

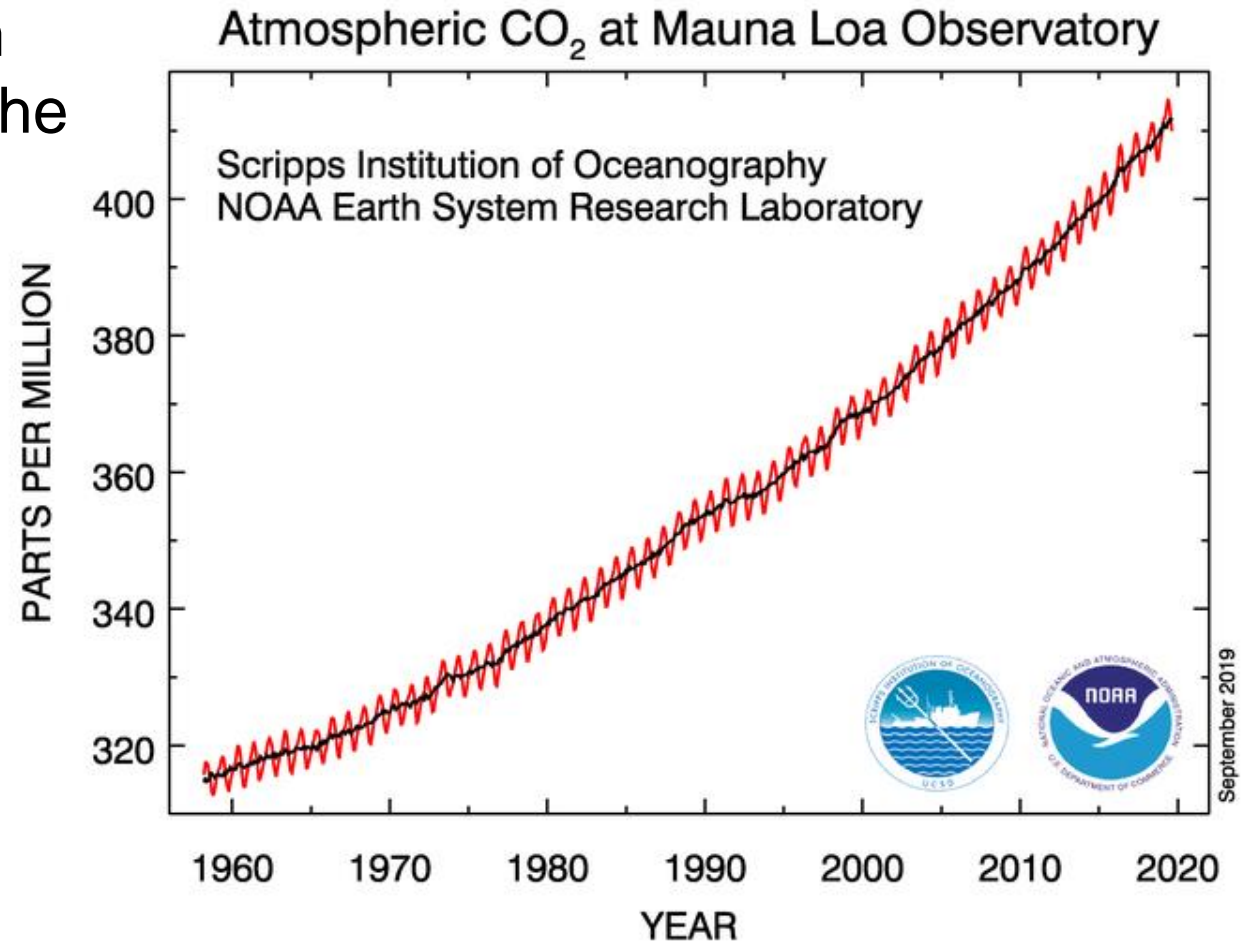
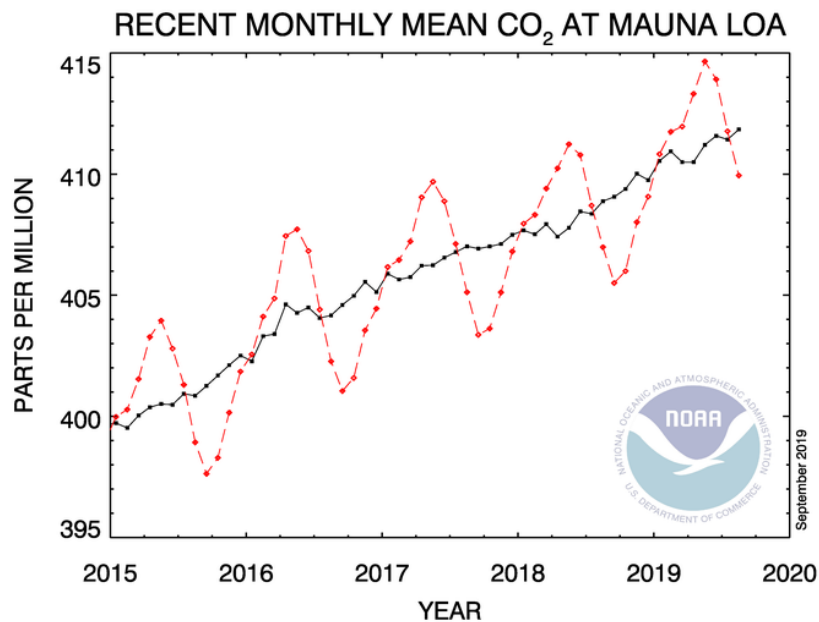
# Few important facts about Climate Change

*Roberto Buizza*

*Sant'Anna School of Advanced Studies, Pisa*

# The GHGs' concentration continues to rise..

The GHGs and CO<sub>2</sub> concentration continues to rise. For CO<sub>2</sub>, 400 ppm were last reached ~ 2M years ago (the pre-industrial level was 270 ppm).

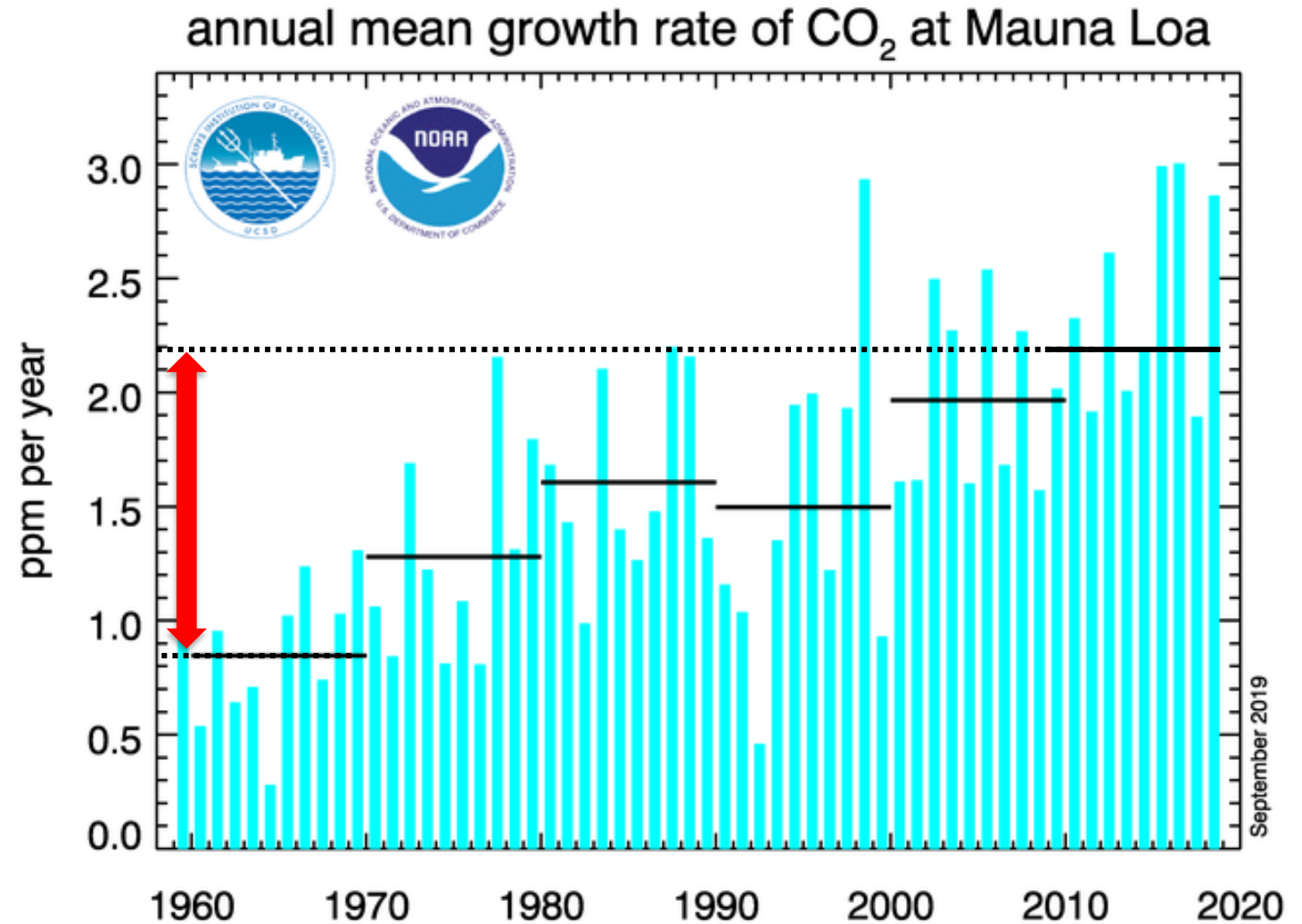


# The GHGs' growth rate continues to increase

Energy is required to develop and increase living standards.

The poorer countries need energy to develop.

We need to change the way we produce and consume energy so that the CO<sub>2</sub> concentration stops increasing and starts falling at a faster rate.

