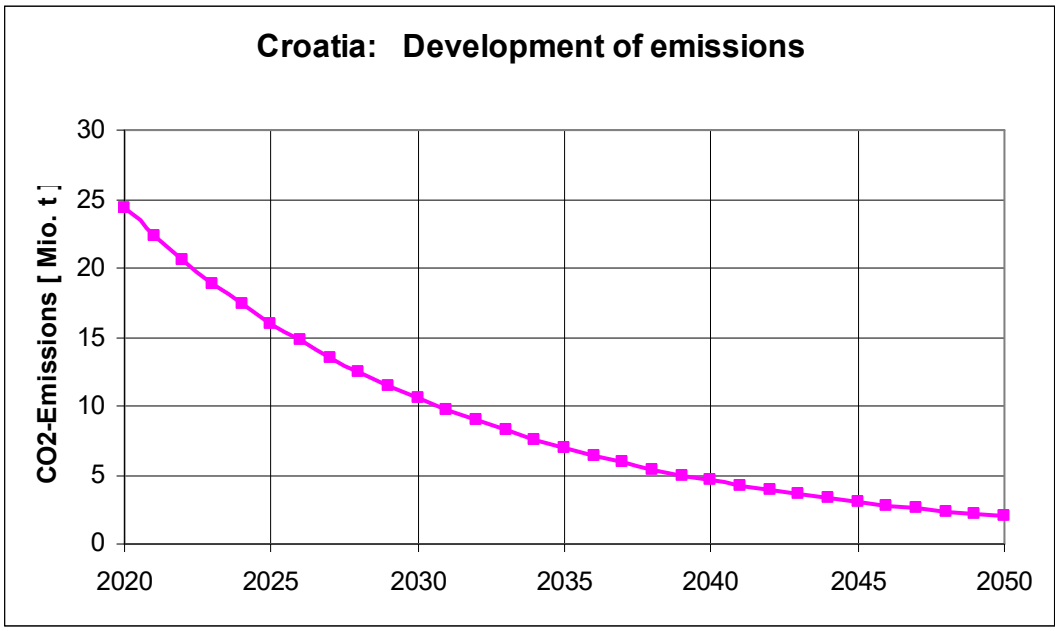
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CO2-Emissions [Mio. t]
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2020
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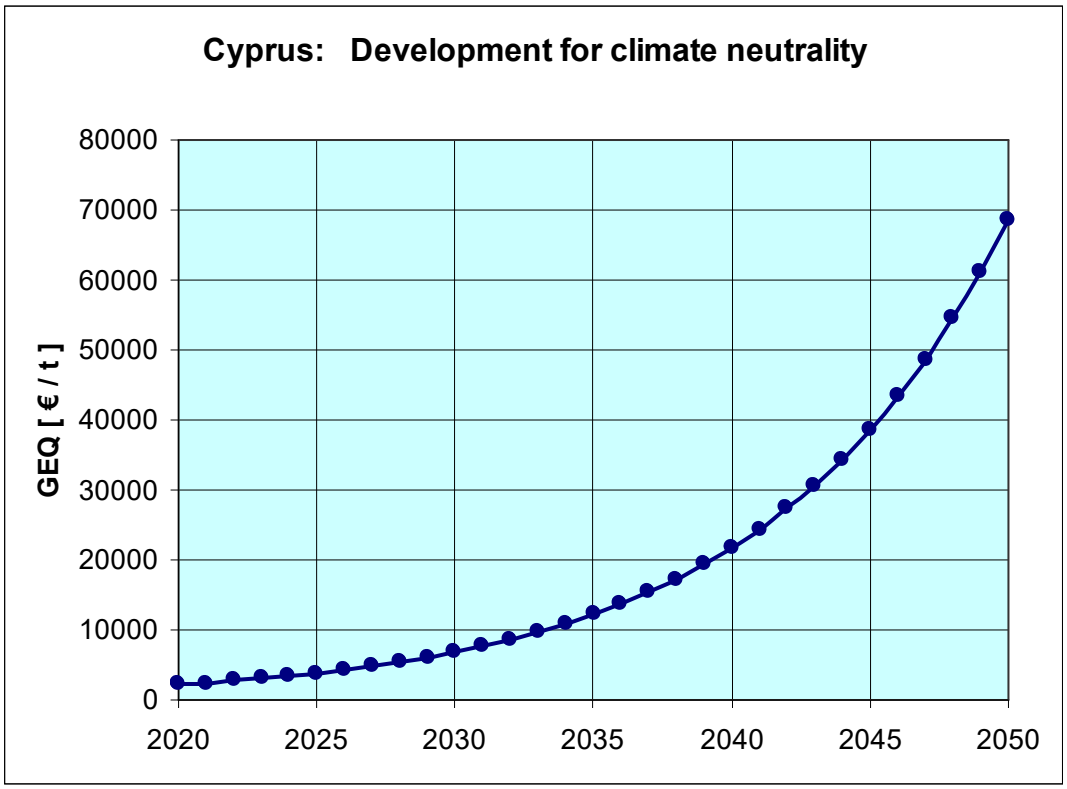
Cyprus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GEQ [€ / t]
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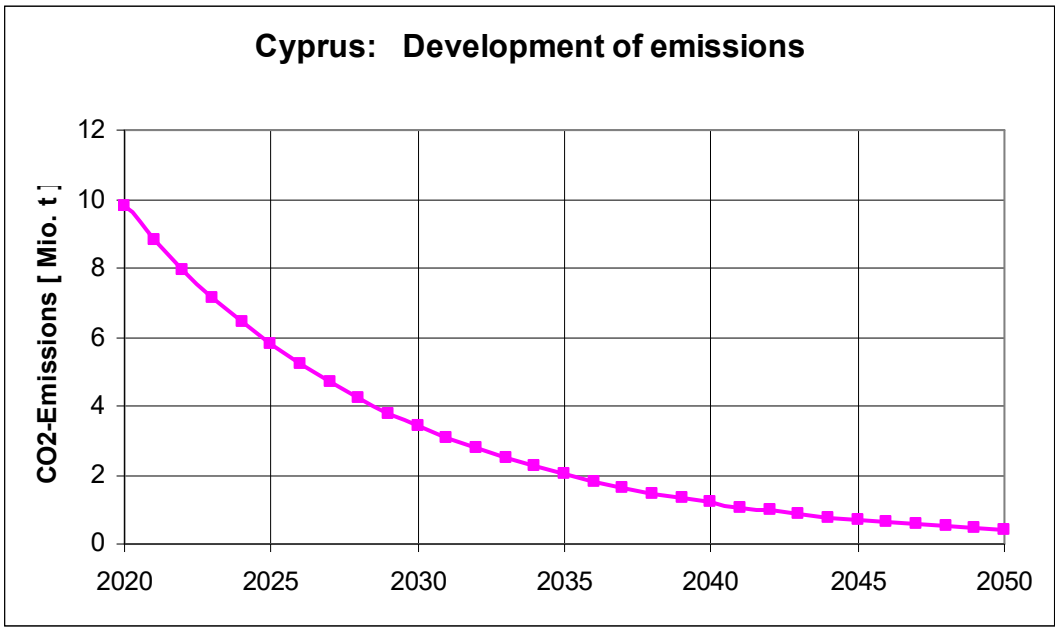
Cyprus: Development of emissions
CO2-Emissions [Mio. t]
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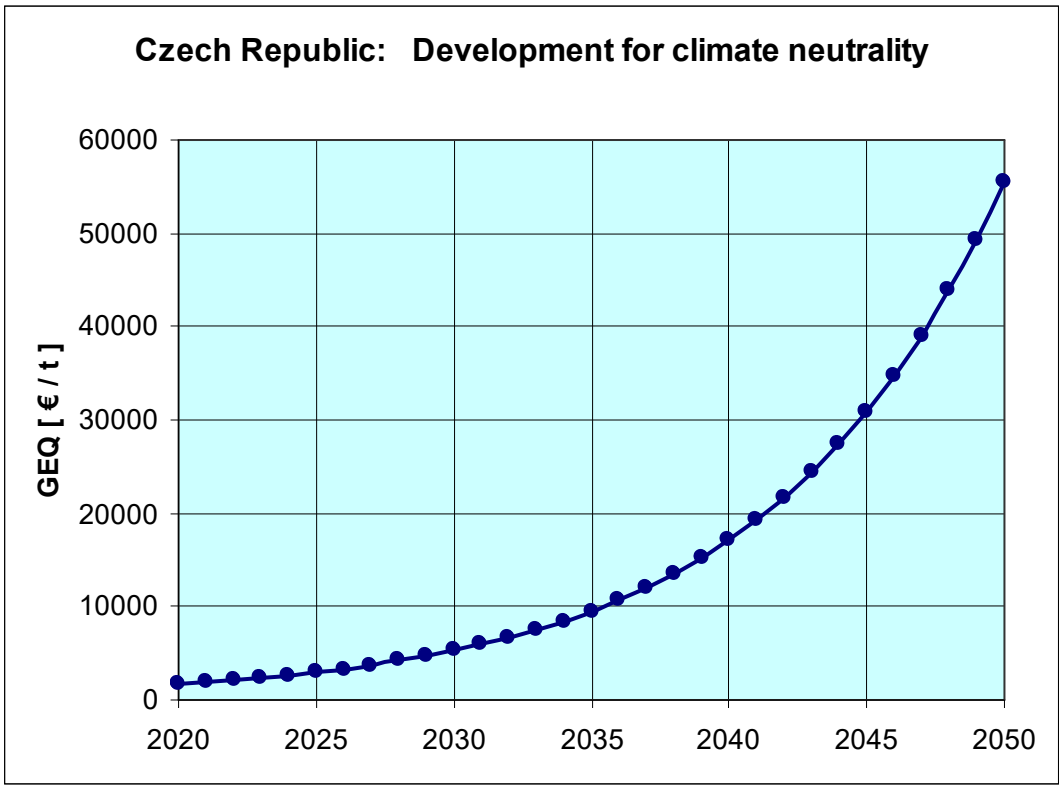
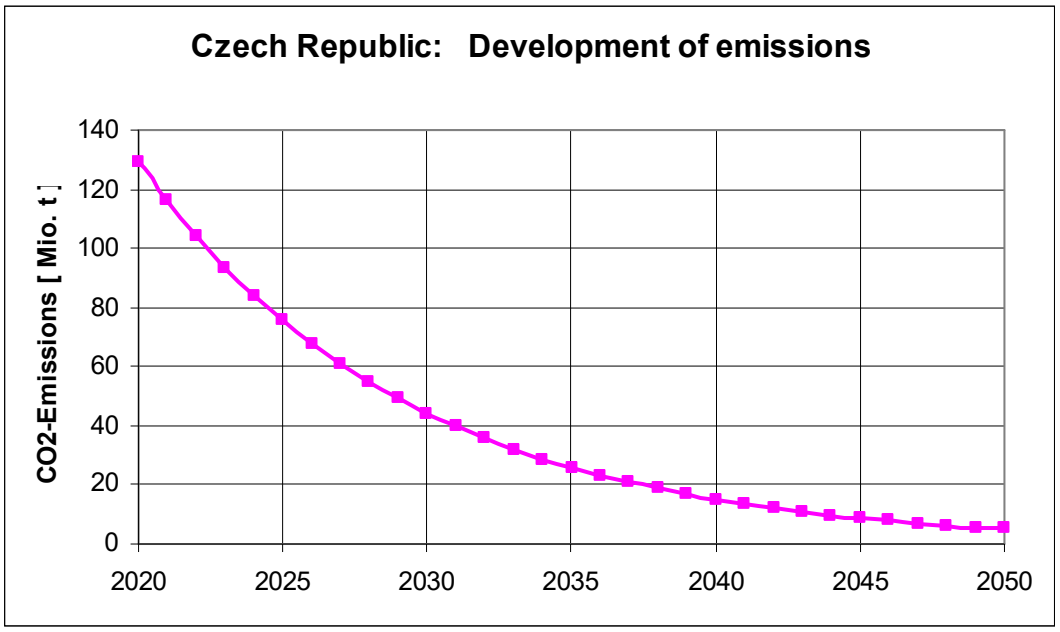
Czech Republic





