

**Climate change:  
We are all part of the solution!**

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IPCC Vice-Chair from 2008 to 2015  
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Tractebel.be, Brussels, 18 June 2019

Thanks to the Walloon government for supporting [www.pplateforme-wallonne-giec.be](http://www.pplateforme-wallonne-giec.be) & my team at UCLouvain

**That small blue dot is the Earth, as seen from  
Cassini, orbiting Saturn, 1.44 billion km from  
us, on 19-7-2013**



# I want you to panic... and act

“I don’t want your hope. I don’t want you to be hopeful. I want you to panic ... and act as if the house was on fire. ”

Greta Thunberg  
Environmental Activist

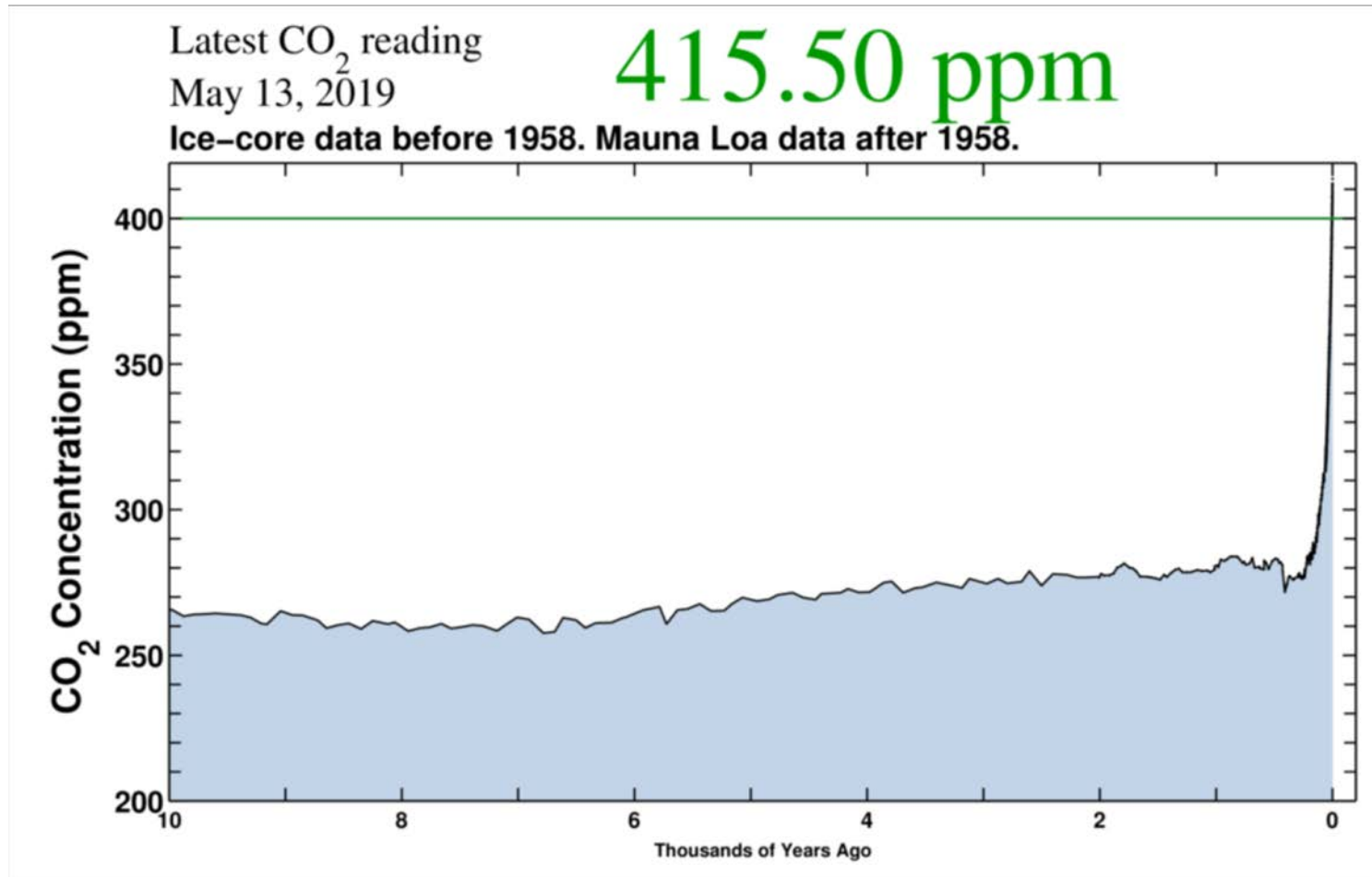
WORLD  
ECONOMIC  
FORUM



**Because we use the atmosphere  
as a dustbin for our greenhouse  
gases, we thicken the insulation  
layer around the planet**