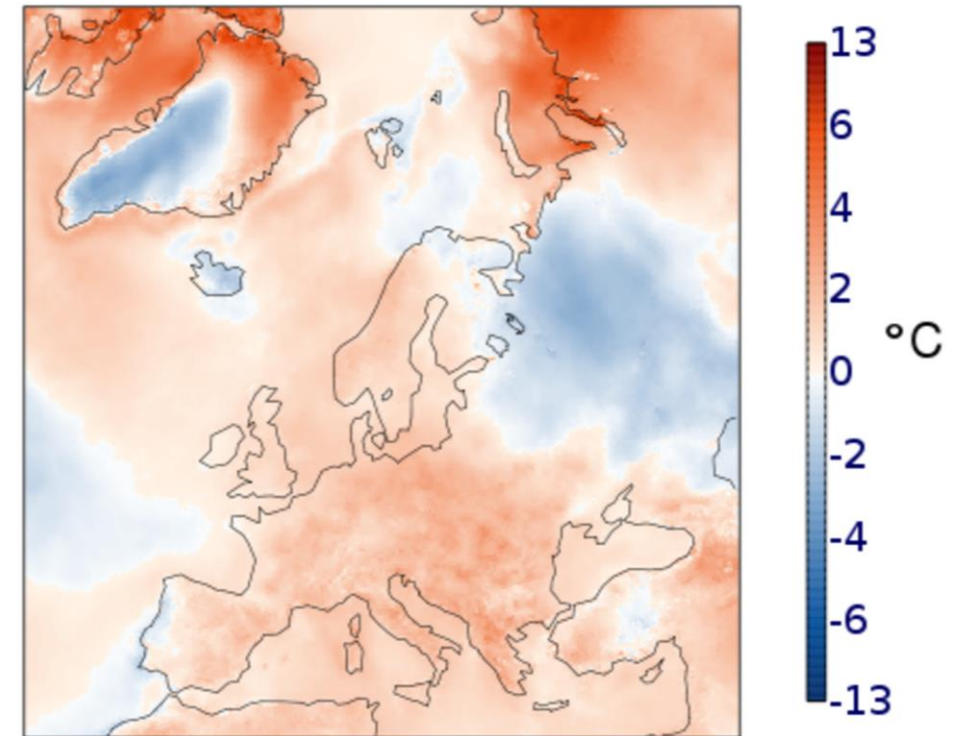


(Source: NOAA)

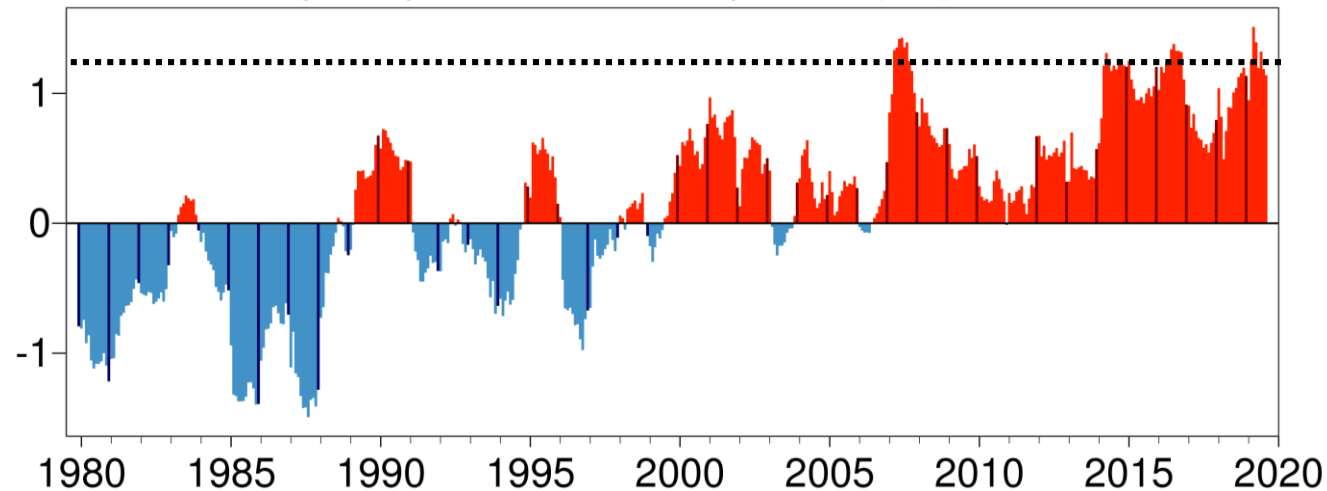
# The climate continues to warm

The JJA ave-EU Temp. was  $\sim 1.1^{\circ}\text{C}$  above the 1981-2010 norm (4<sup>th</sup> warmest summer since 1979). Temp. trends confirm continuous warming. Globally, the 5 warmest years occurred in the past 5 years.

August 2019 2mT anomaly (wrt 1981-2010)



12month-anomaly European surface air temperature ( $^{\circ}\text{C}$ ) relative to 1981-2010





# More frequent & intense extremes are detected

A warmer atmosphere has more energy and holds moisture, and events can intensify more and happen more frequently. With the mean, the variance has also increased, and this implies more variability.

## Hurricane Dorian crossing the Bahamas



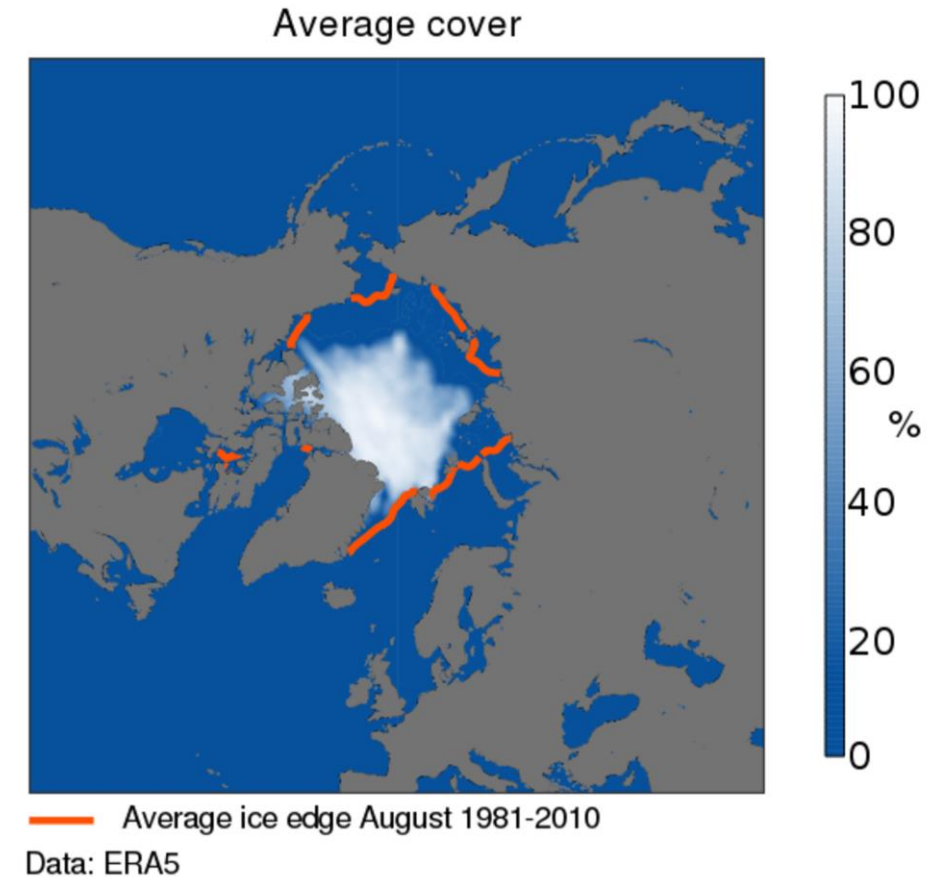
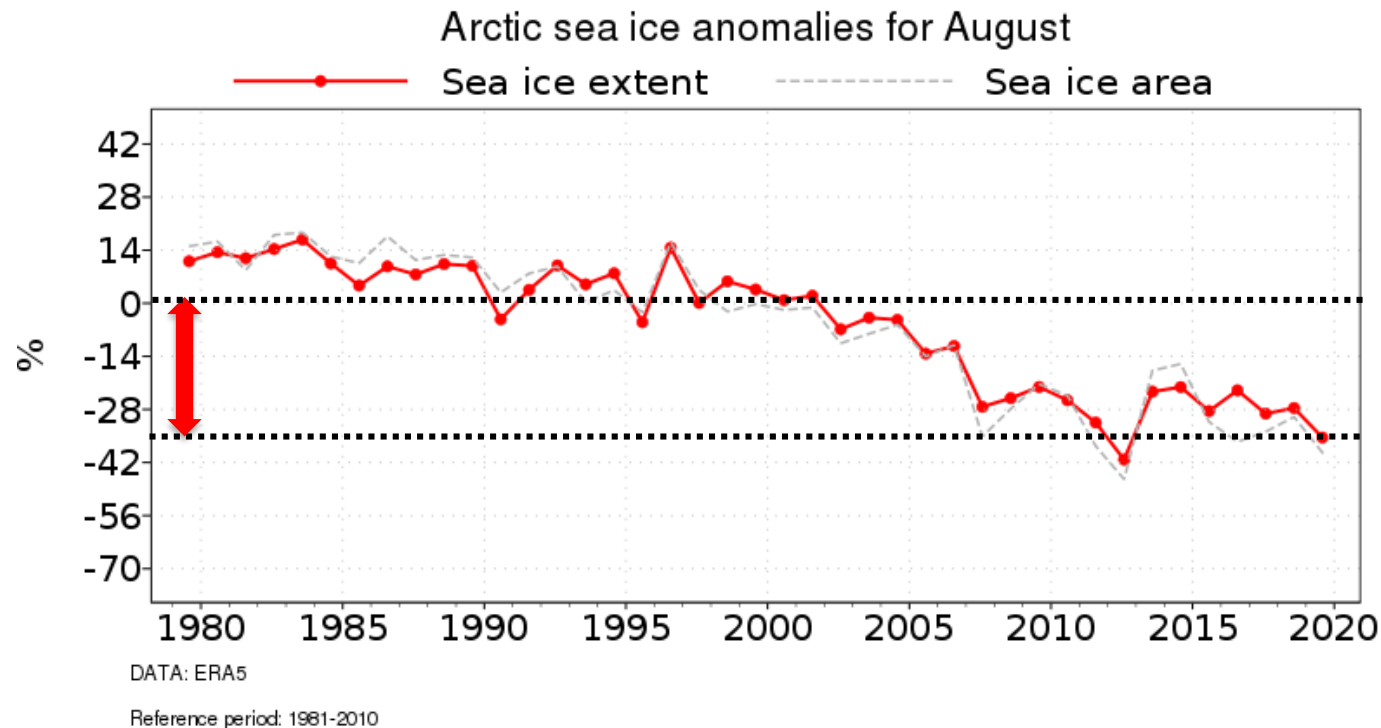
(Source: NOAA)



(Source: ABC News go.com)