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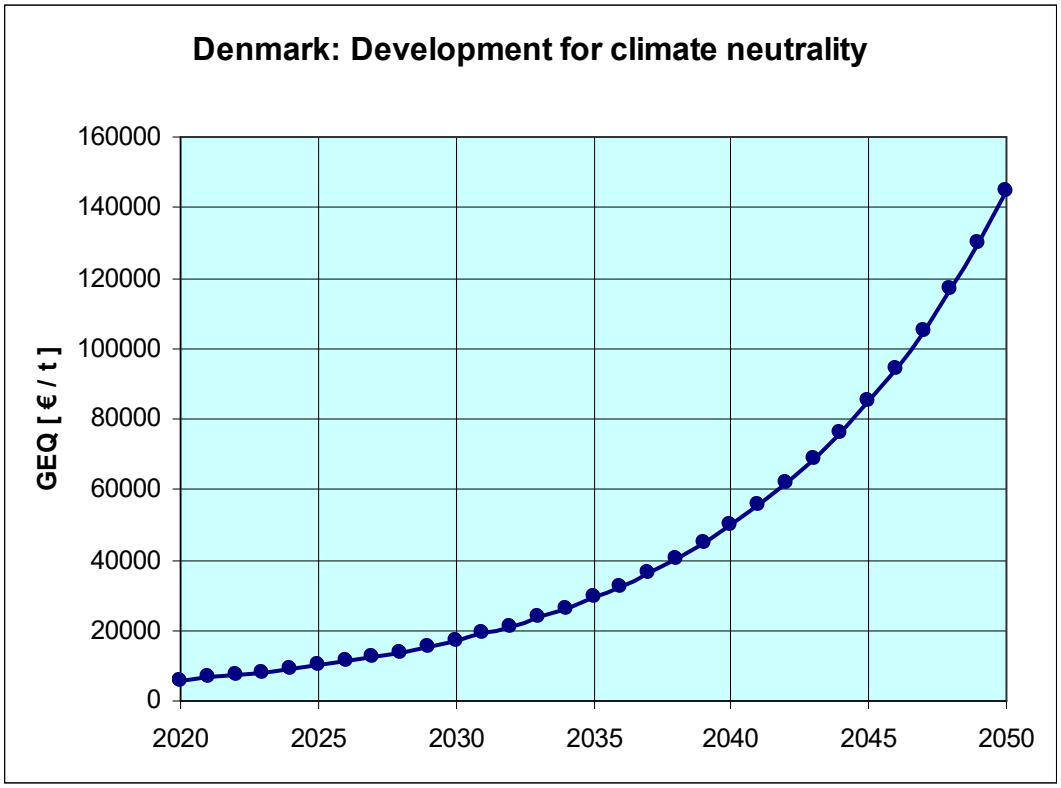
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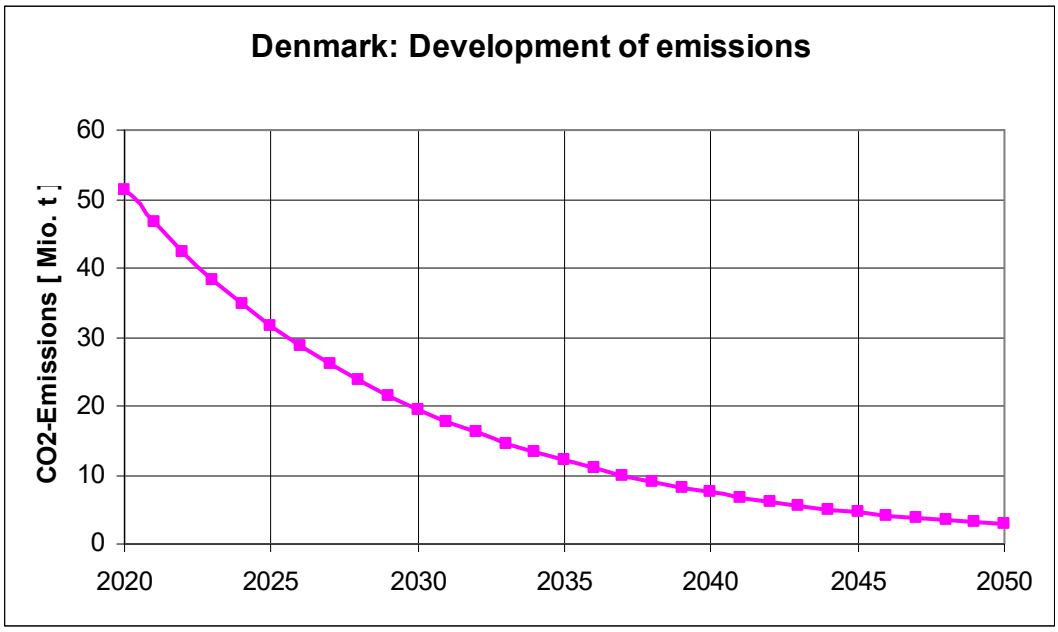
Denmark: Development of emissions
CO2-Emissions [Mio. t]
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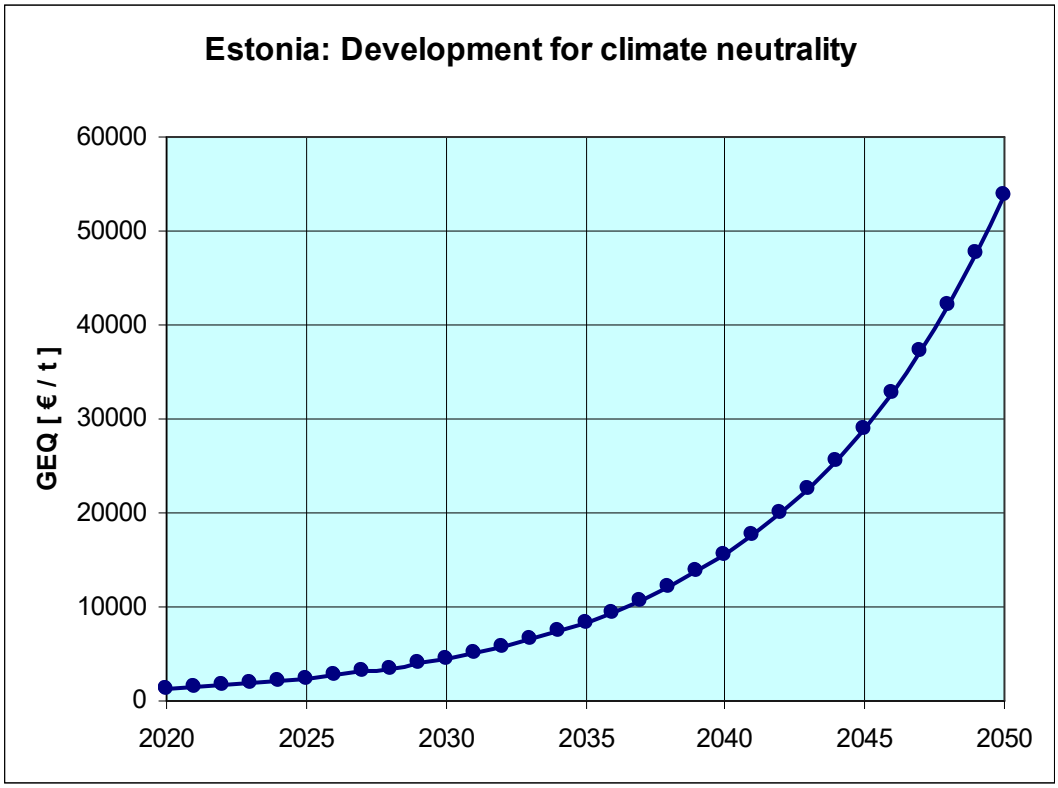
Estonia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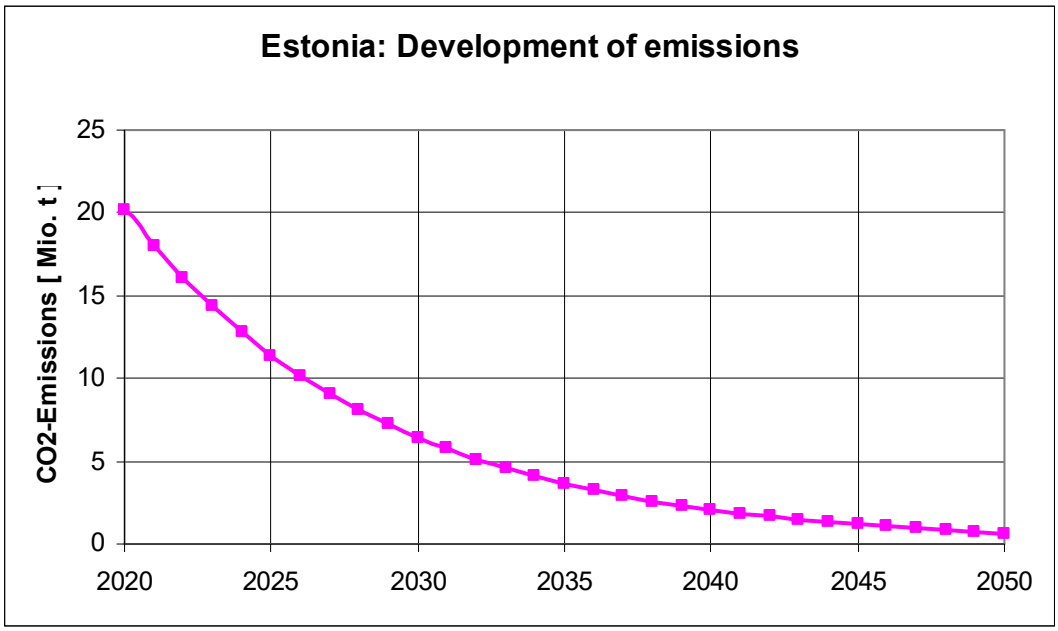
Estonia: Development of emissions
CO2-Emissions [Mio. t]
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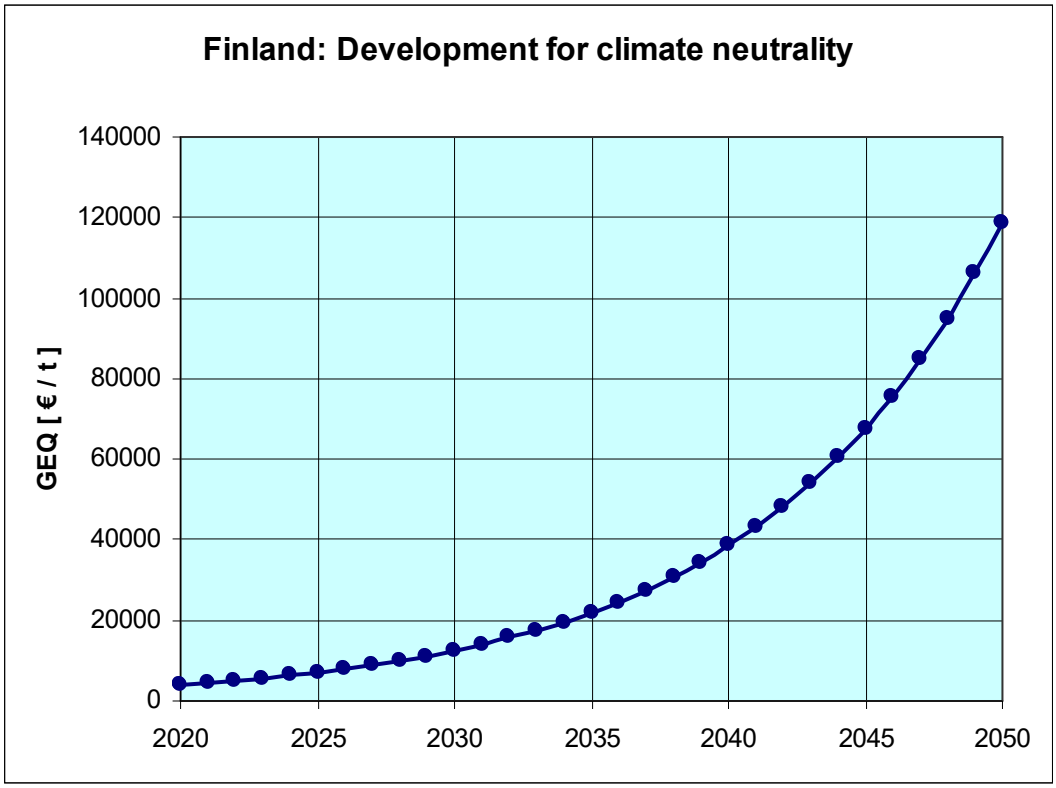
Finland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GEQ [€ / t]
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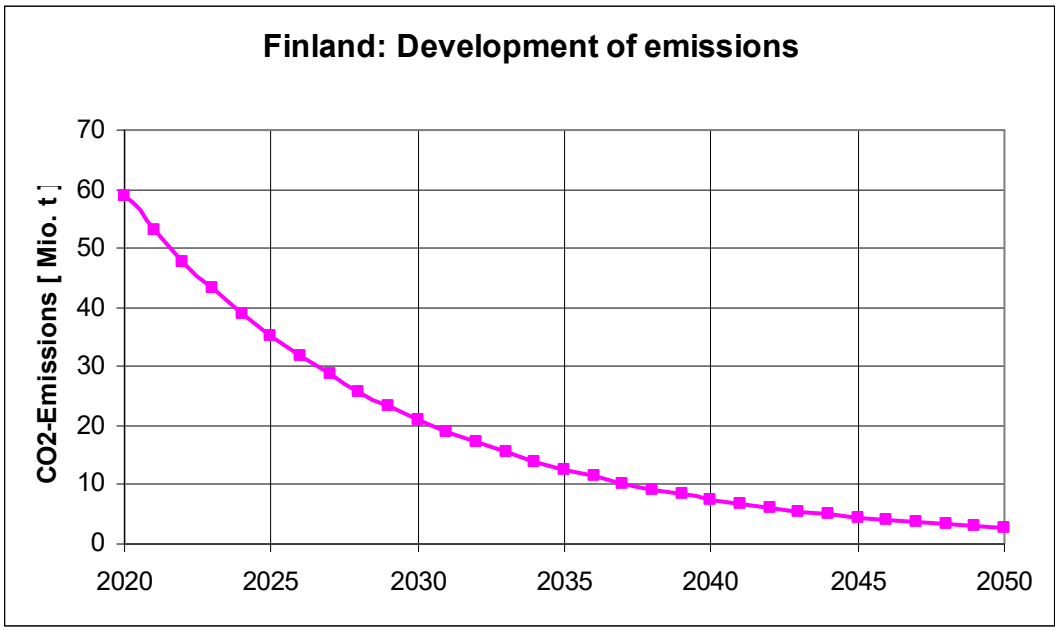
Finland: Development of emissions
CO2-Emissions [Mio. t]
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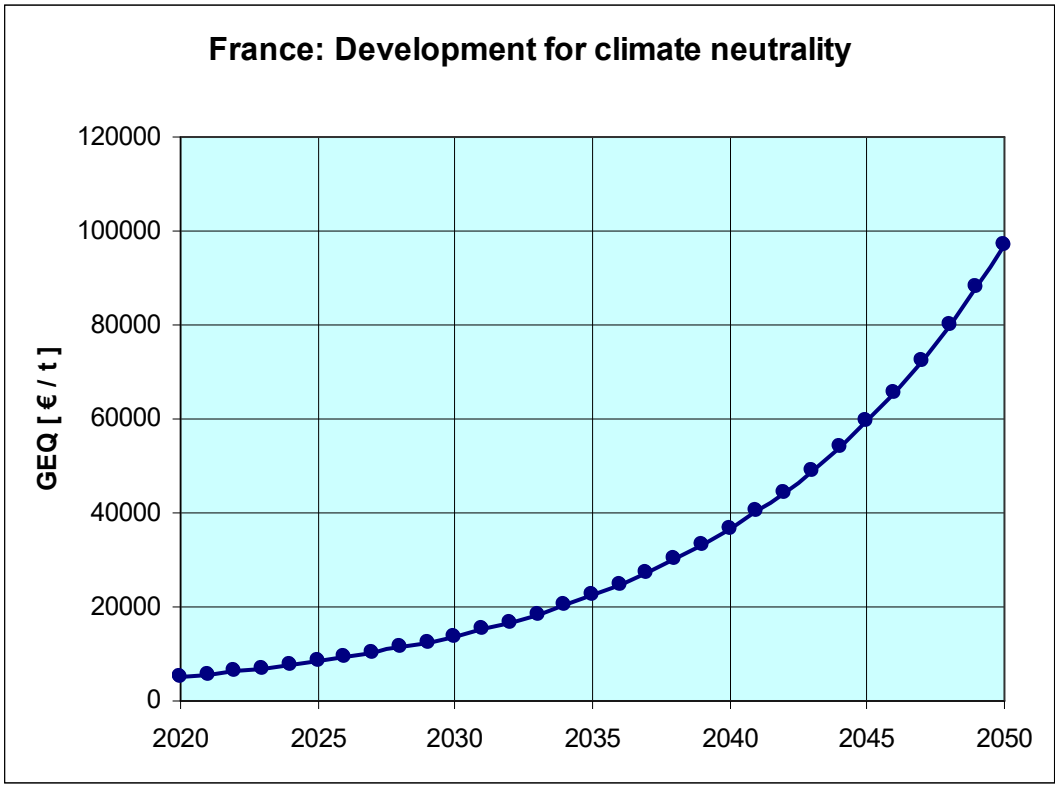
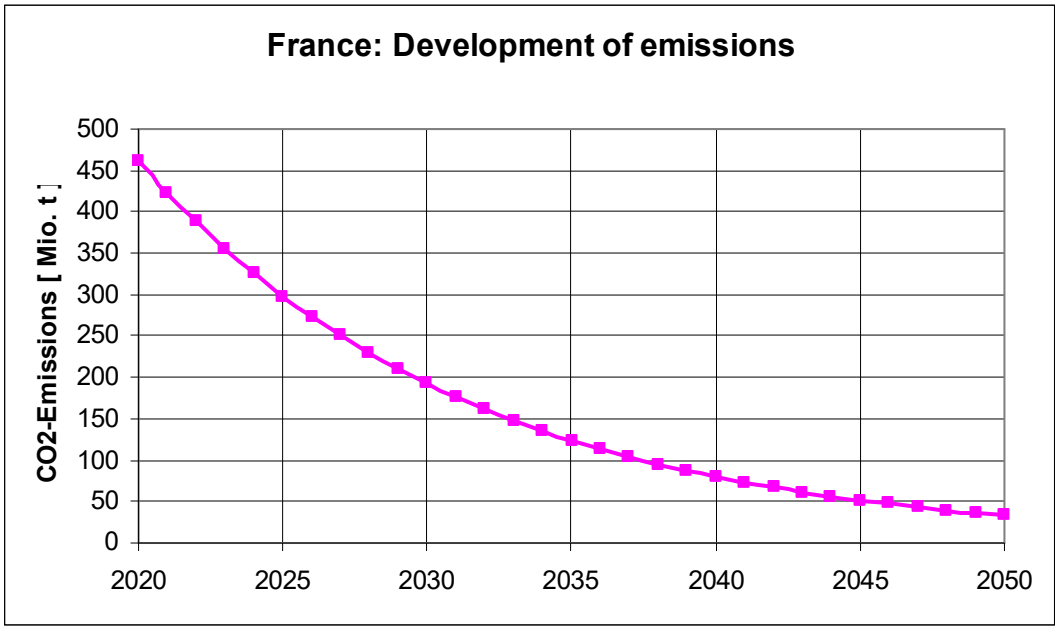
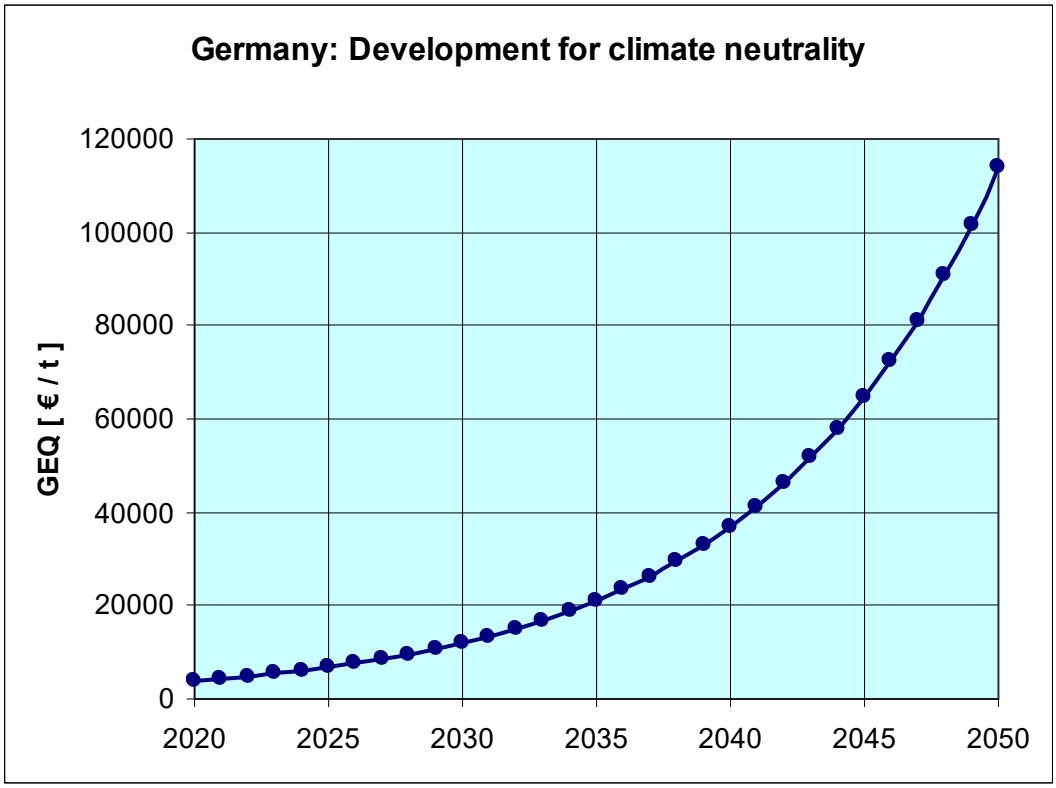
2035
2040
2045
2050