# The Arctic sea ice continues to melt

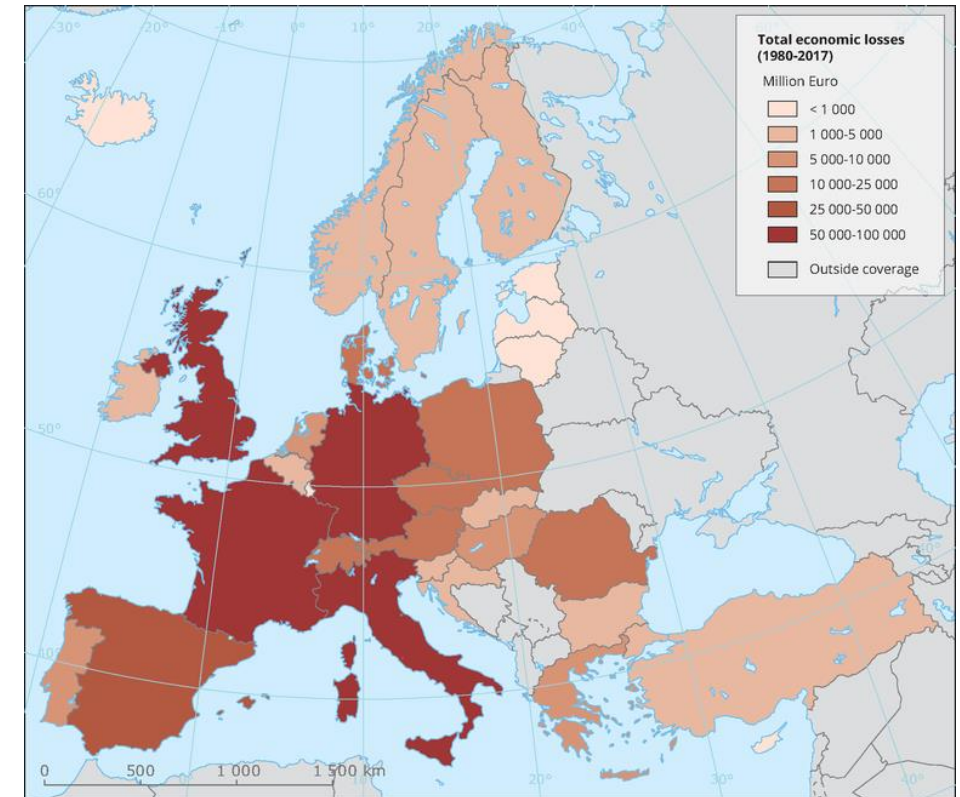
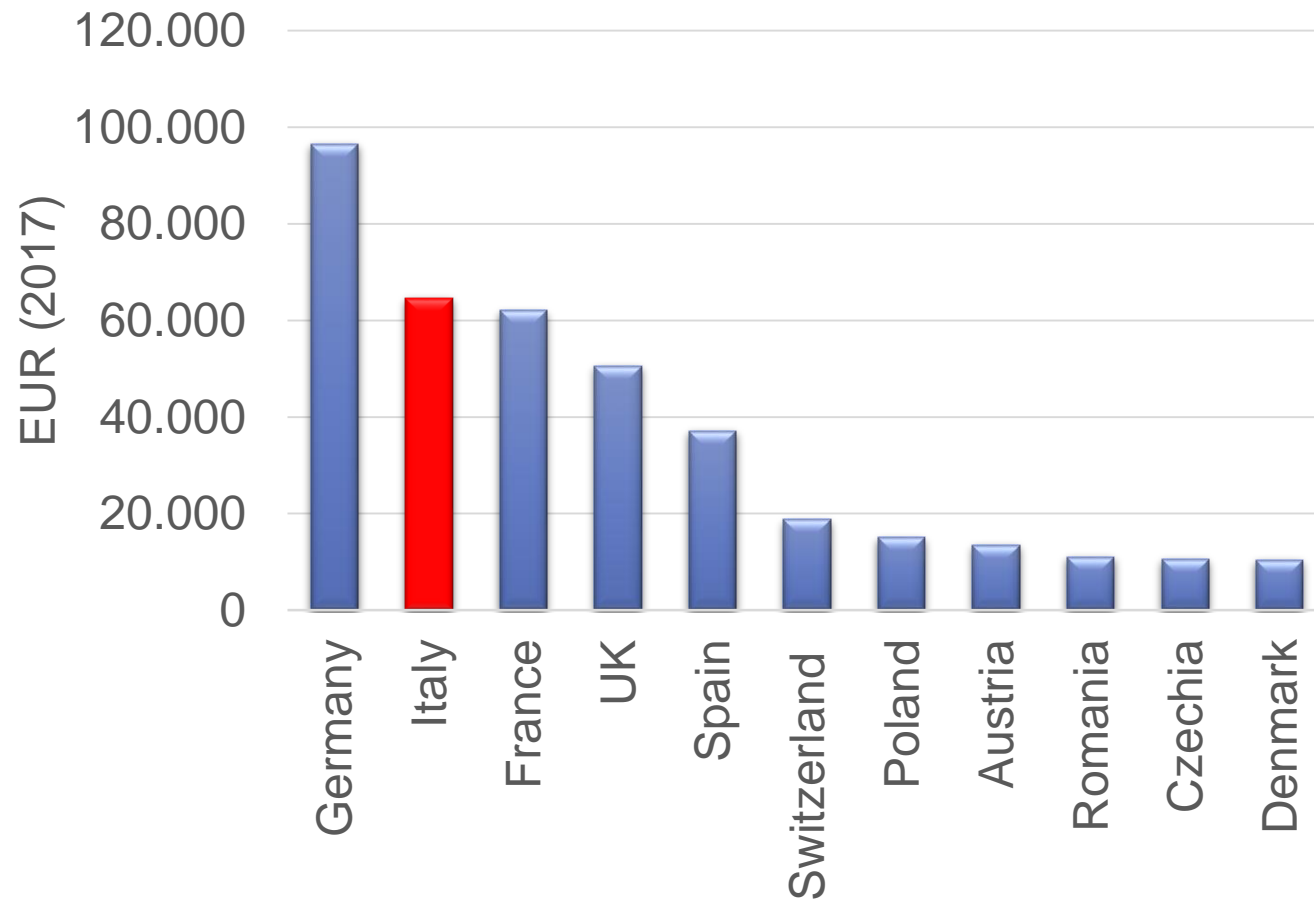
In Aug-2019, Arctic sea ice extent was 2.6M km<sup>2</sup> lower than the 1981-2010 average (4.8M km<sup>2</sup> instead of 7.4; 35% less). Trends indicate a continued melting.





# Italy is one of the EU countries hit harder

Impact of extreme weather 1980-2017  
(EEA)



(Source: European Environment Agency)

Roberto Buizza – "Few important facts about climate change" (Forum ENGIE, 27 Sep 2019)

# In Italy, the future climate could be very different

The Mediterranean is one of the areas expected to have severe CC impacts:

- More frequent and intense heatwaves ➤ health effects
- Summer droughts (more evaporation) ➤ consequences for agriculture, wildlife
- Heavy rainfall events (higher capacity for moisture in atmosphere) ➤ flooding
- Loss of snow in alps ➤ lower levels in water reservoirs
- Influence from outside, e.g. additional immigration from climate-hit countries





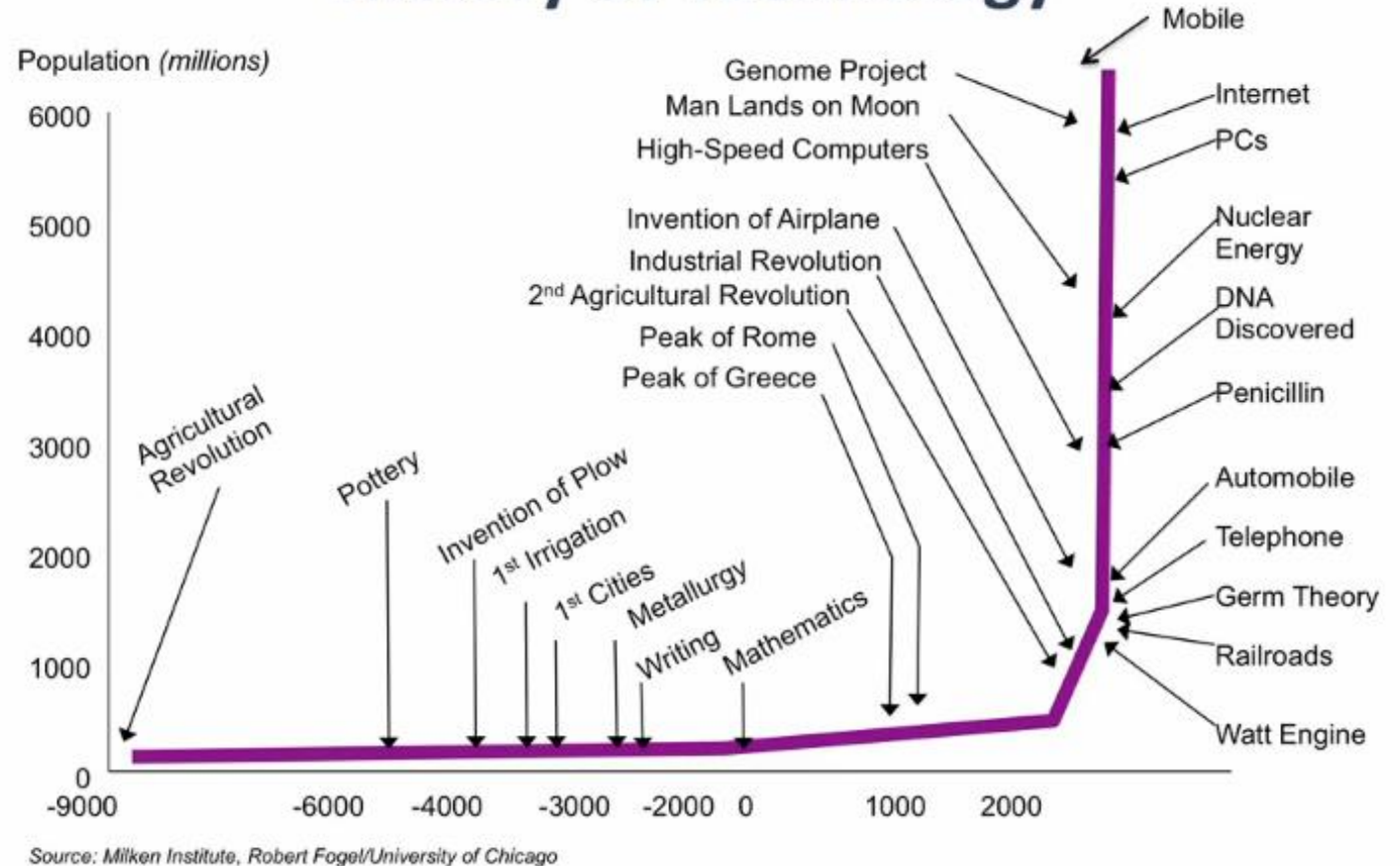
# CC must be addressed urgently

Never before the Earth population has been so large.

This means that CC is affecting the lives of millions of people, especially the poorer and least prepared.

This is one of the reasons why CC has to be confronted urgently.

## Growth of World Population and the History of Technology



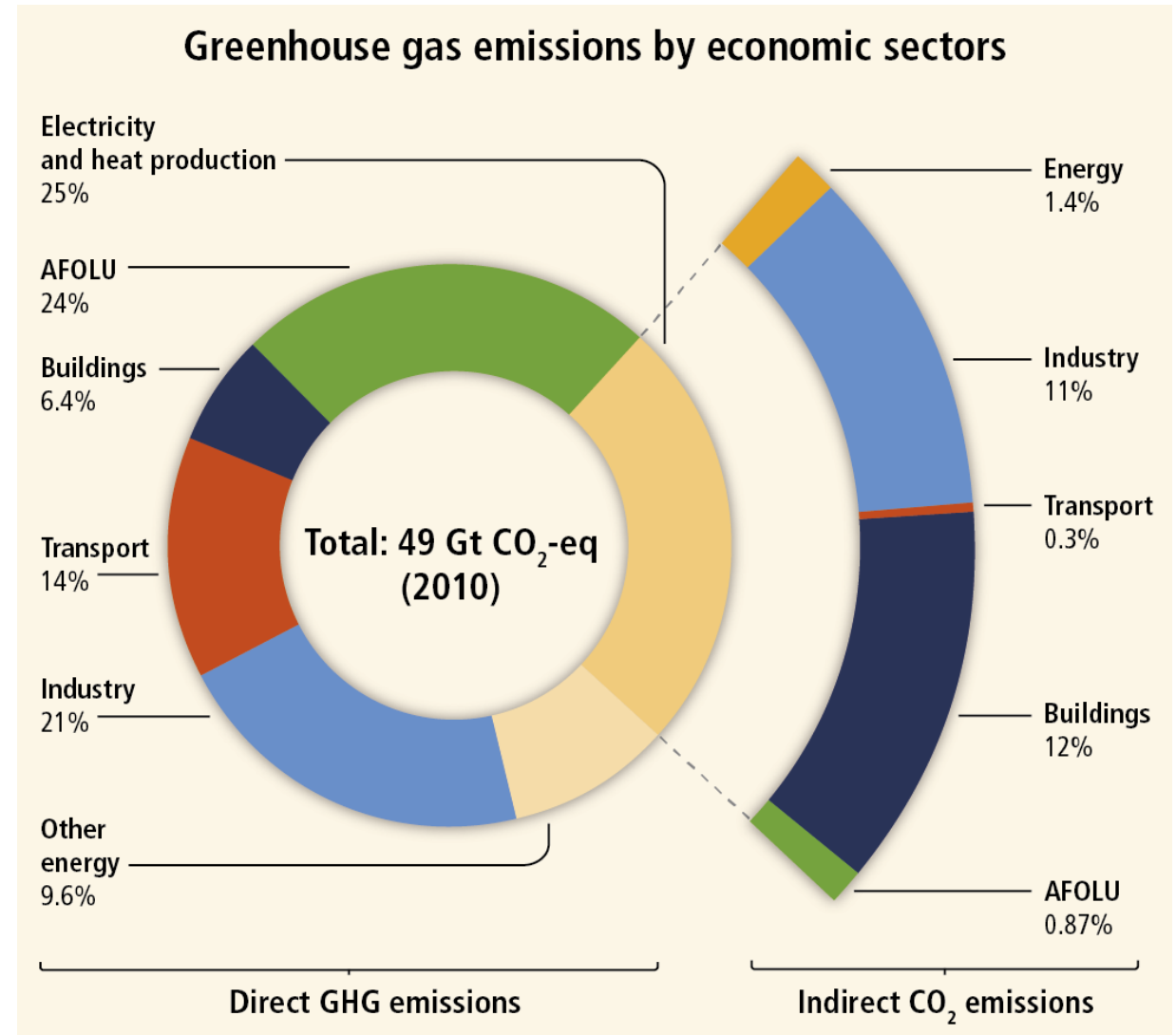
(Source: Milken Institute/Univ. of Chicago)

# Most human activities contribute to CC

We need a new industrial revolution that would lead to a decarbonized society:

**Industry 5.0 = industry 4.0 – CO2**

- *Electric transport*
- *Renewables energy production*
- *Reduction of energy needs*
- *More efficiency*
- *Life style changes*
- *Nutrition changes*
- *Telework*
- ...



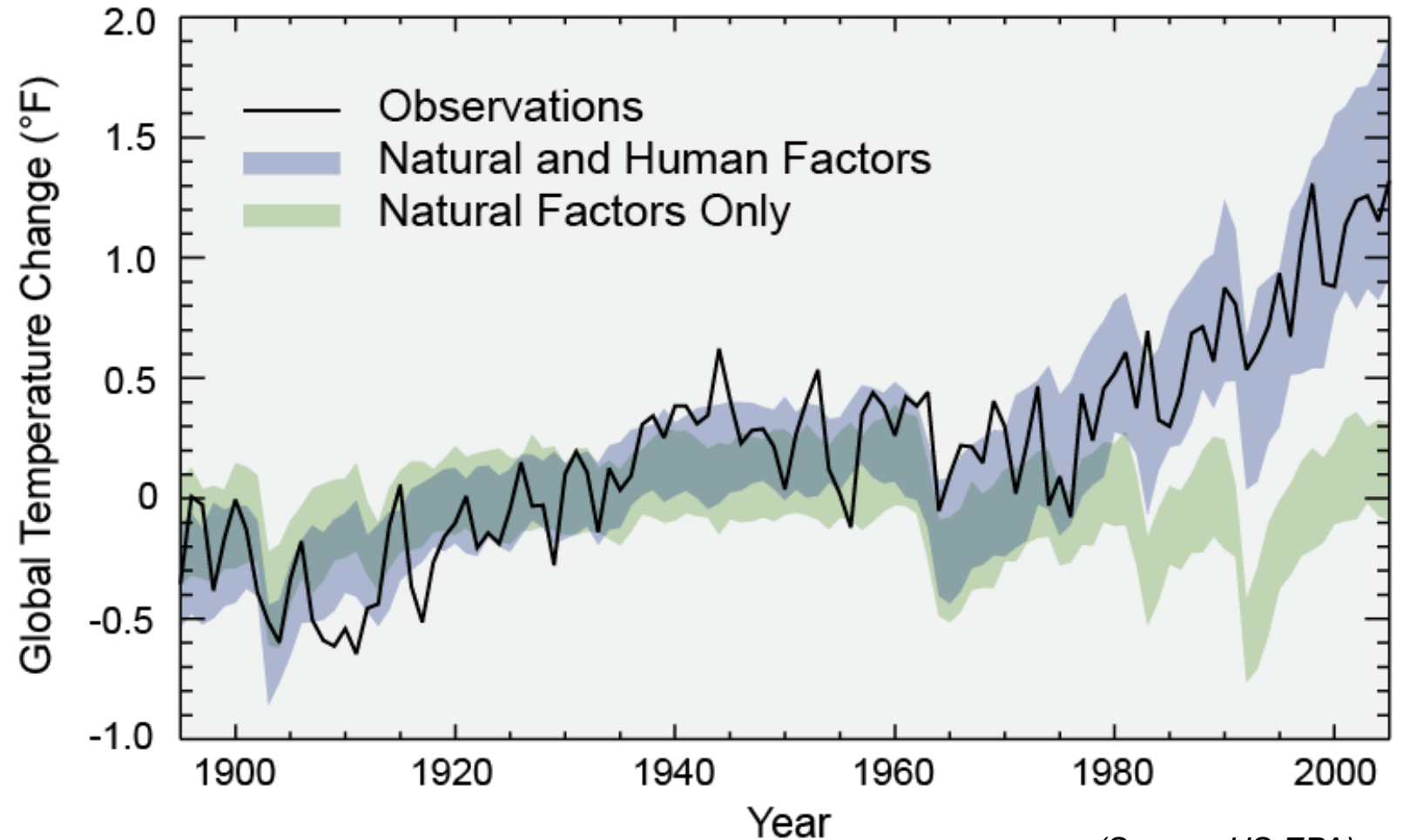
(Source: IPCC AR5 projections)

# We are responsible for CC: we need to solve it!

Natural factors alone would not explain the observed warming.

Only if the human contribution is taken into account we can reconstruct the observed trend.

Separating Human and Natural Influences on Climate

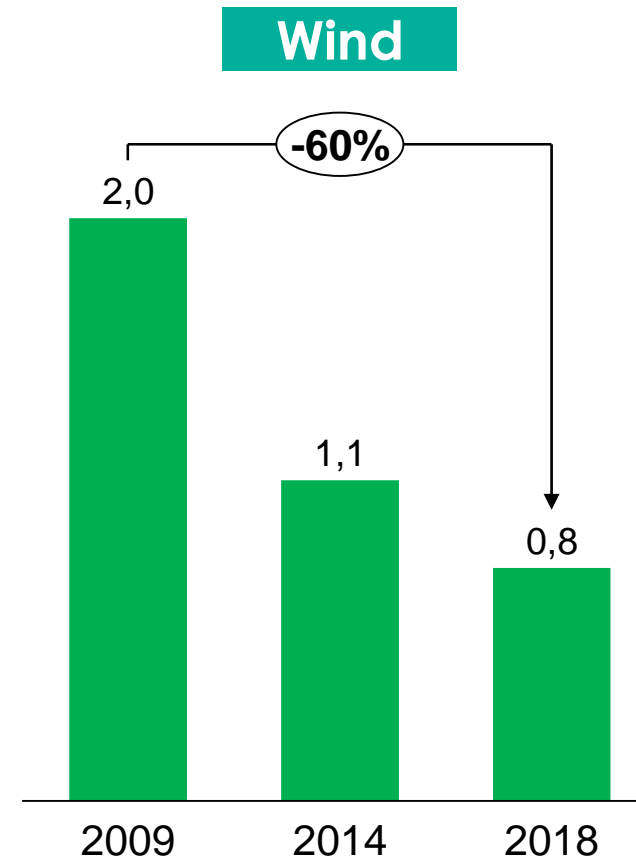
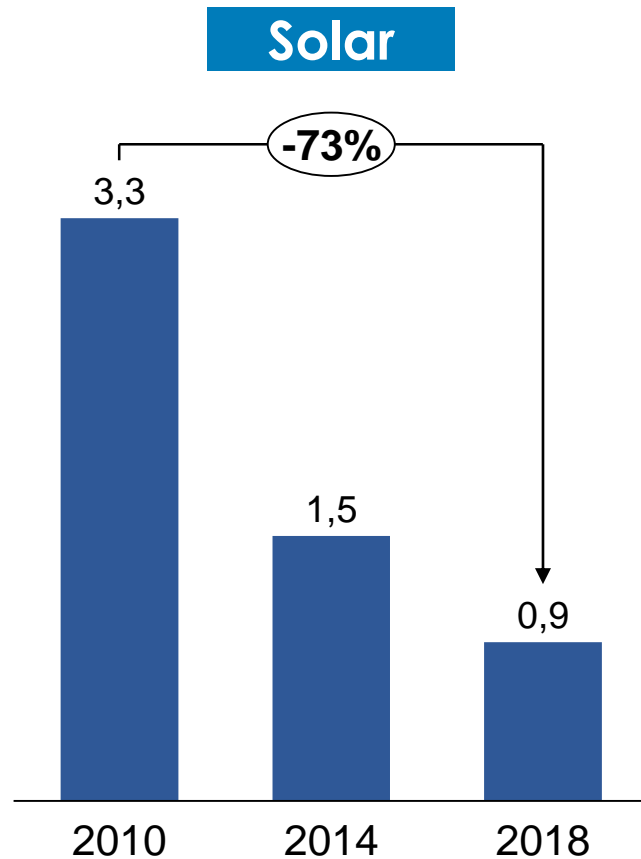


(Source: US EPA)



# We can do it: falling costs of solar and wind ...

**Cost of renewable capacity: Global average benchmark**  
US\$m per MW, 2017 (real)



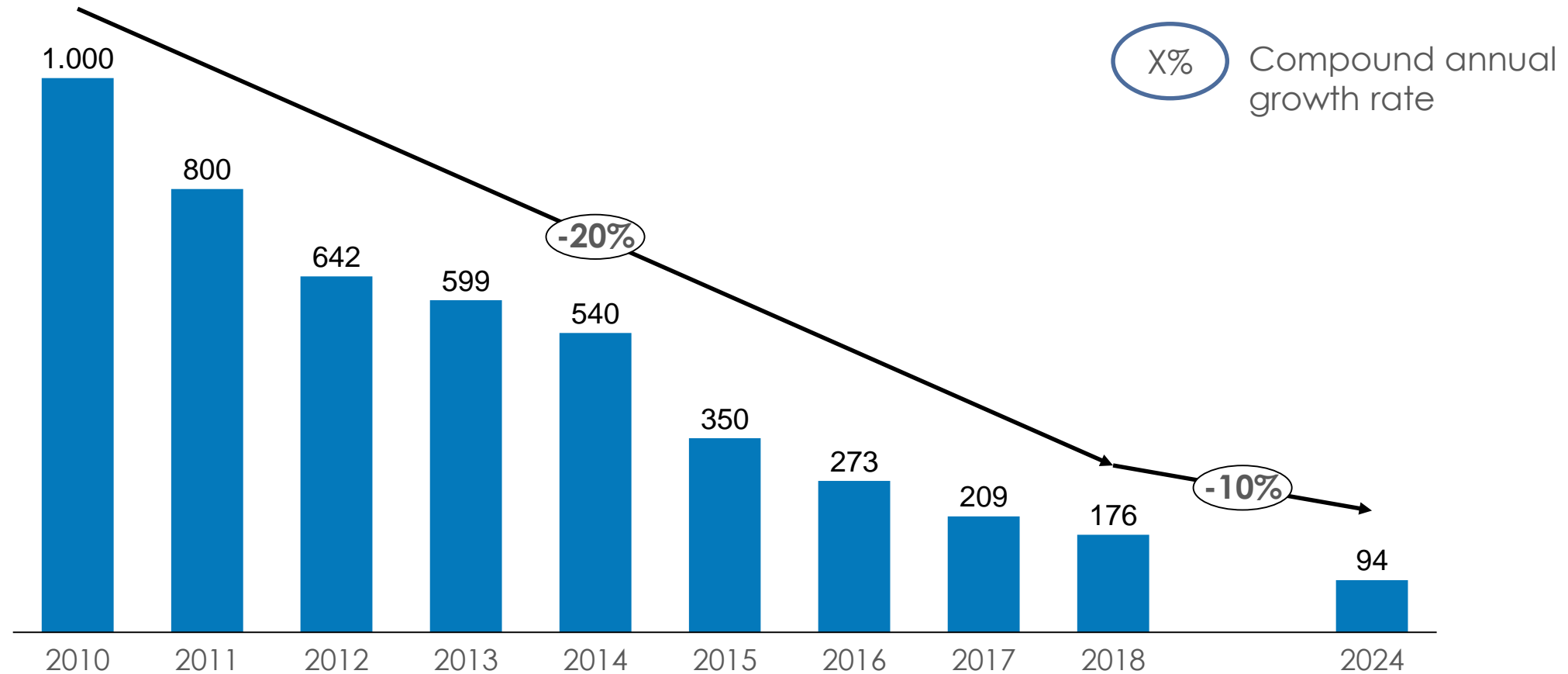
[Source: A Turner (ETC), Bloomberg New Energy Finance (2017)]