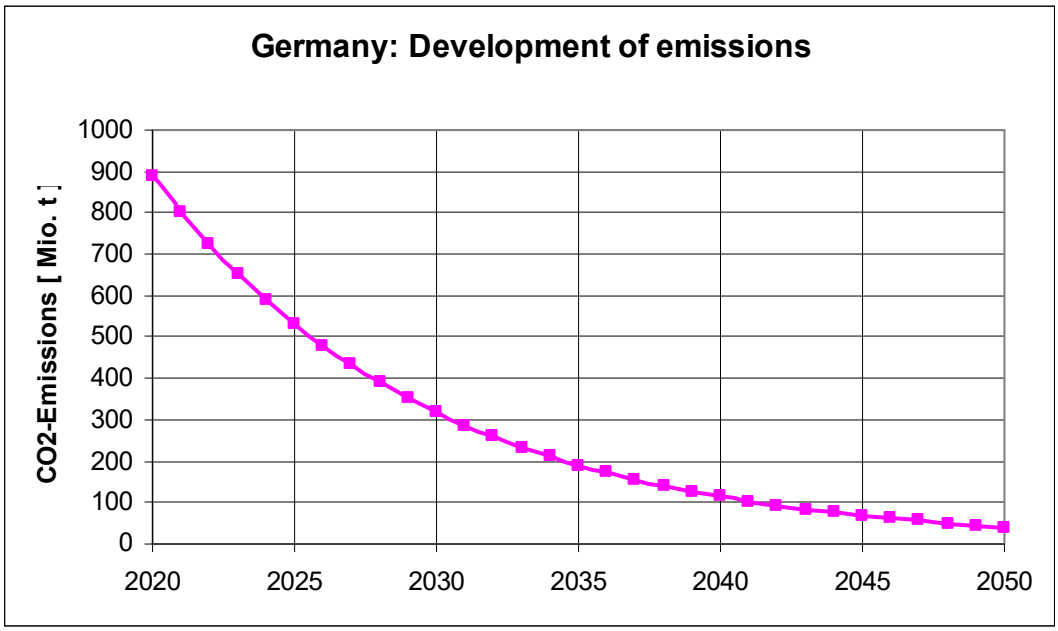
France


France: Development for climate neutrality
GEQ [€ / t]
120000
100000
80000
60000
40000
20000
0
2020
2025
2030
2035
2040
2045
2050

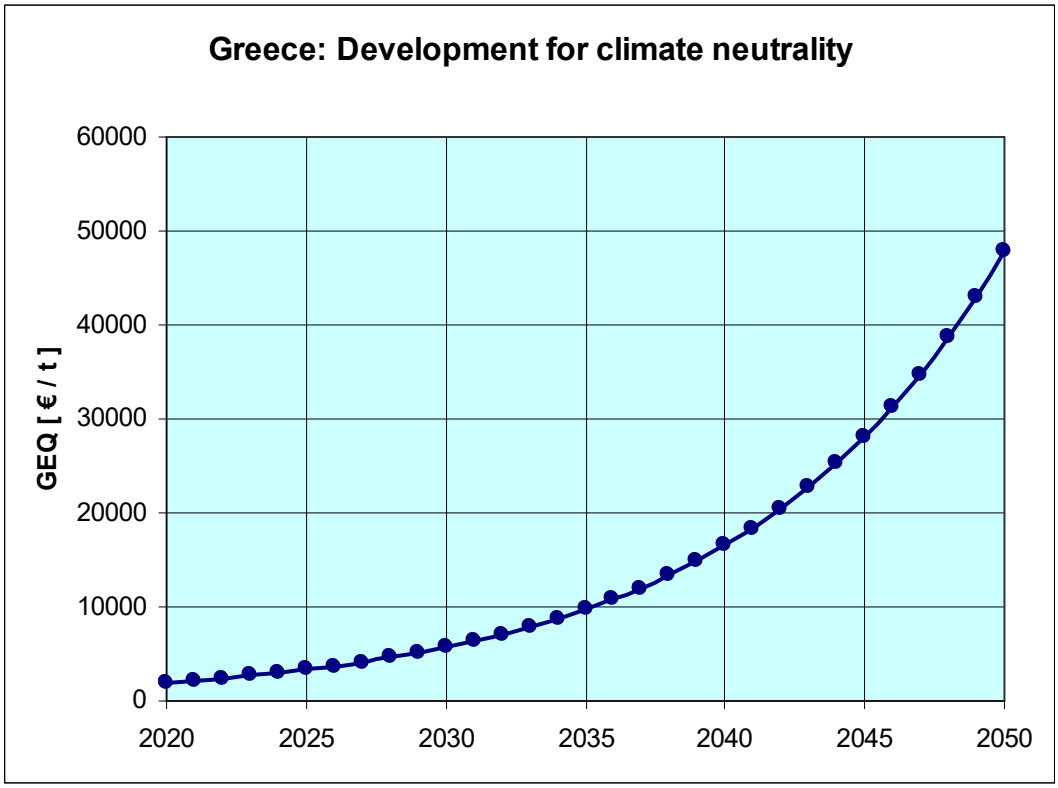

France: Development of emissions
CO2-Emissions [Mio. t]
500
450
400
350
300
250
200
150
100
50
0
2020
2025
2030
2035
2040
2045
2050

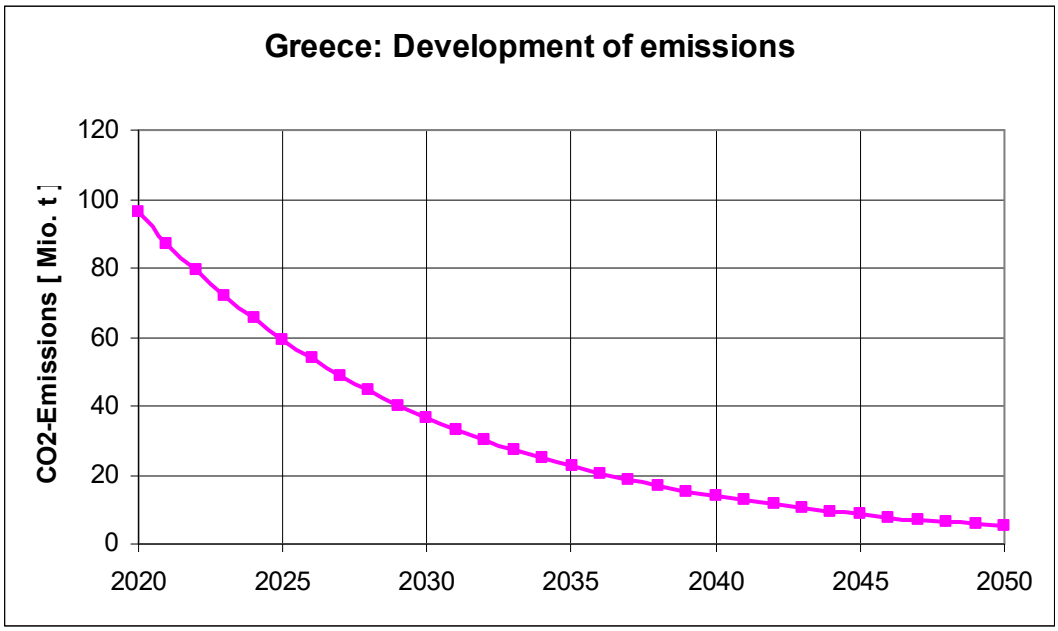
Germany


Germany: Development for climate neutrality
GEQ [€ / t]
120000
100000
80000
60000
40000
20000
0
2020
2025
2030
2035
2040
2045
2050

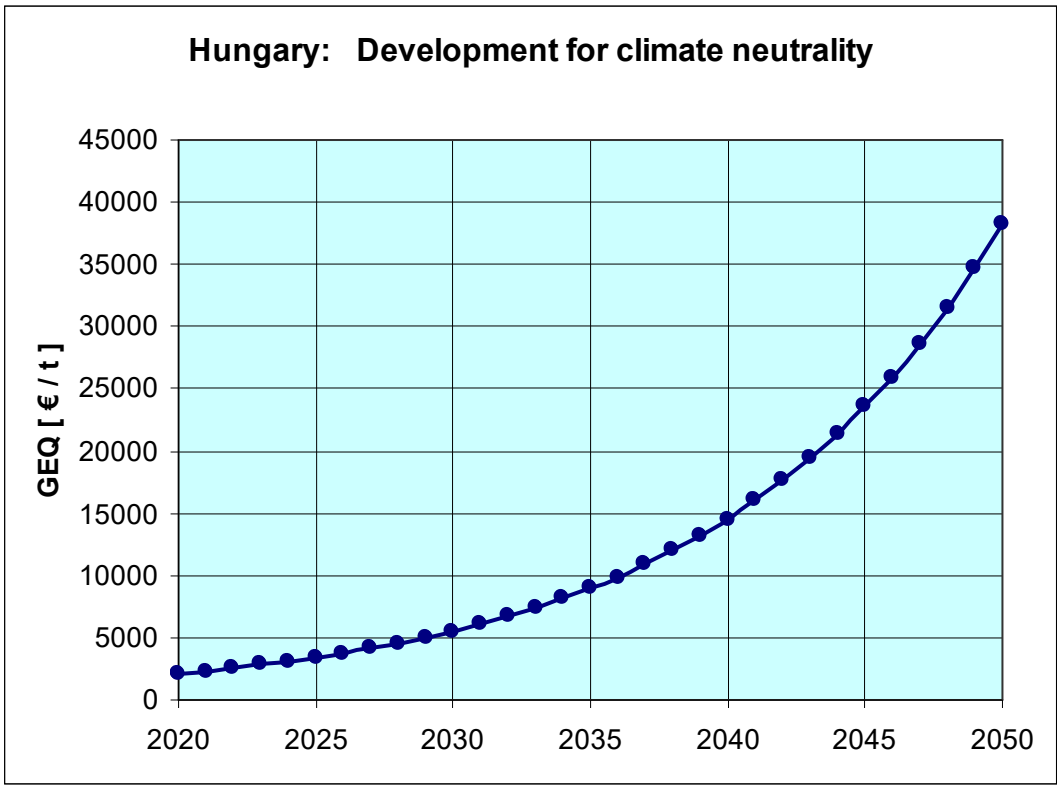

Germany: Development of emissions
CO2-Emissions [Mio. t]
1000
900
800
700
600
500
400
300
200
100
0
2020
2025
2030
2035
2040
2045
2050