Roberto Buizza – "Few important facts about climate change" (Forum ENGIE, 27 Sep 2019)

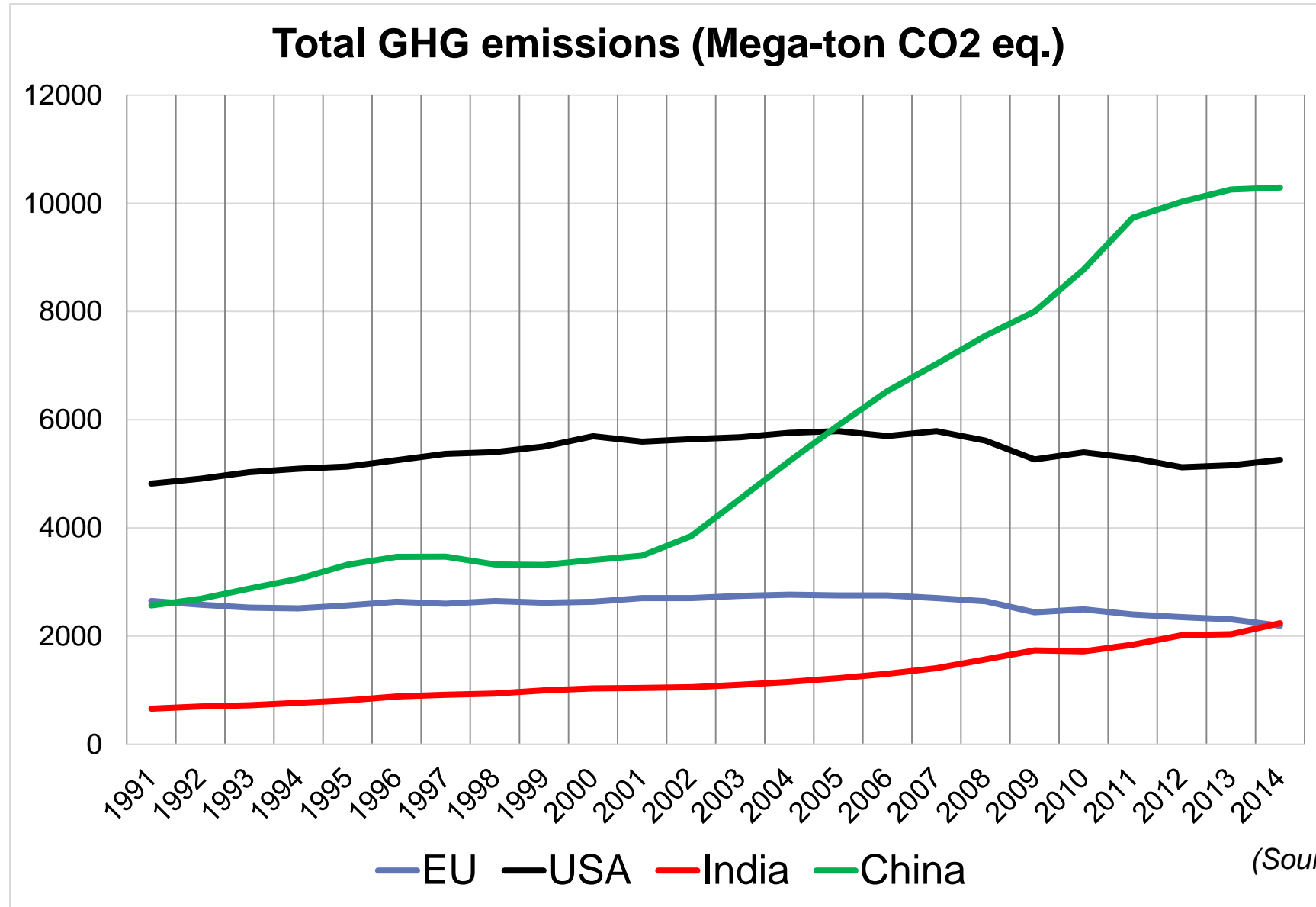
# We can do it: battery prices keep falling ...