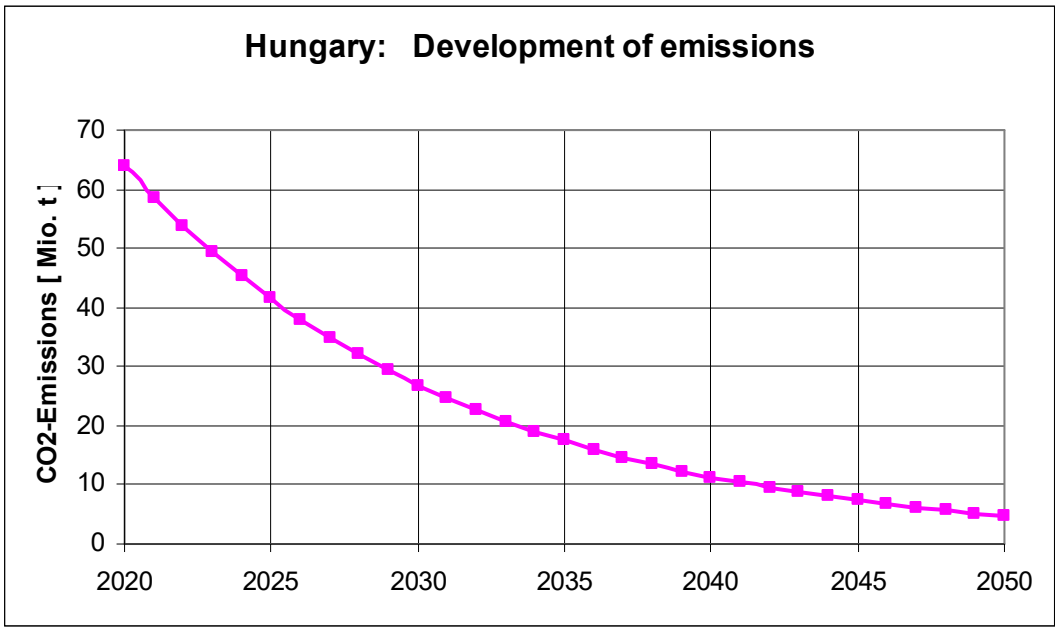
Greece


Greece: Development for climate neutrality
GEQ [€ / t]
60000
50000
40000
30000
20000
10000
0
2020
2025
2030
2035
2040
2045
2050

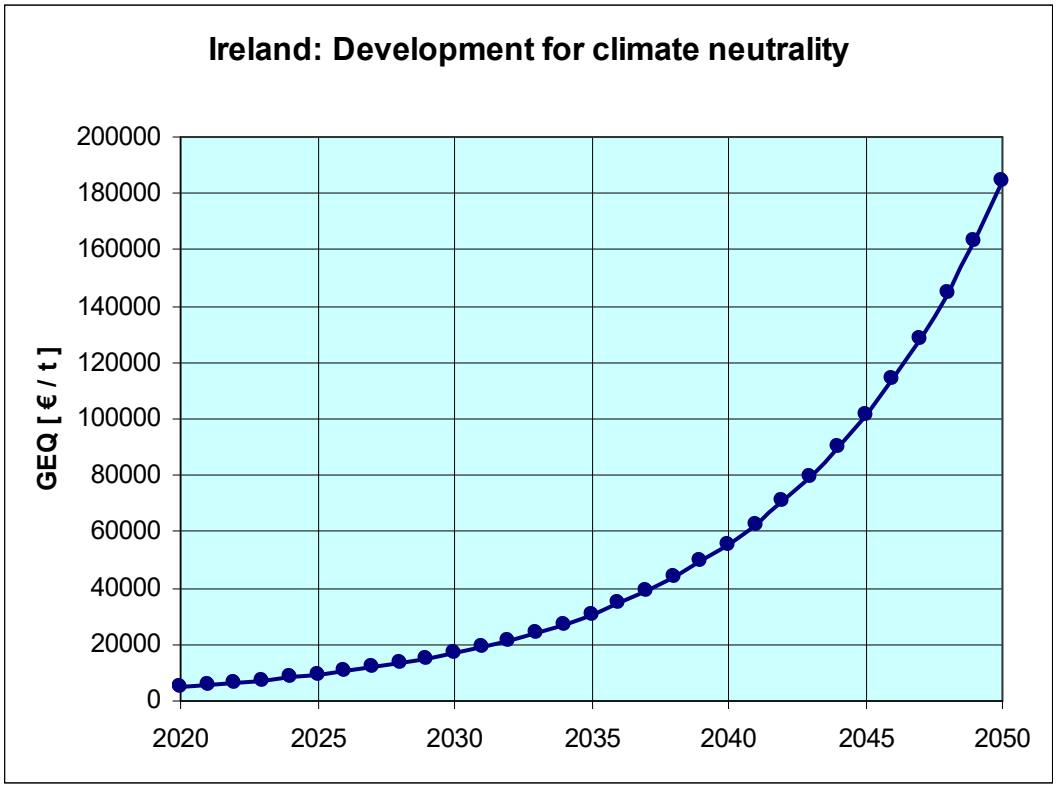

Greece: Development of emissions
CO2-Emissions [Mio. t]
120
100
80
60
40
20
0
2020
2025
2030
2035
2040
2045
2050

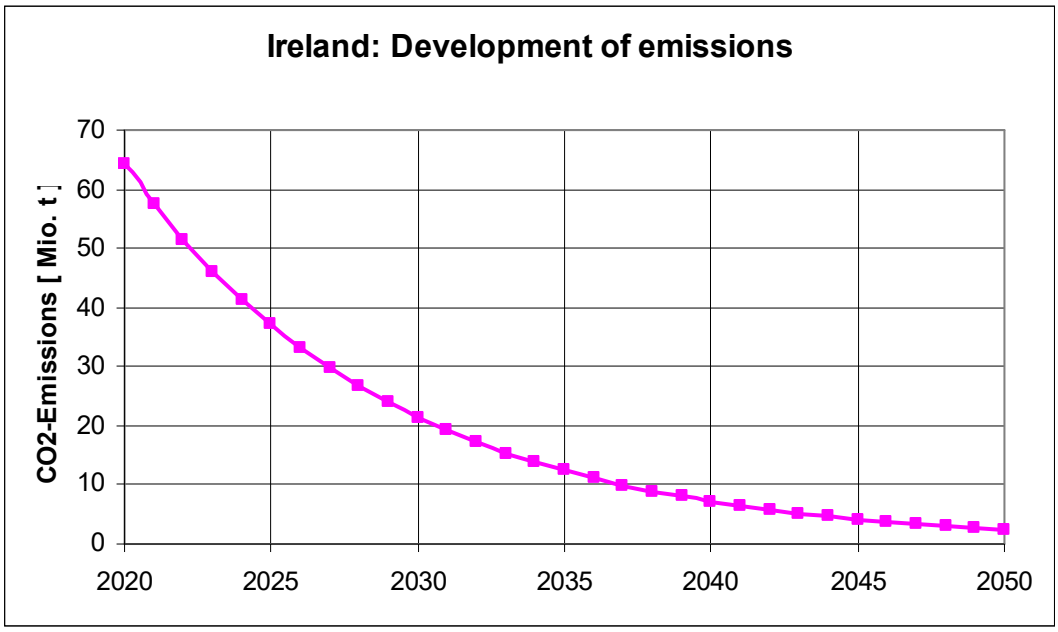
Hungary


Hungary: Development for climate neutrality
GEQ [€ / t]
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
2020
2025
2030
2035
2040
2045
2050

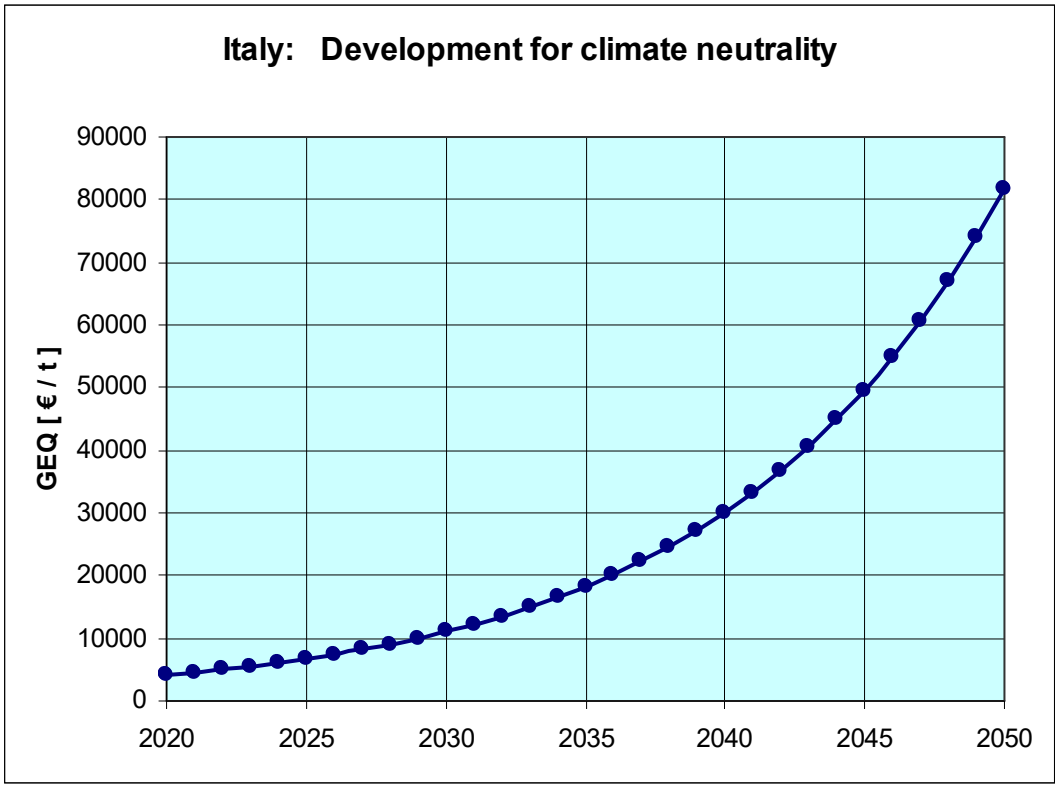

Hungary: Development of emissions
CO2-Emissions [Mio. t]
70
60
50
40
30
20
10
0
2020
2025
2030
2035
2040
2045
2050

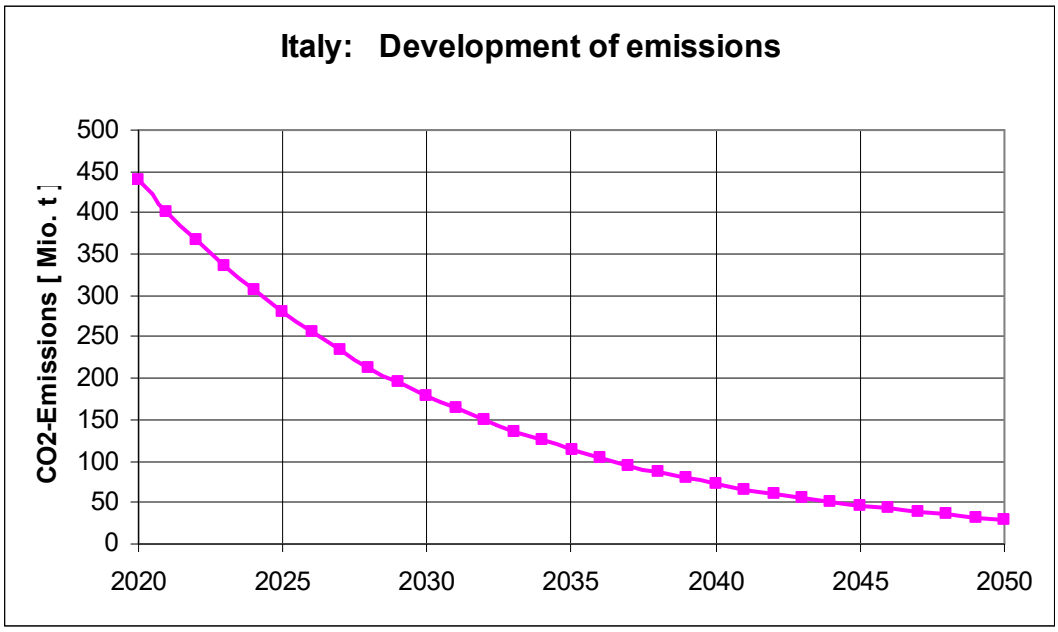
Ireland


Ireland: Development for climate neutrality
GEQ [€ / t]
200000
180000
160000
140000
120000
100000
80000
60000
40000
20000
0
2020
2025
2030
2035
2040
2045
2050

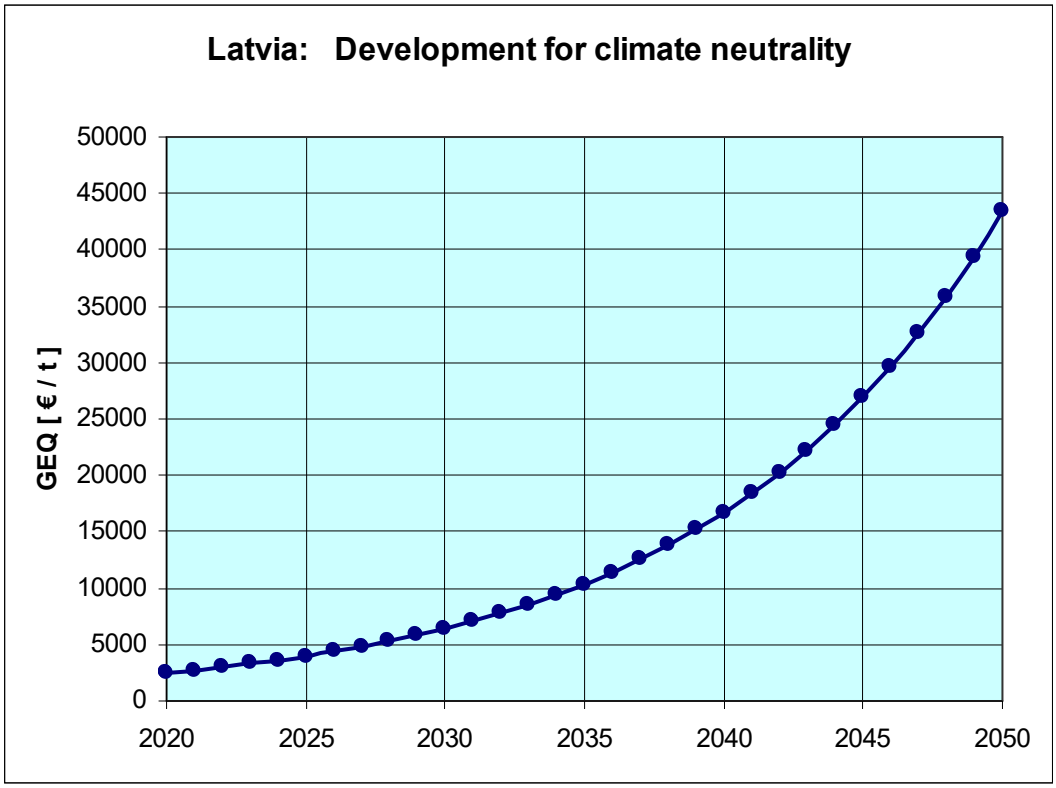

Ireland: Development of emissions
CO2-Emissions [Mio. t]
70
60
50
40
30
20
10
0
2020
2025
2030
2035
2040
2045
2050