**Battery prices – Observed**  
US\$/kWh of storage

**Battery prices – Outlook**  
Predicted

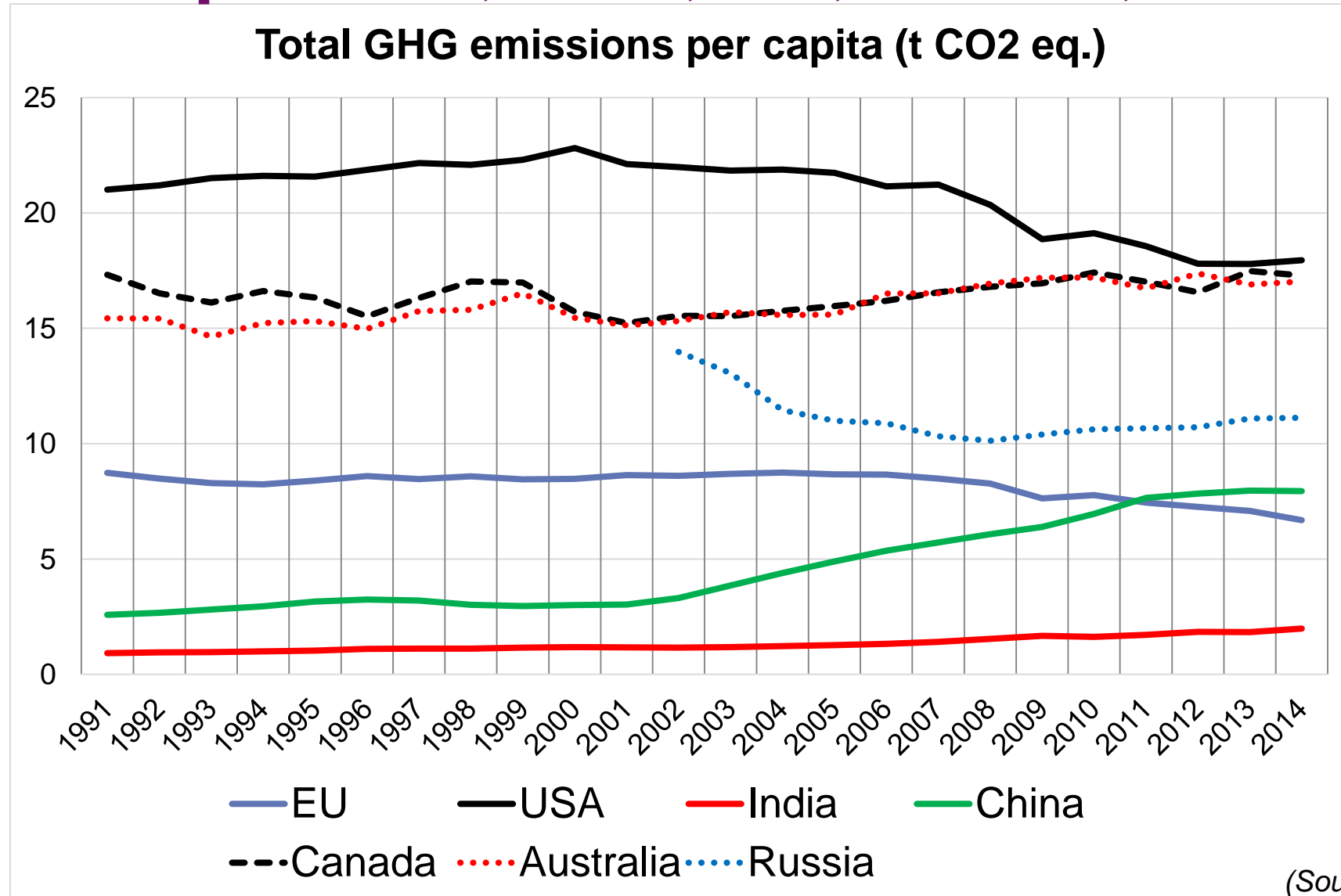


# The total GHG emissions continue to rise



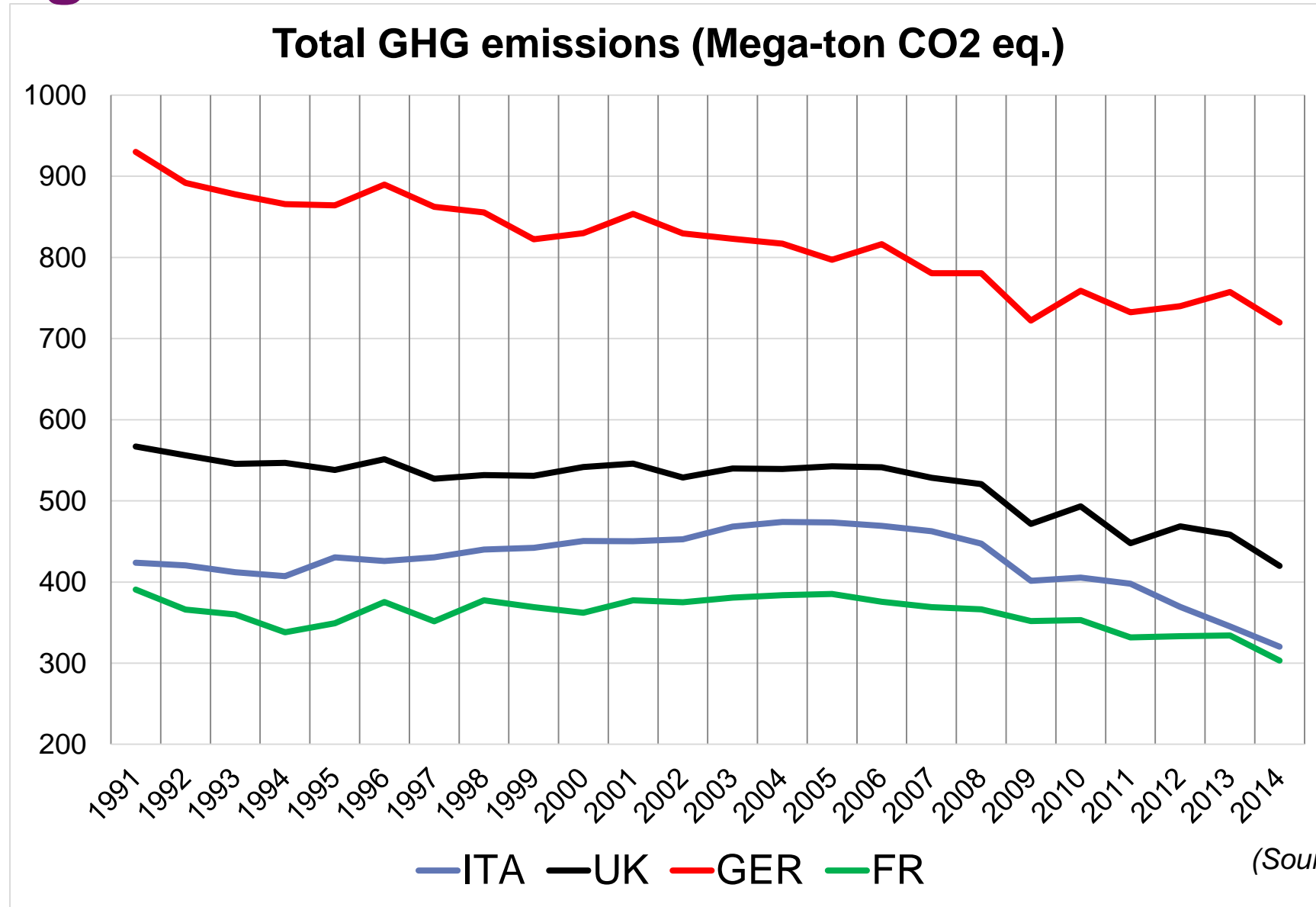


# CO2 per capita: US, CAN, AU, Russia, China, EU

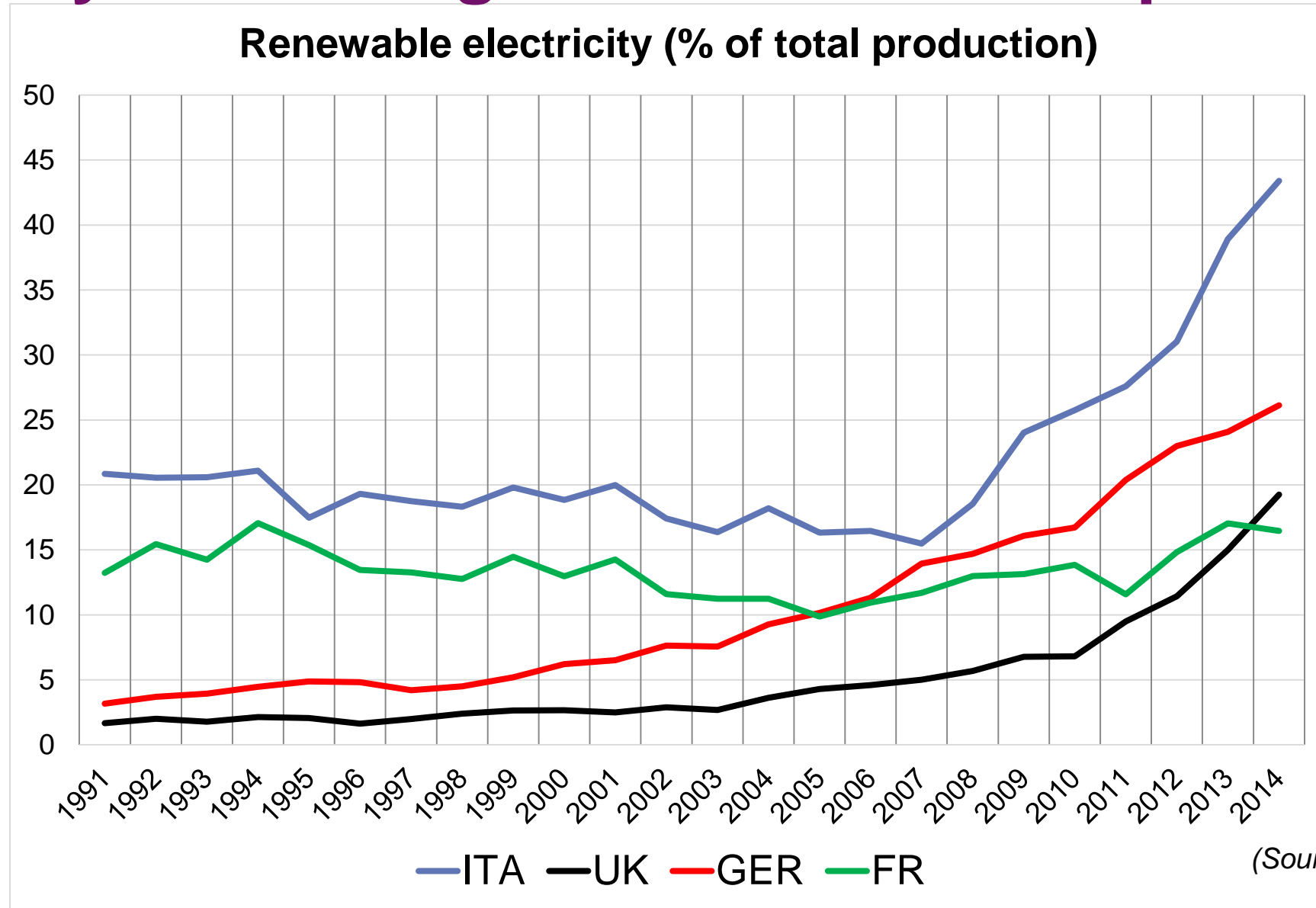


(Source: World Bank)