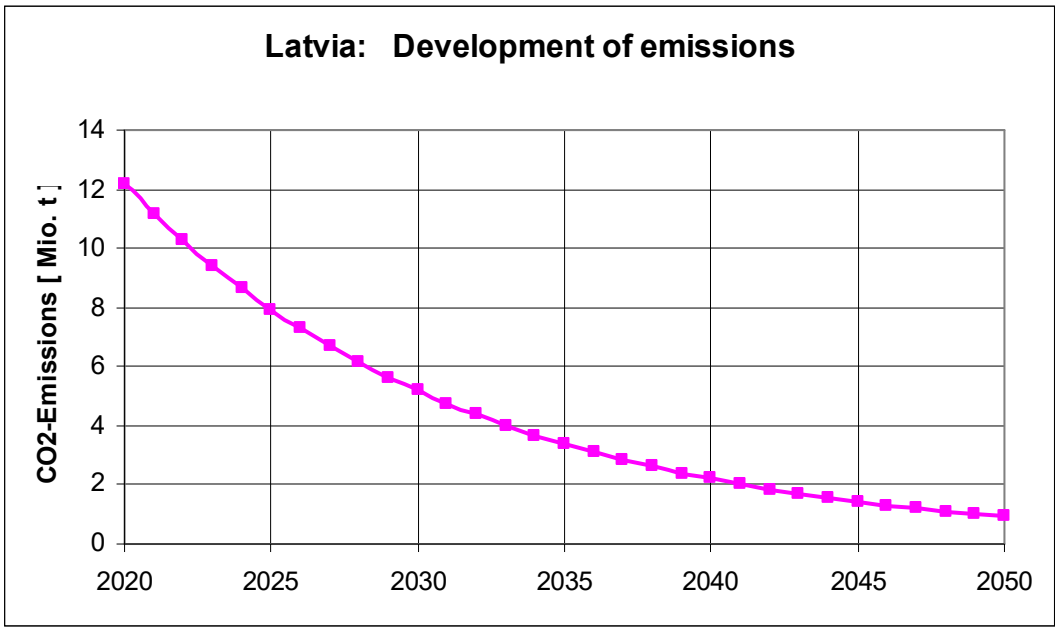
Italy


Italy: Development for climate neutrality
GEQ [€ / t]
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
2020
2025
2030
2035
2040
2045
2050

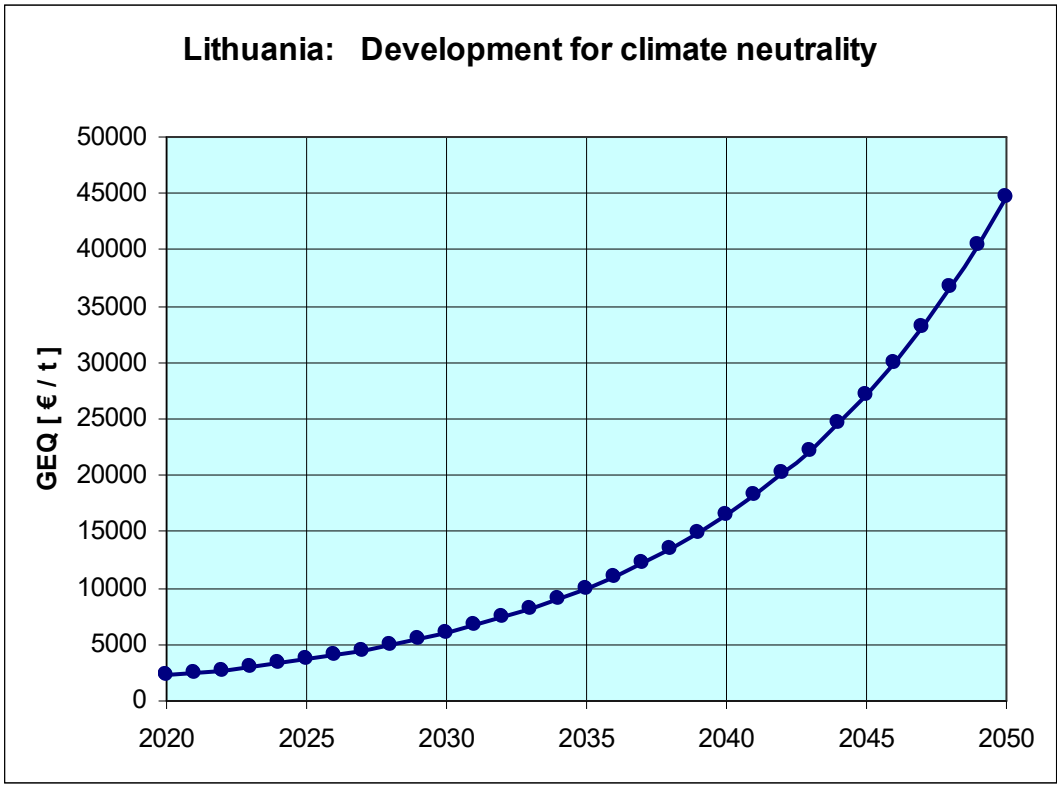

Italy: Development of emissions
CO2-Emissions [Mio. t]
500
450
400
350
300
250
200
150
100
50
0
2020
2025
2030
2035
2040
2045
2050

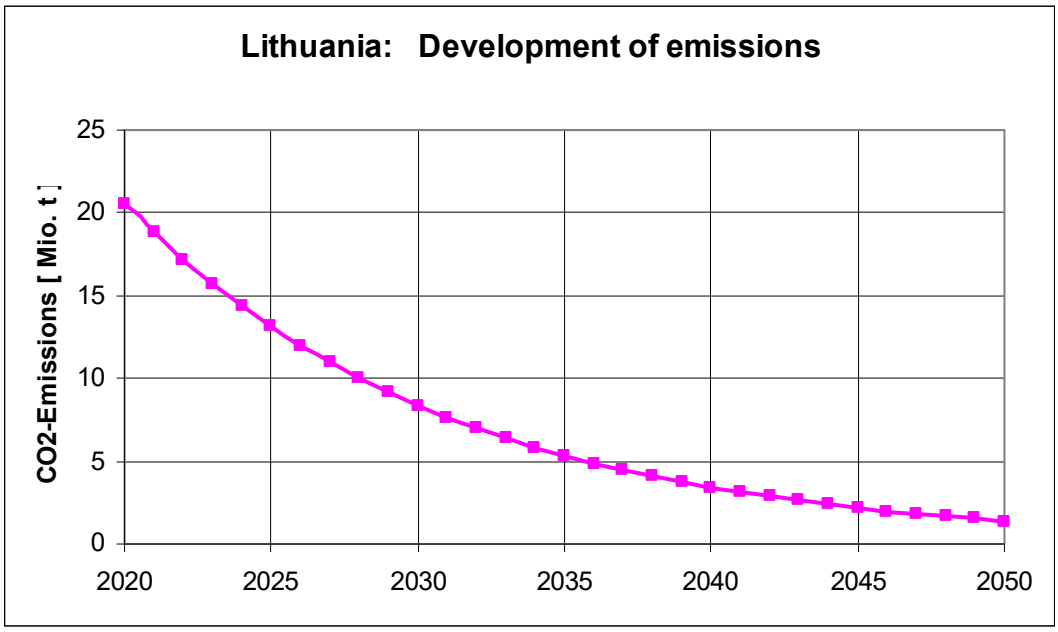
Latvia


Latvia: Development for climate neutrality
GEQ [€ / t]
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
2020
2025
2030
2035
2040
2045
2050

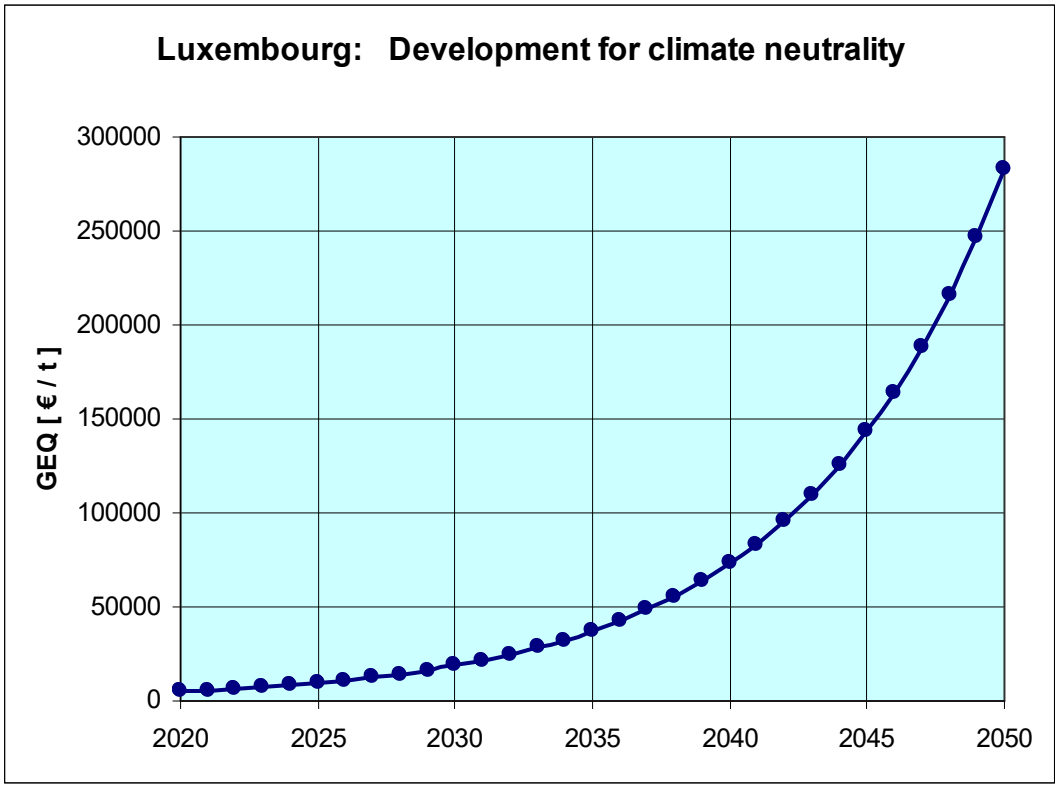

Latvia: Development of emissions
CO2-Emissions [Mio. t]
14
12
10
8
6
4
2
0
2020
2025
2030
2035
2040
2045
2050

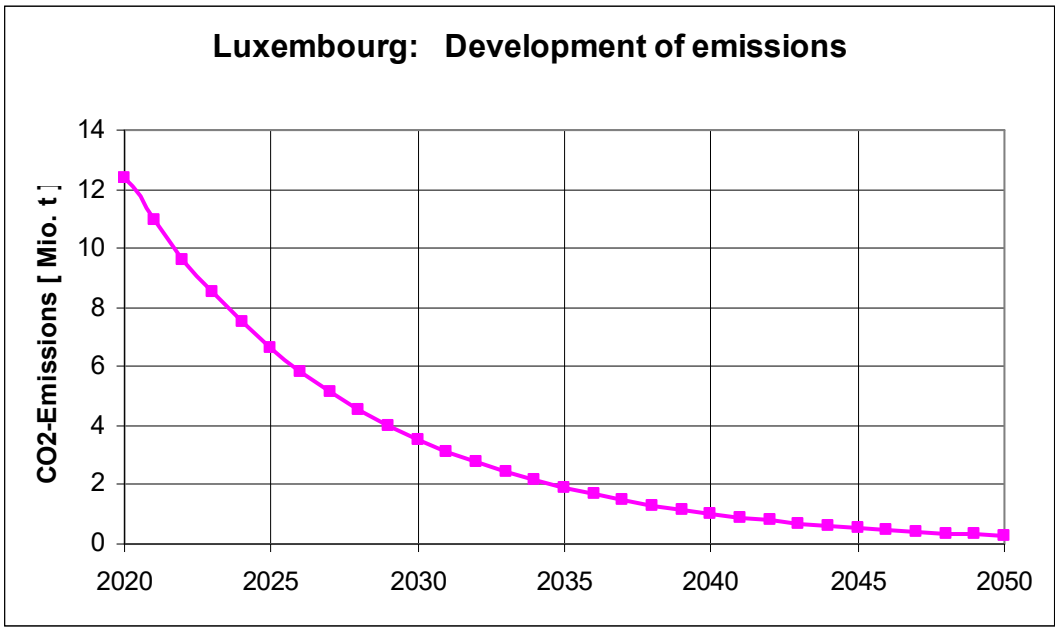
Lithuania


Lithuania: Development for climate neutrality
GEQ [€ / t]
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
2020
2025
2030
2035
2040
2045
2050

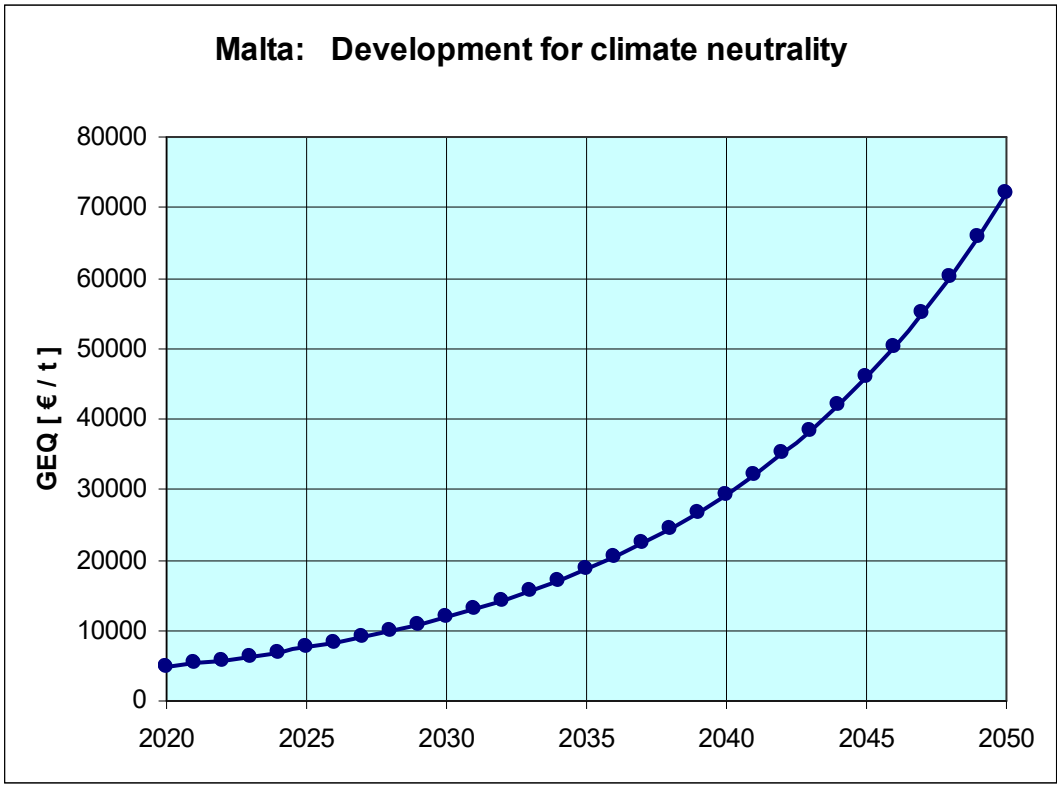

Lithuania: Development of emissions
CO2-Emissions [Mio. t]
25
20
15
10
5
0
2020
2025
2030
2035
2040
2045
2050