# The largest EU countries have reduced emissions

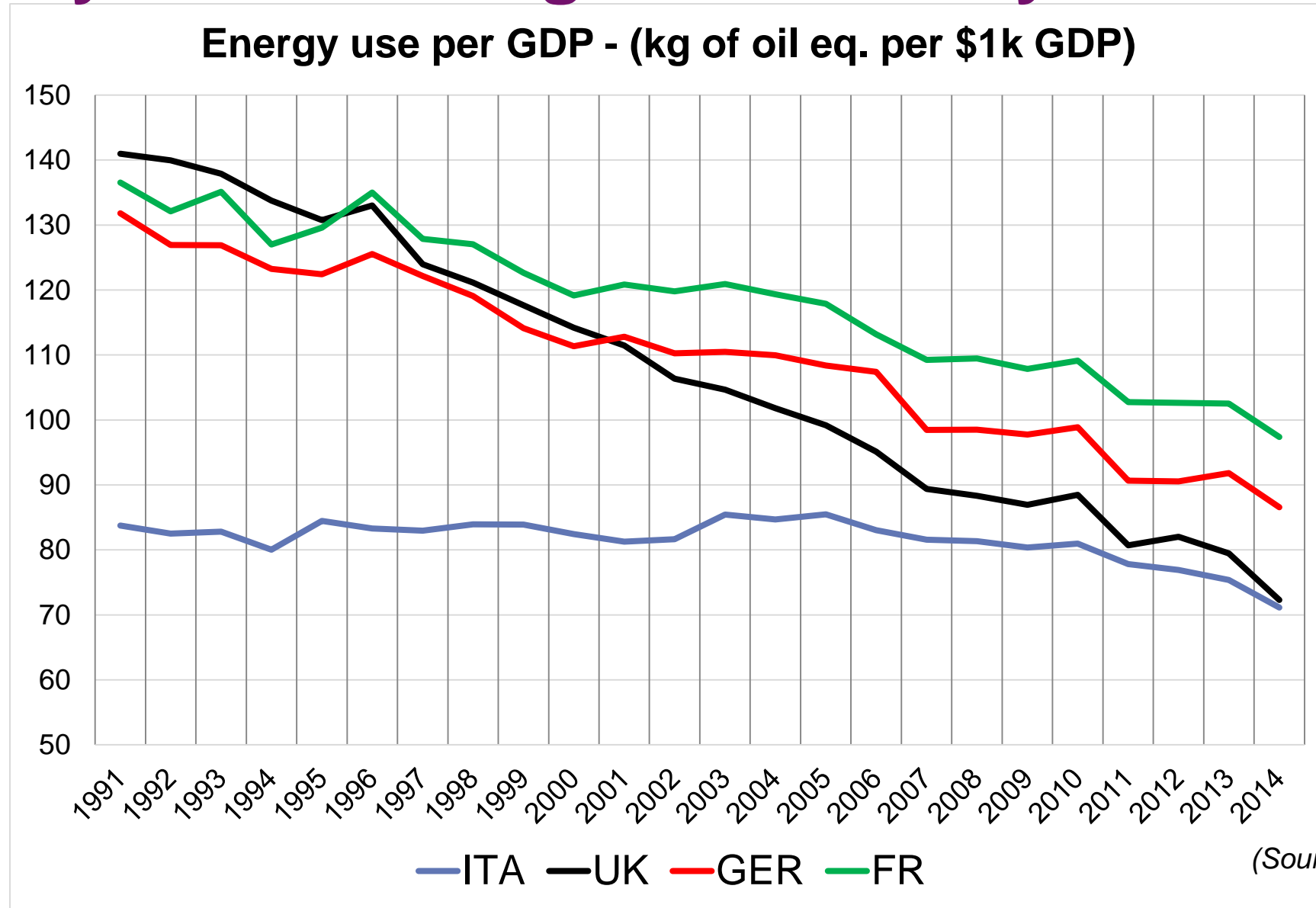


# Partly by increasing renewable Electr. production

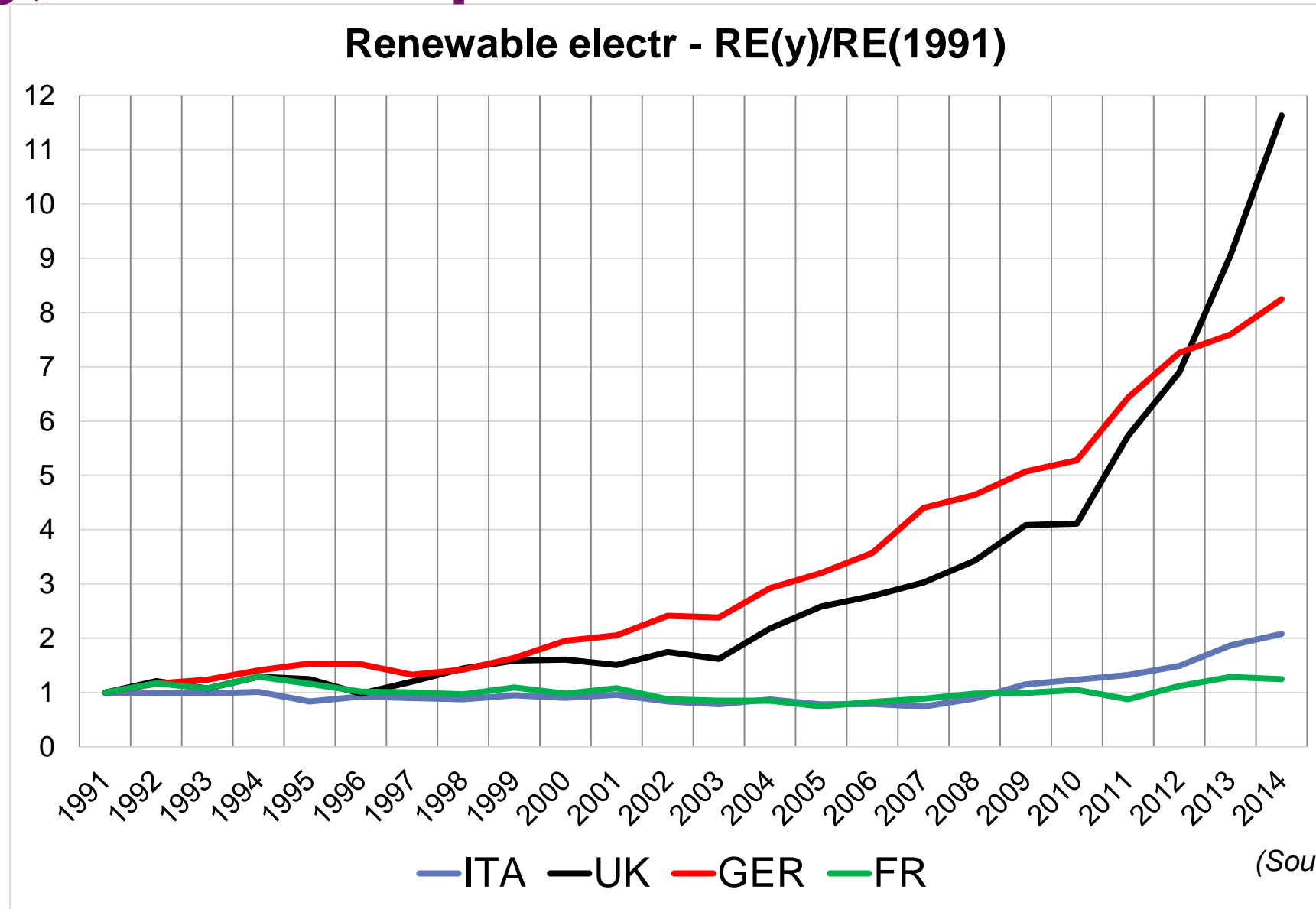




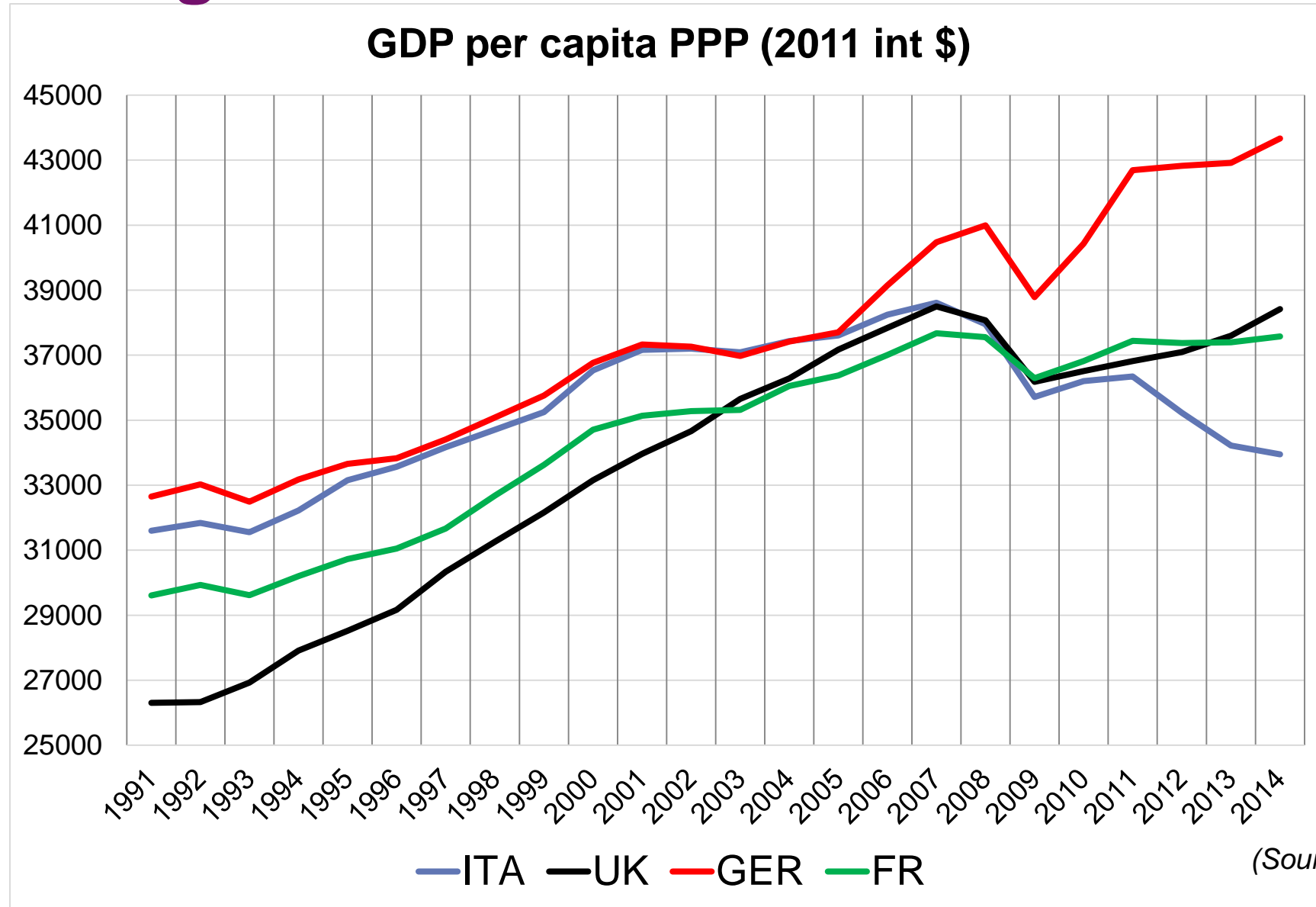
# Partly by transforming the economy



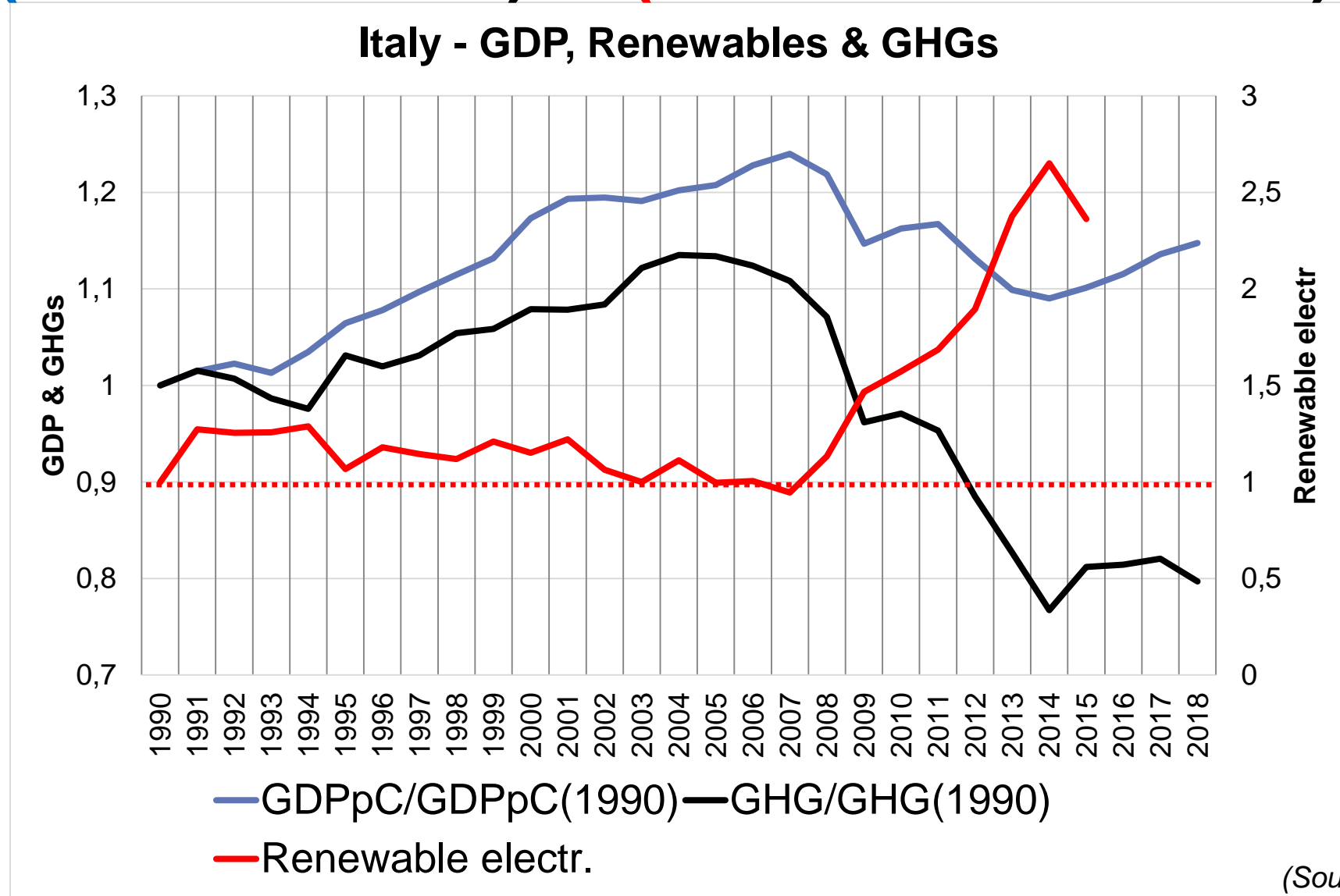
# In Italy, ren-Electr. production has increased ~2x