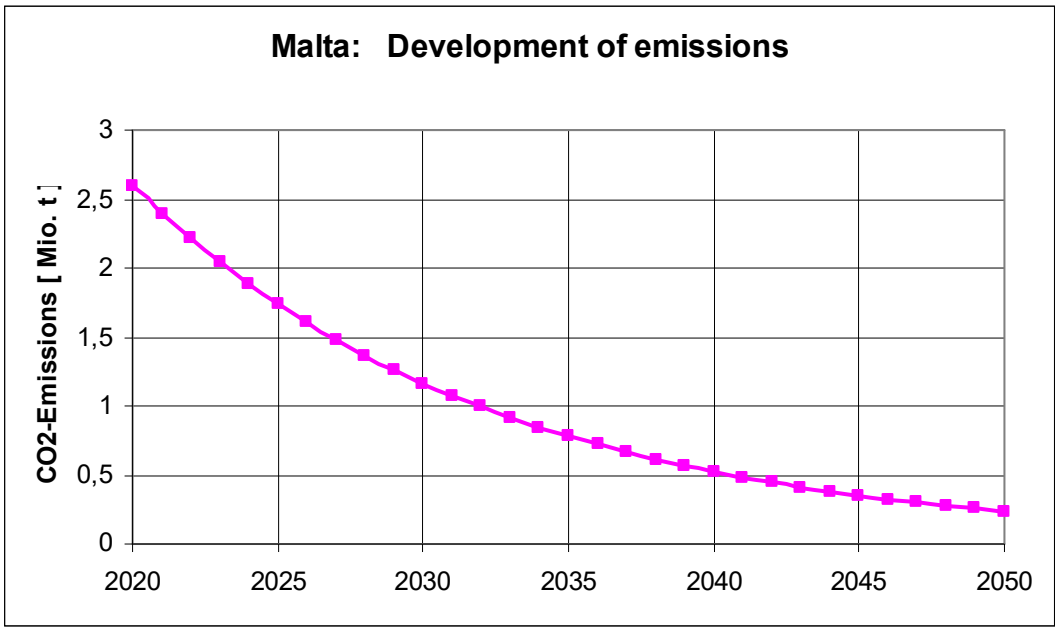
Luxembourg


Luxembourg: Development for climate neutrality
GEQ [€ / t]
300000
250000
200000
150000
100000
50000
0
2020
2025
2030
2035
2040
2045
2050

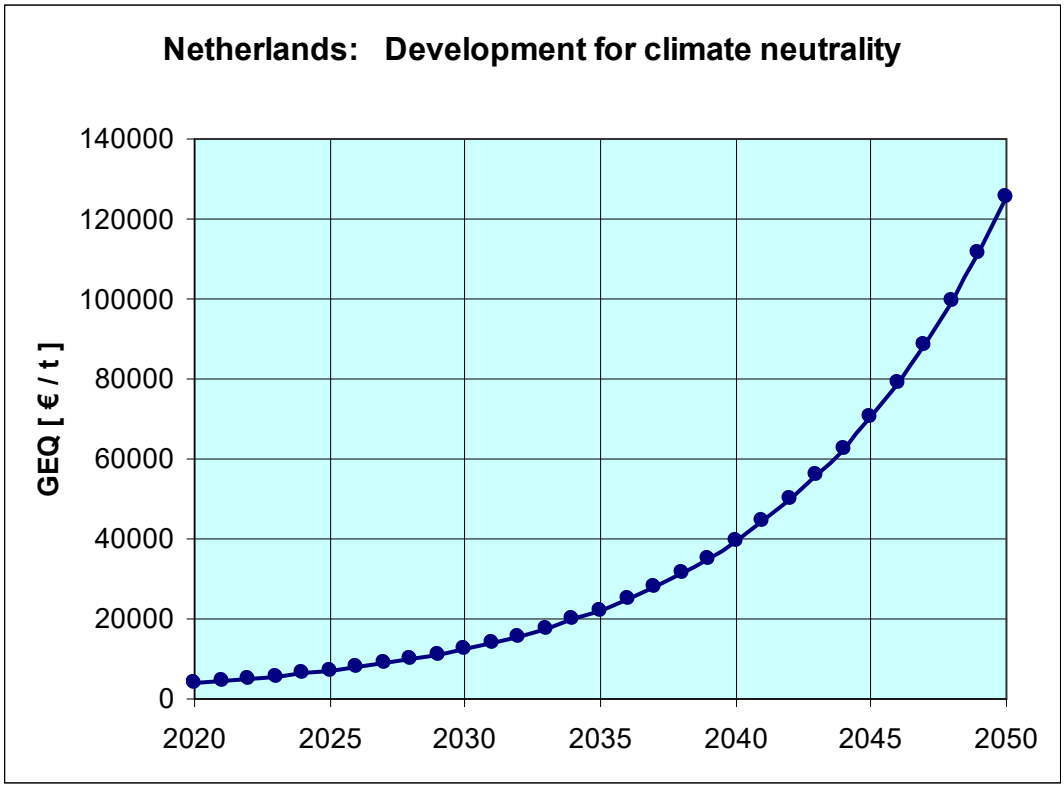

Luxembourg: Development of emissions
CO2-Emissions [Mio. t]
14
12
10
8
6
4
2
0
2020
2025
2030
2035
2040
2045
2050

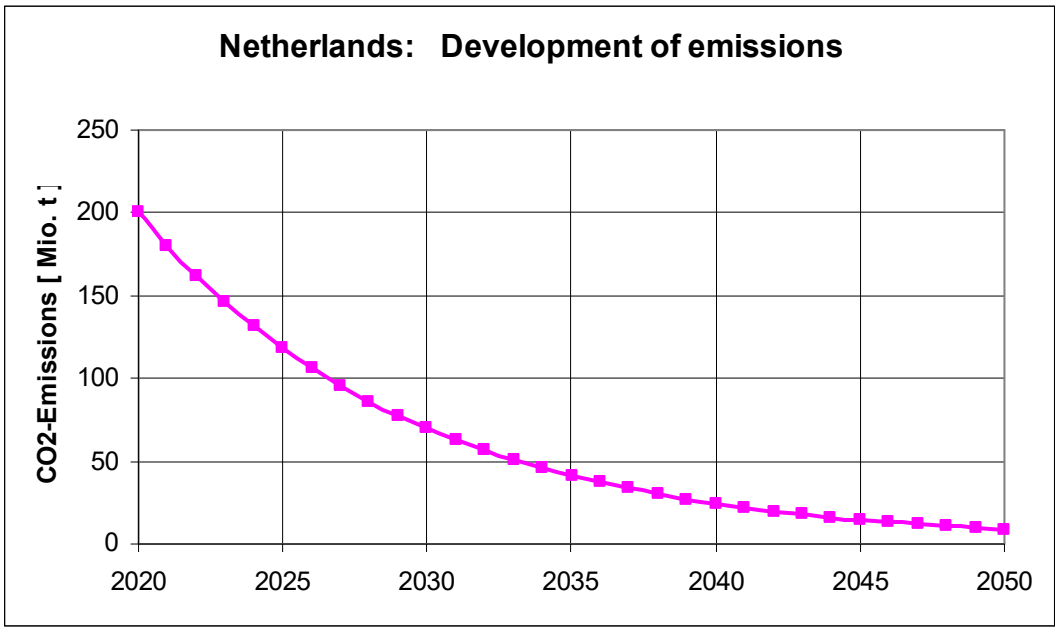
Malta


Malta: Development for climate neutrality
GEQ [€ / t]
80000
70000
60000
50000
40000
30000
20000
10000
0
2020
2025
2030
2035
2040
2045
2050

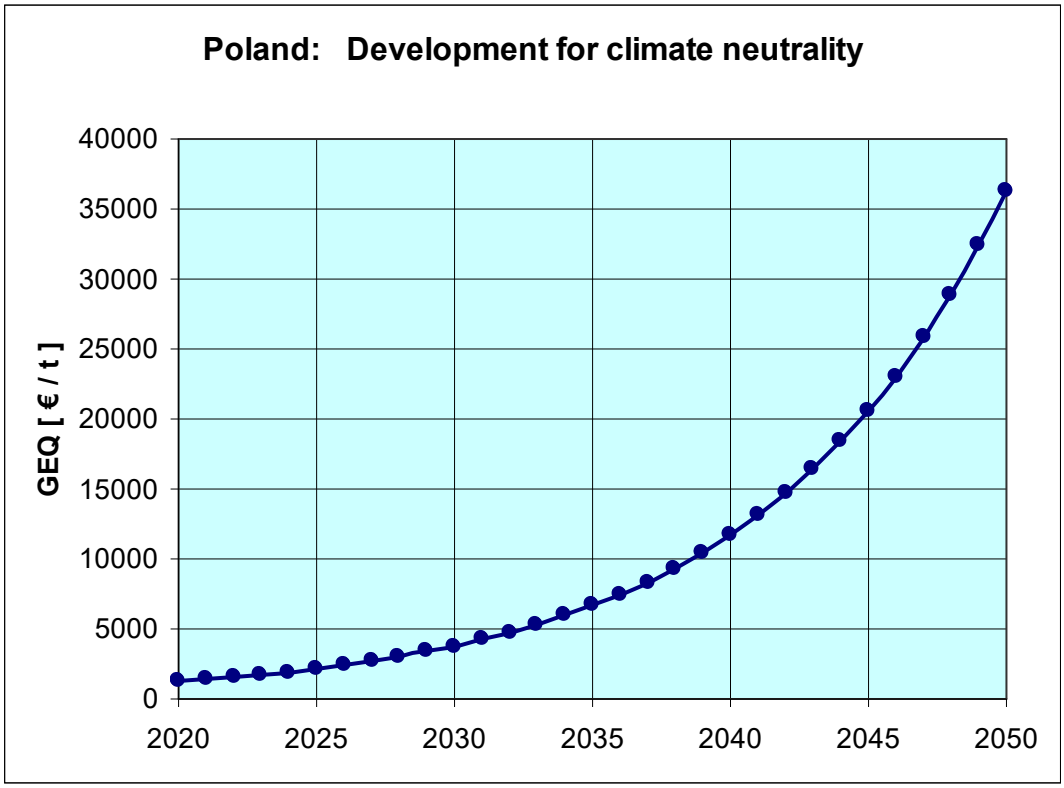

Malta: Development of emissions
CO2-Emissions [Mio. t]
3
2,5
2
1,5
1
0,5
0
2020
2025
2030
2035
2040
2045
2050

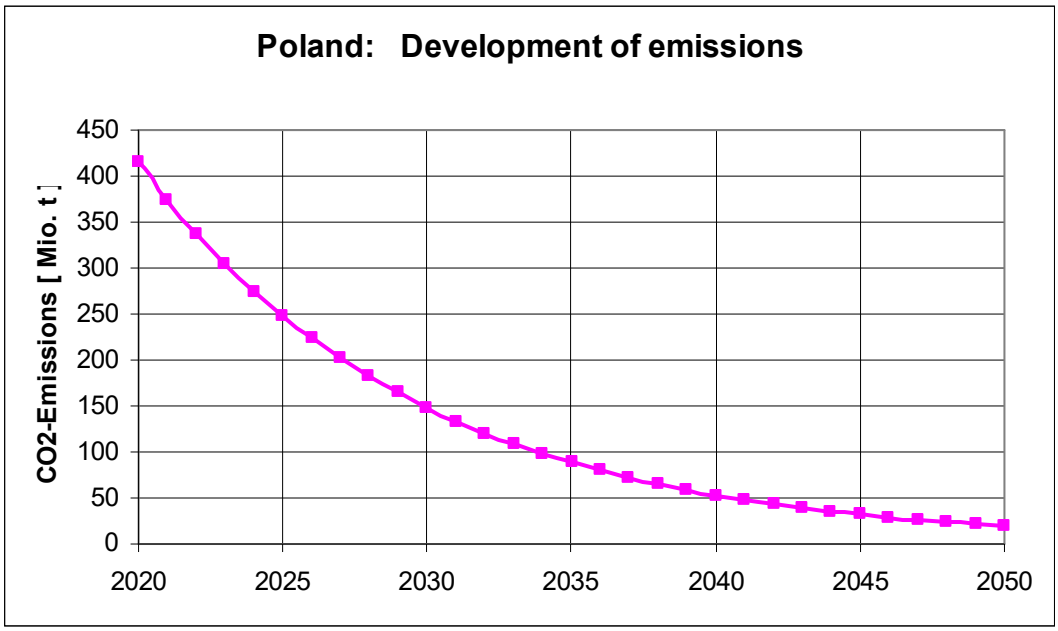
Netherlands



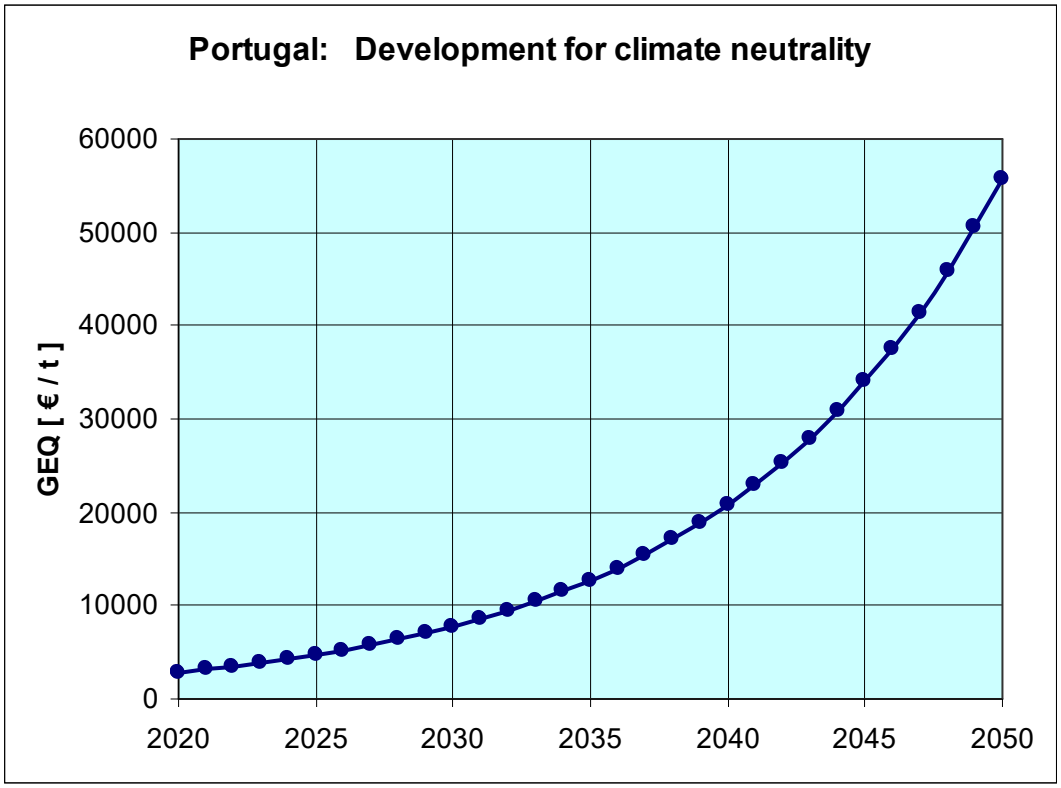


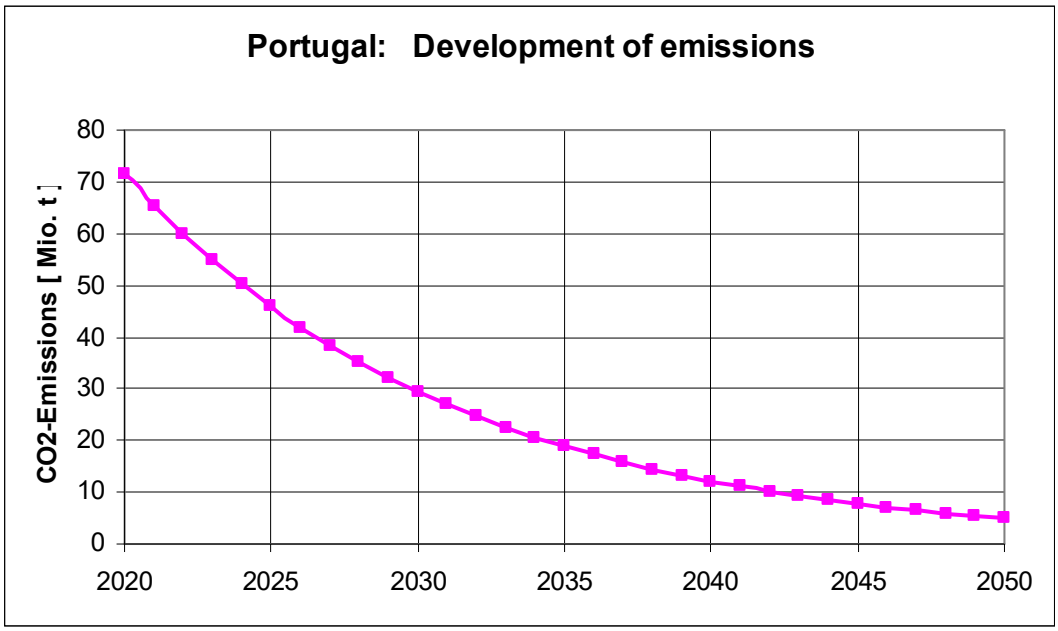
Poland


Poland: Development for climate neutrality
GEQ [€ / t]
40000
35000
30000
25000
20000
15000
10000
5000
0
2020
2025
2030
2035
2040
2045
2050

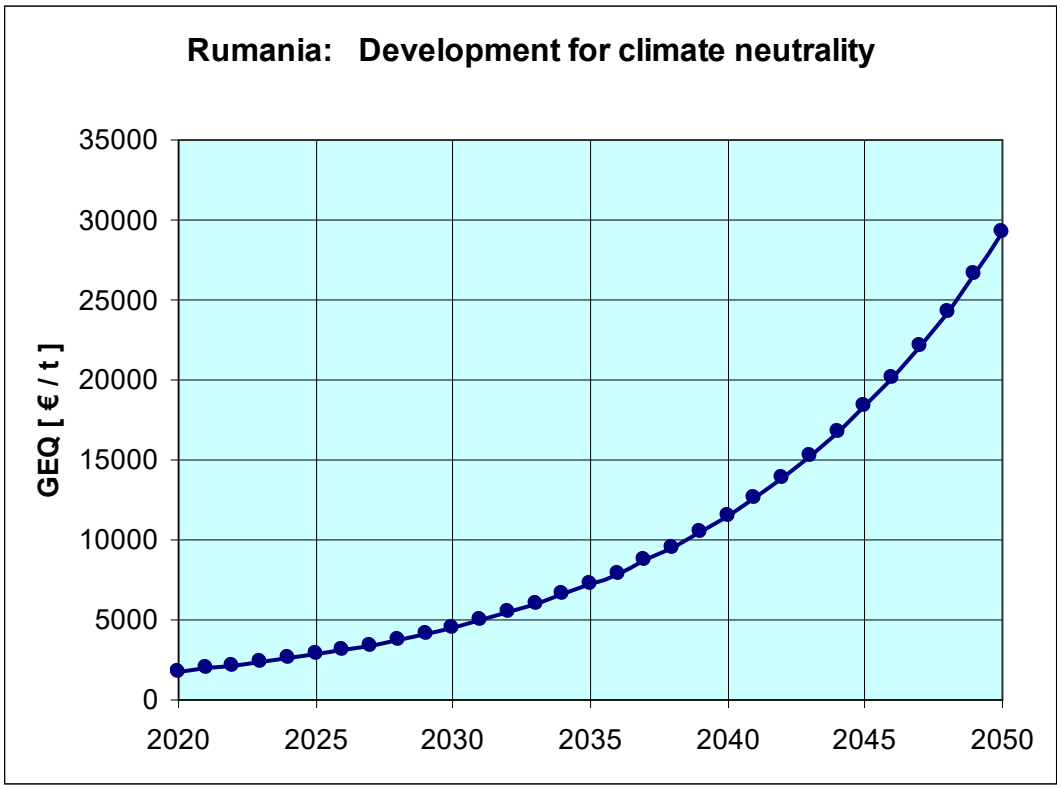

Poland: Development of emissions
CO2-Emissions [Mio. t]
450
400
350
300
250
200
150
100
50
0
2020
2025
2030
2035
2040
2045
2050

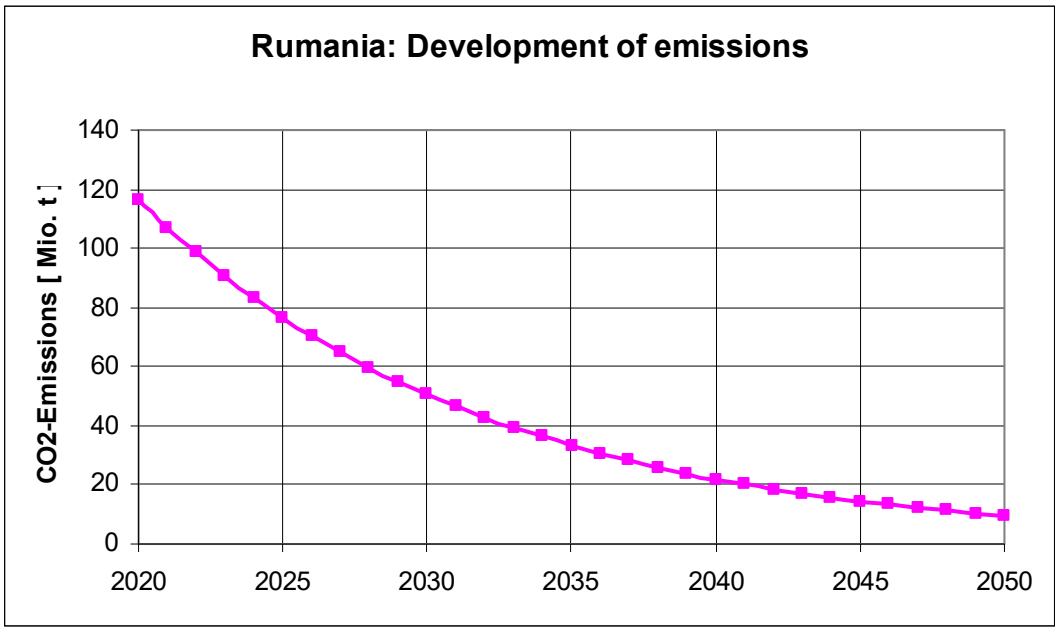
Portugal


Portugal: Development for climate neutrality
GEQ [€ / t]
60000
50000
40000
30000
20000
10000
0
2020
2025
2030
2035
2040
2045
2050

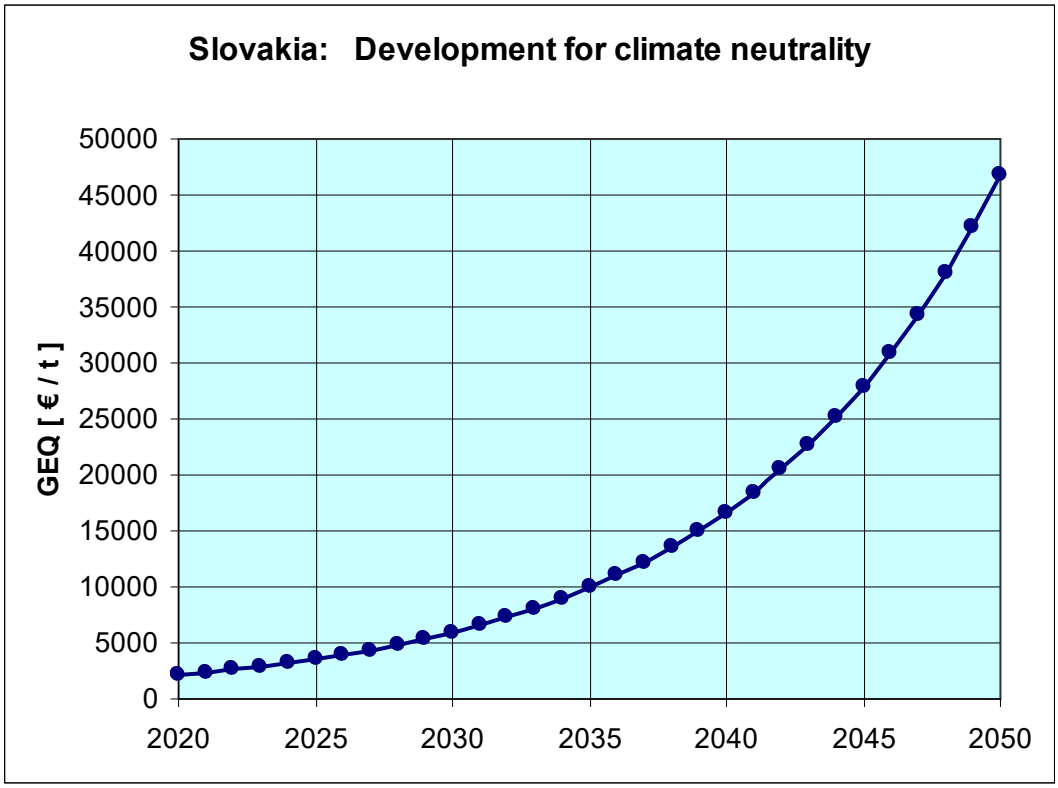

Portugal: Development of emissions
CO2-Emissions [Mio. t]
80
70
60
50
40
30
20
10
0
2020
2025
2030
2035
2040
2045
2050

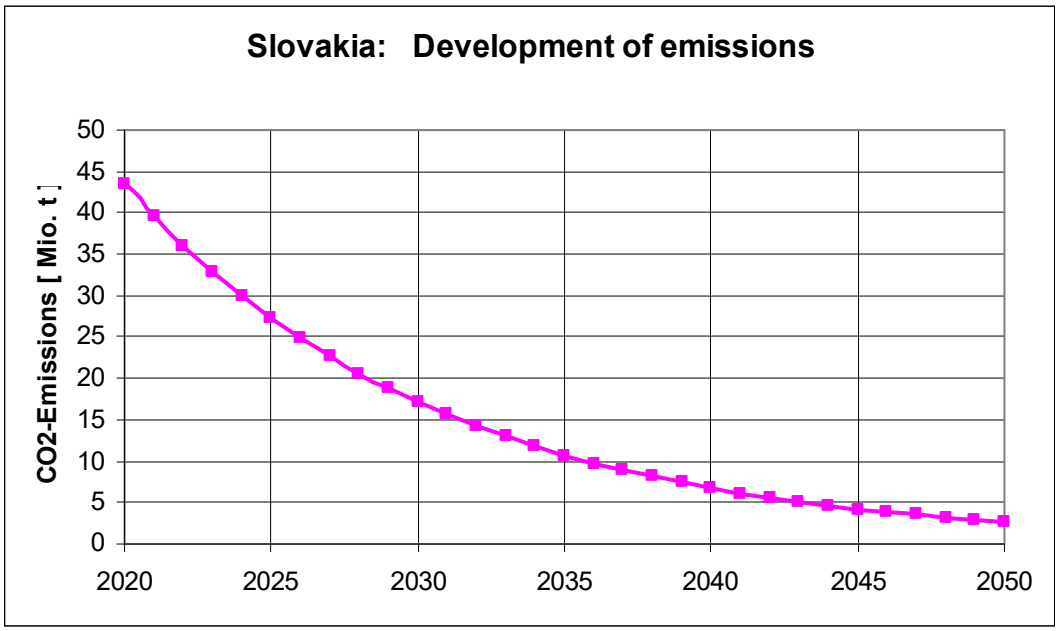
Rumania


Rumania: Development for climate neutrality
GEQ [€ / t]
35000
30000
25000
20000
15000
10000
5000
0
2020
2025
2030
2035
2040
2045
2050