# Economic growth also influences CO2 emissions

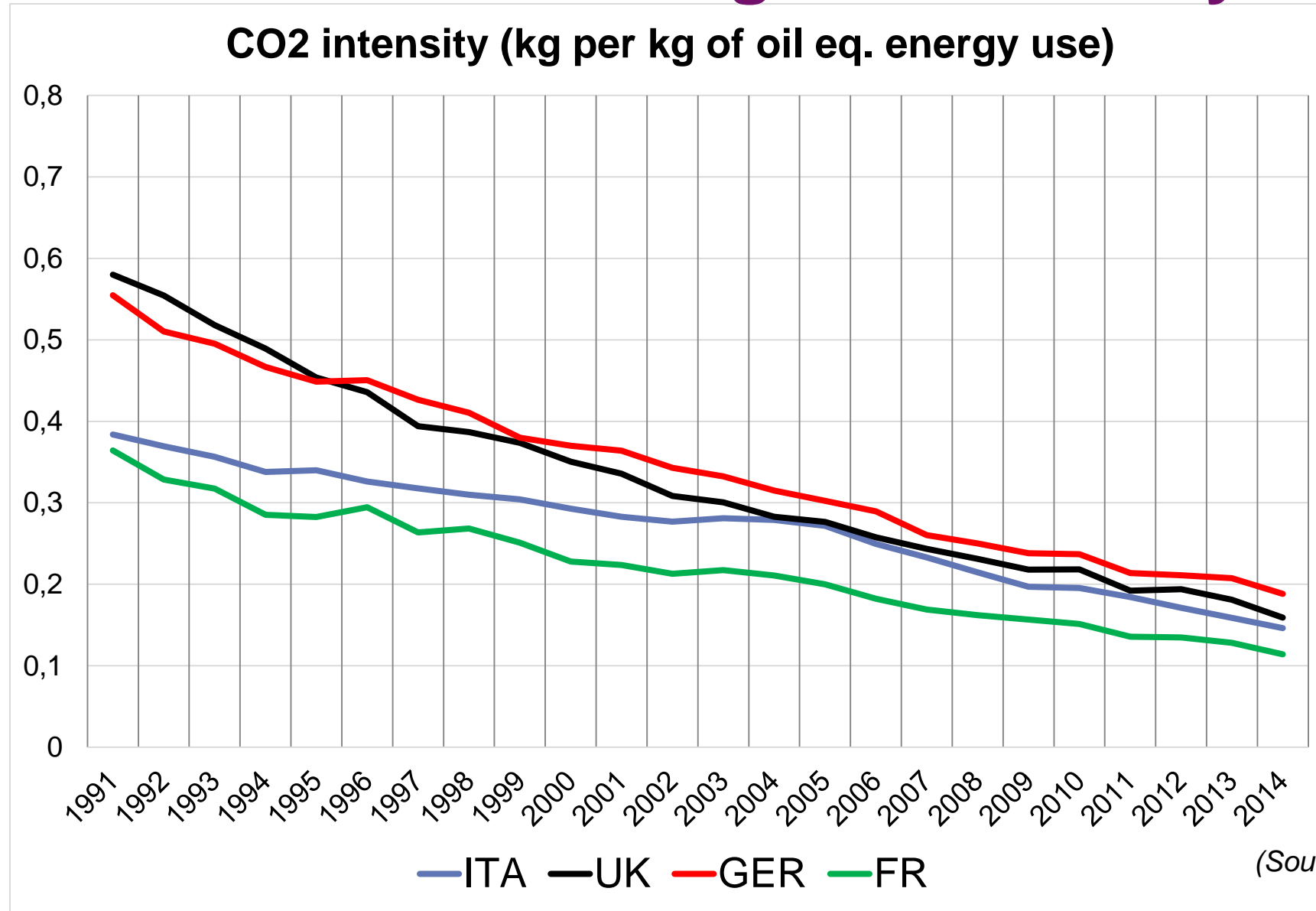


# Italy: (+GDP > +CO2) & (+RenElectr > -CO2)



(Source: World Bank)

# Italy is slow in transforming the economy



(Source: World Bank)



# Zero-net emissions and the letter to Institutions

All countries need to transform their economy and life style (energy production, transport, life style, efficiency, nutrition habits, ..) to reduce further the GHGs emissions.

300+ scientists and 21,500 citizen asked the Italian Institutions that **Italy becomes a leader in this transformation.**



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## Attività non legislative

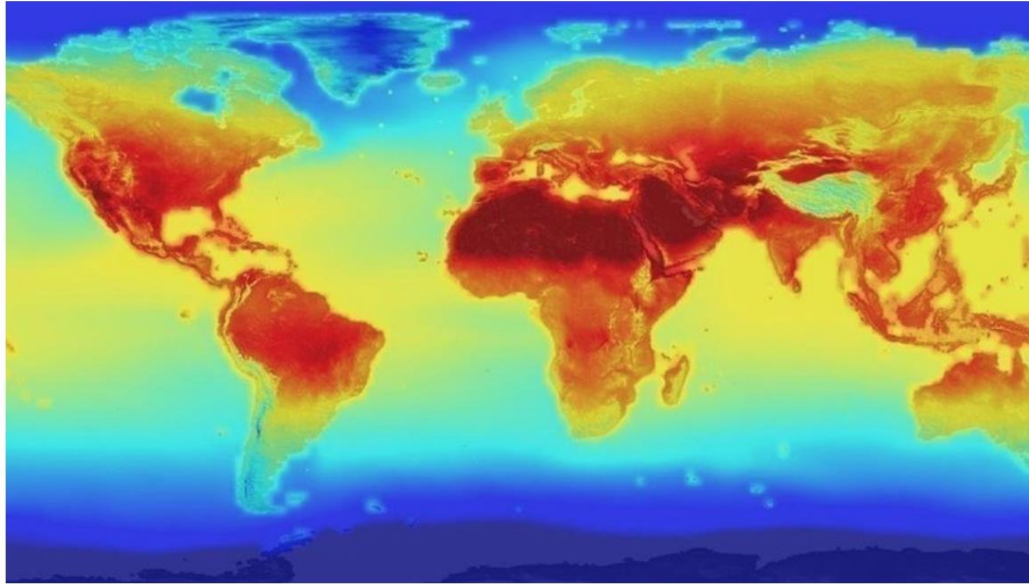
### Petizione n. 392

XVIII Legislatura

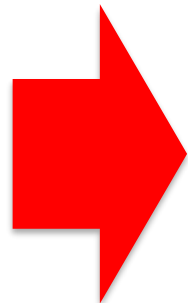
 [Segui l'iter](#)

I signori Roberto Buizza, E. Coppola, S. Corti, F. Giorgi, R. Nogherotto, F. Raffaele, G. Giuliani, E. Pichelli, S. Abelli, C. Adamo, M. Alabrese, P.P. Alberoni, S. Alessandrini, L. Ambrosio, L. Andreani, G. Antolini, F. Apadula, C.L. Archer, N. Armaroli, V. Artale, G. Badin, M. Bagliani, G. Baldacci, M. Baldi, V. Balzani, L. Bani, C. Barbante, R. Barbiero, U. Bardi, S. Bastianoni, A. Bellini, A. Bellucci, M.C. Beltrano, L. Bernardini, A. Bigano, M. Bindi, M. Biscarini, F. Boccanera, P. Bonasoni, A. Bonoli, R. Boscolo, A. Bozzo, E. Brattich, N. Bressi, M. Brunetti, G. Budillon, B. Bulgarelli, C. Buontempo, A. Buzzi, C. Cacciamani, C. Cafaro, C. Cagnazzo, S. Calmanti, A. Camerlenghi, D. Canu, D. Capolongo, L. Caporaso, S. Cappa, G. Carrosio, D. Cesari, A. Cherchi, D. Cimini, F. Cioffi, A. Collalti, S. Casadei, G. Casasanta, S. Caserini, S. Castellari, E. Cattani, F. Cazorzi, P. Cecon, A. Ceppi, F. Colleoni, R. Colucci, G. Comoretto, A. Corigliano, U. Cortesi, R. Coscarelli, F. Cresto Aleina, A. Crise, F. Cristiani, G. Curci, L. Danieli, P. Davini, F. Ferrero, F.

# Zero-net emissions and the letter to Institutions



 **Roberto Buizza** ha lanciato questa petizione e l'ha diretta a [Sergio Mattarella \(Presidente della Repubblica Italiana\)](#) e a [3 altri/altre](#)



È urgente e fondamentale affrontare e risolvere il problema dei cambiamenti climatici. Chiediamo che l'Italia segua l'esempio di molti paesi Europei, e decida di agire sui processi produttivi ed il trasporto, trasformando l'economia in modo da raggiungere il traguardo di 'zero emissioni nette di gas serra' entro il 2050.

Tale risultato deve essere raggiunto per i seguenti motivi:

21.411 hanno firmato. Arriviamo a 25.000.



 **Carlo Tosi** ha firmato la petizione 2 ore fa

 **Fabio Iannantuono** ha firmato la petizione 10 ore fa

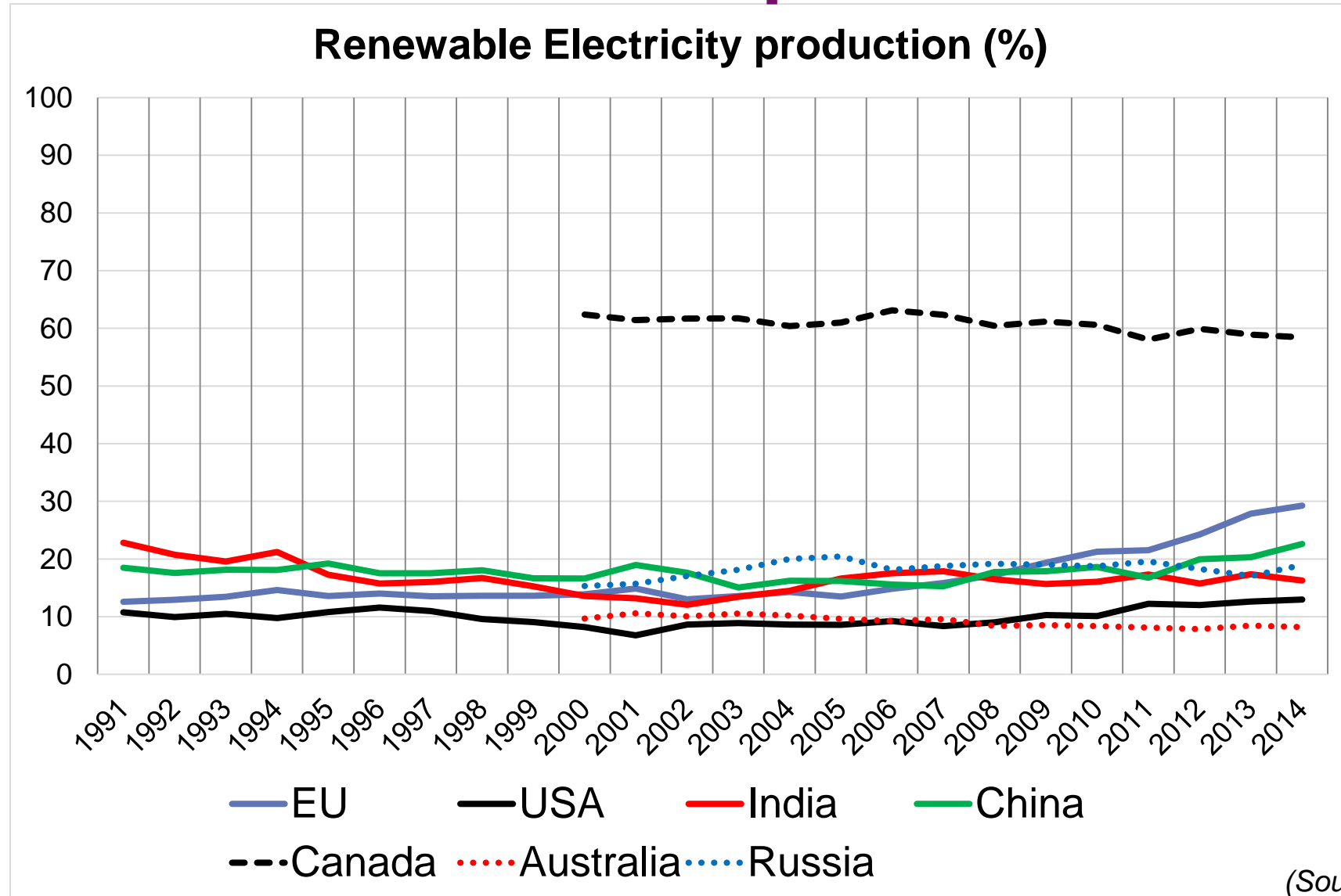
 **Roberto Buizza** Agliati Palaia, Italia 

Sto firmando perché... (opzionale)

Non mostrare il mio nome e il mio commento su questa petizione

 **Firma questa petizione**

# The % of renewable electr. production is still low



(Source: World Bank)

# Conclusions

We have the technology and the resources to address Climate Change. We have to decide to do it, and invest to realize a new industrial revolution: **industry 5.0**. We have to aim for **GDP growth at zero-net GHGs emissions**.

Energy production and storage, transport, improved efficiency, life-style changes: they all have to change.

We need to change the narrative from 'addressing CC consumes resources' into 'investing in industry 5.0 leads to addressing CC and to economic growth'.