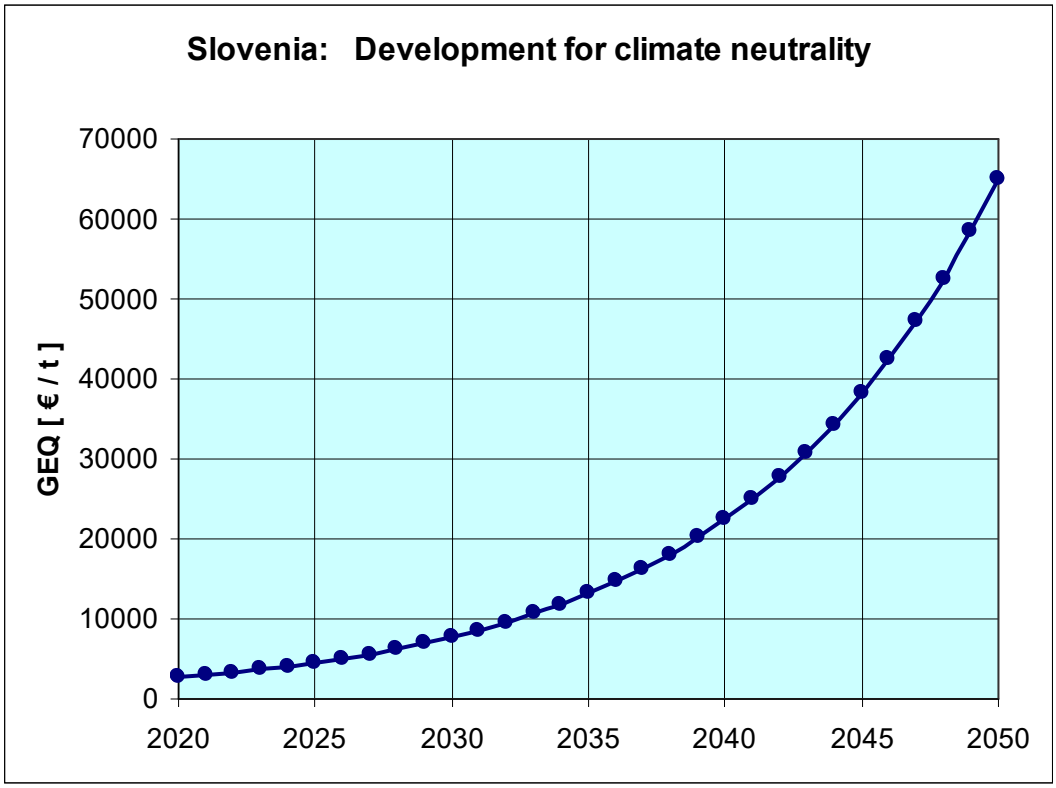

Rumania: Development of emissions
CO2-Emissions [Mio. t]
140
120
100
80
60
40
20
0
2020
2025
2030
2035
2040
2045
2050

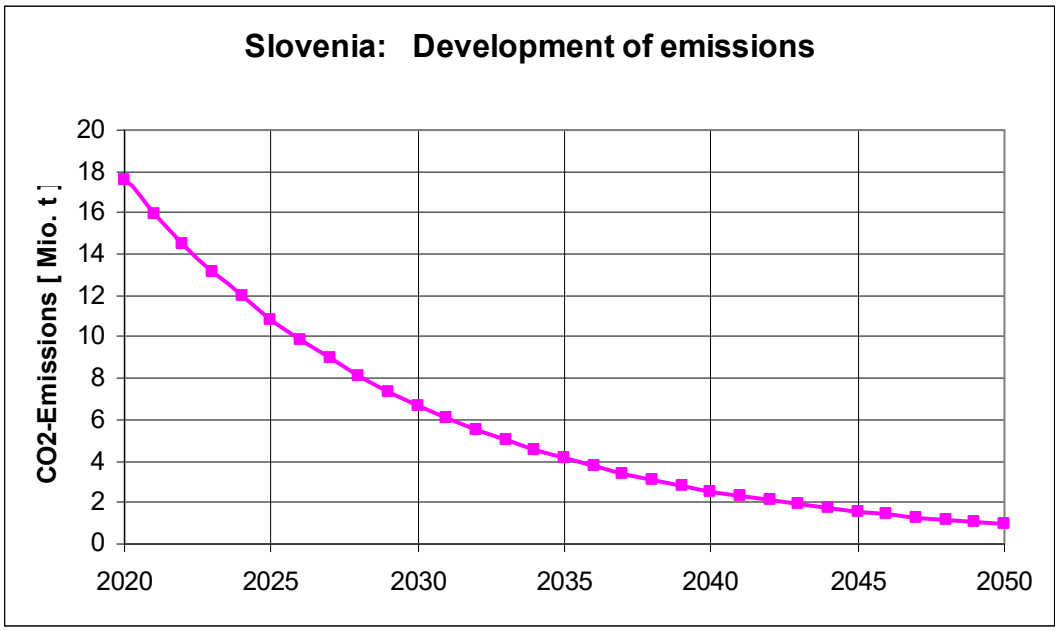
Slovakia


Slovakia: Development for climate neutrality
GEQ [€ / t]
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
2020
2025
2030
2035
2040
2045
2050

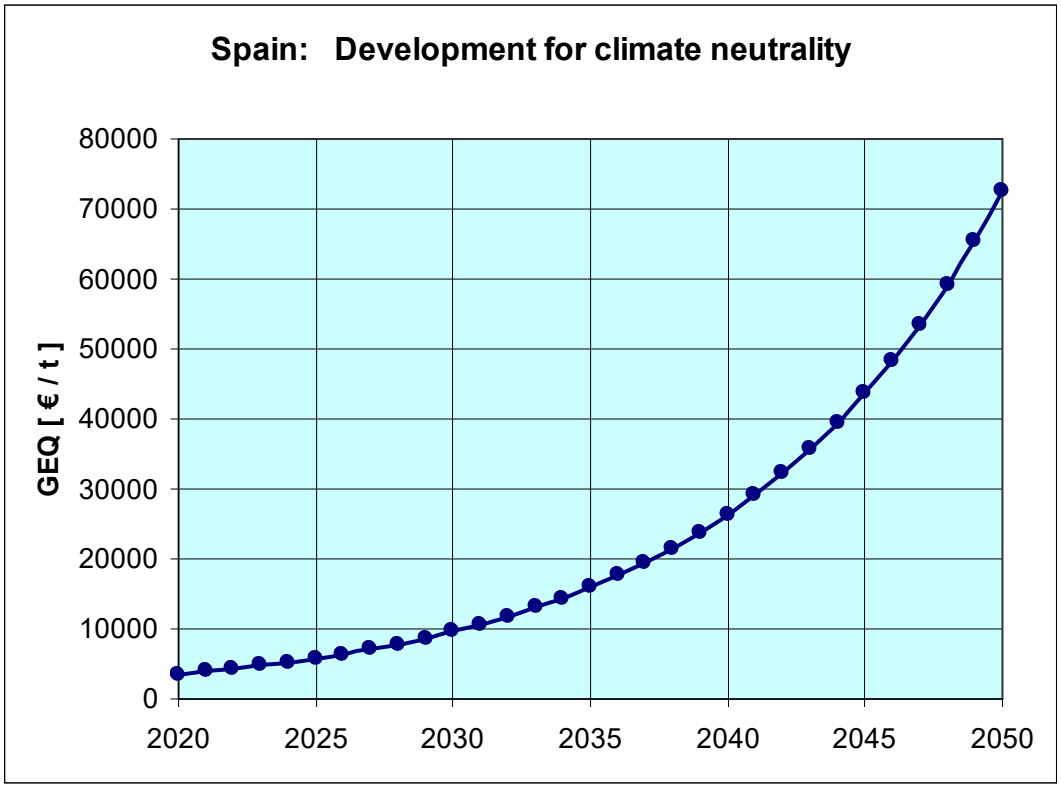

Slovakia: Development of emissions
CO2-Emissions [Mio. t]
50
45
40
35
30
25
20
15
10
5
0
2020
2025
2030
2035
2040
2045
2050

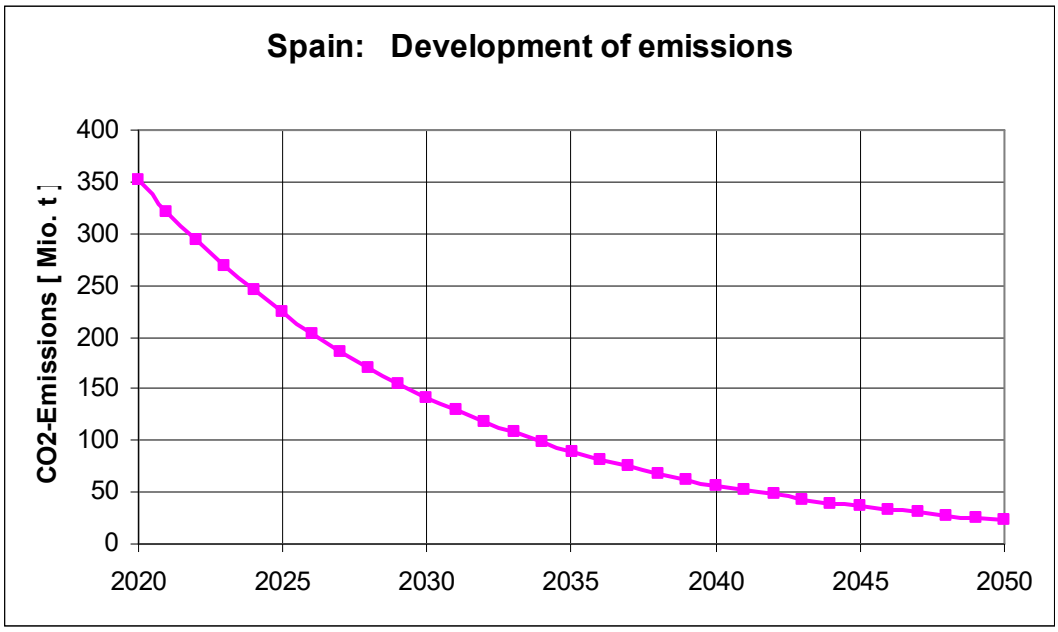
Slovenia


Slovenia: Development for climate neutrality
GEQ [€ / t]
70000
60000
50000
40000
30000
20000
10000
0
2020
2025
2030
2035
2040
2045
2050

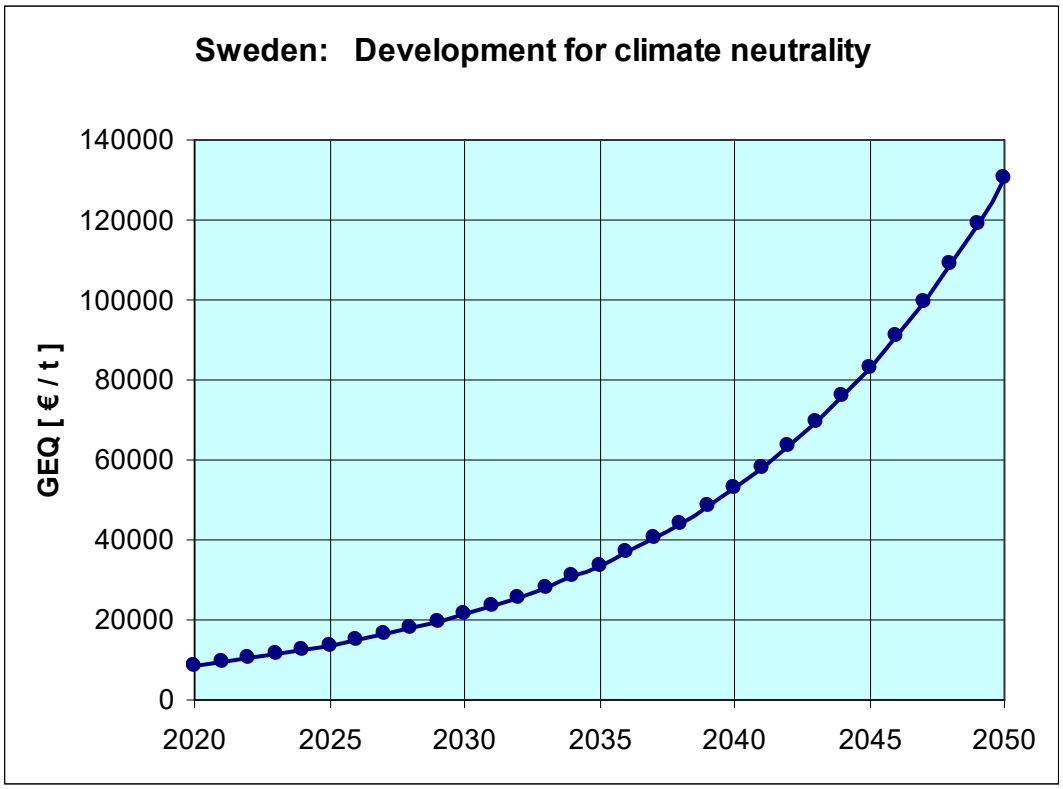

Slovenia: Development of emissions
CO2-Emissions [Mio. t]
20
18
16
14
12
10
8
6
4
2
0
2020
2025
2030
2035
2040
2045
2050

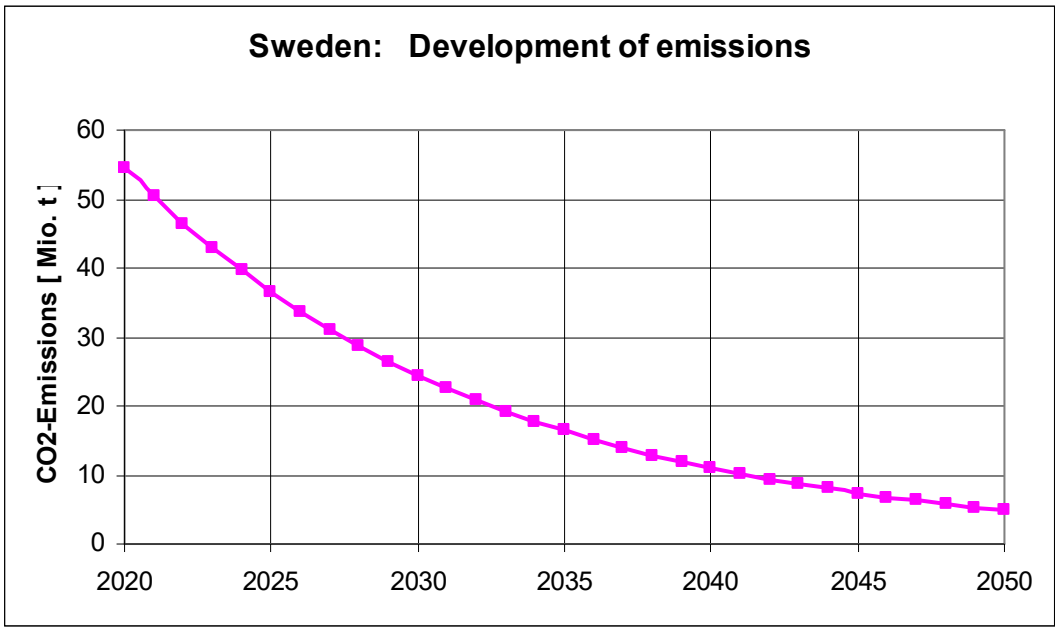
Spain


Spain: Development for climate neutrality
GEQ [€ / t]
80000
70000
60000
50000
40000
30000
20000
10000
0
2020
2025
2030
2035
2040
2045
2050


Spain: Development of emissions
CO2-Emissions [Mio. t]
400
350
300
250
200
150
100
50
0
2020
2025
2030
2035
2040
2045
2050

Sweden


Sweden: Development for climate neutrality
GEQ [€ / t]
140000
120000
100000
80000
60000
40000
20000
0
2020
2025
2030
2035
2040
2045
2050


Sweden: Development of emissions
CO2-Emissions [Mio. t]
60
50
40
30
20
10
0
2020
2025
2030
2035
2040
2045
2050