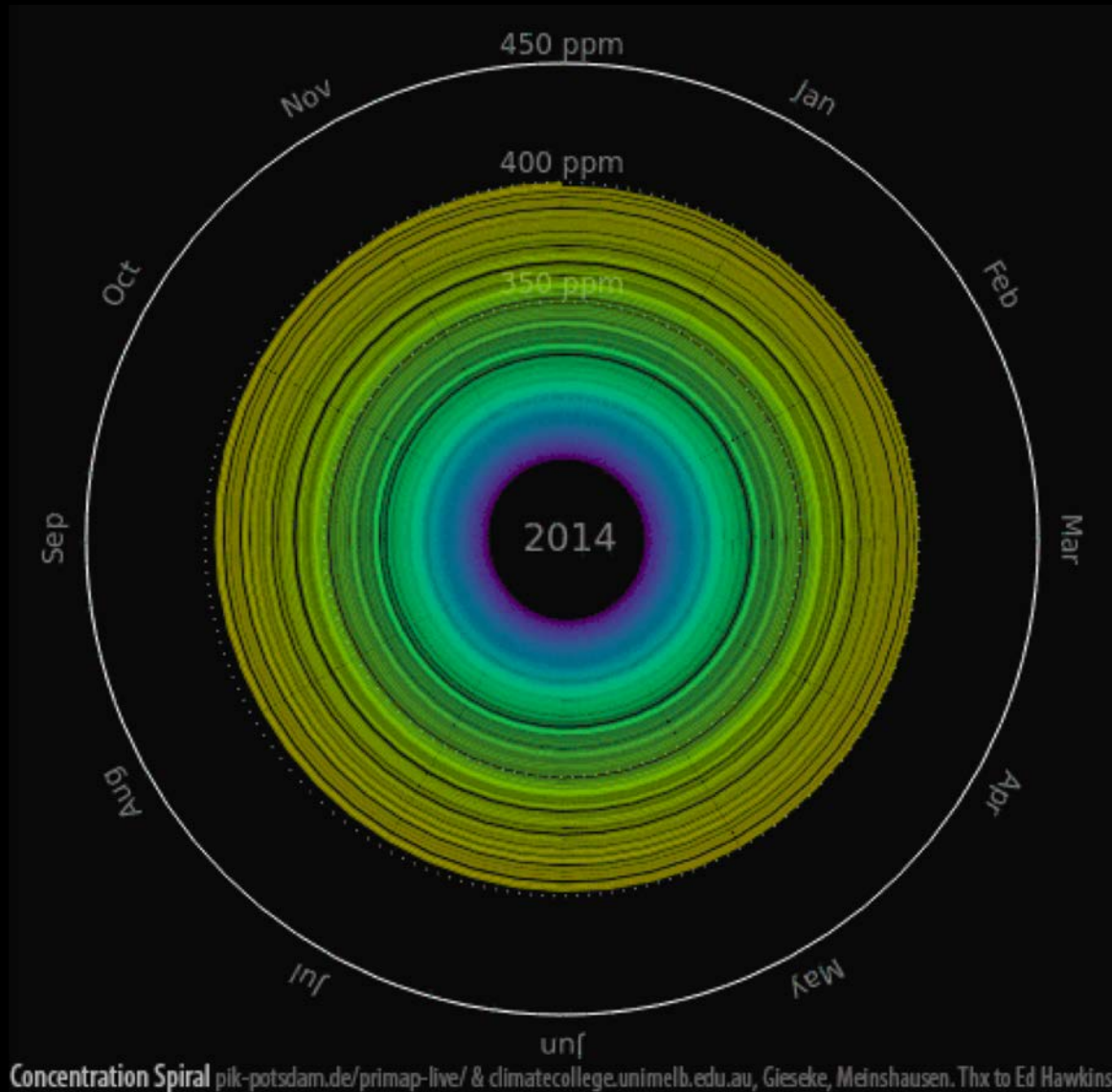
**That is why we must cut emissions  
to ZERO as soon as possible**

# CO<sub>2</sub> Concentration, 13 May 2019 (Keeling curve)



Source: [scripps.ucsd.edu/programs/keelingcurve/](https://scripps.ucsd.edu/programs/keelingcurve/)

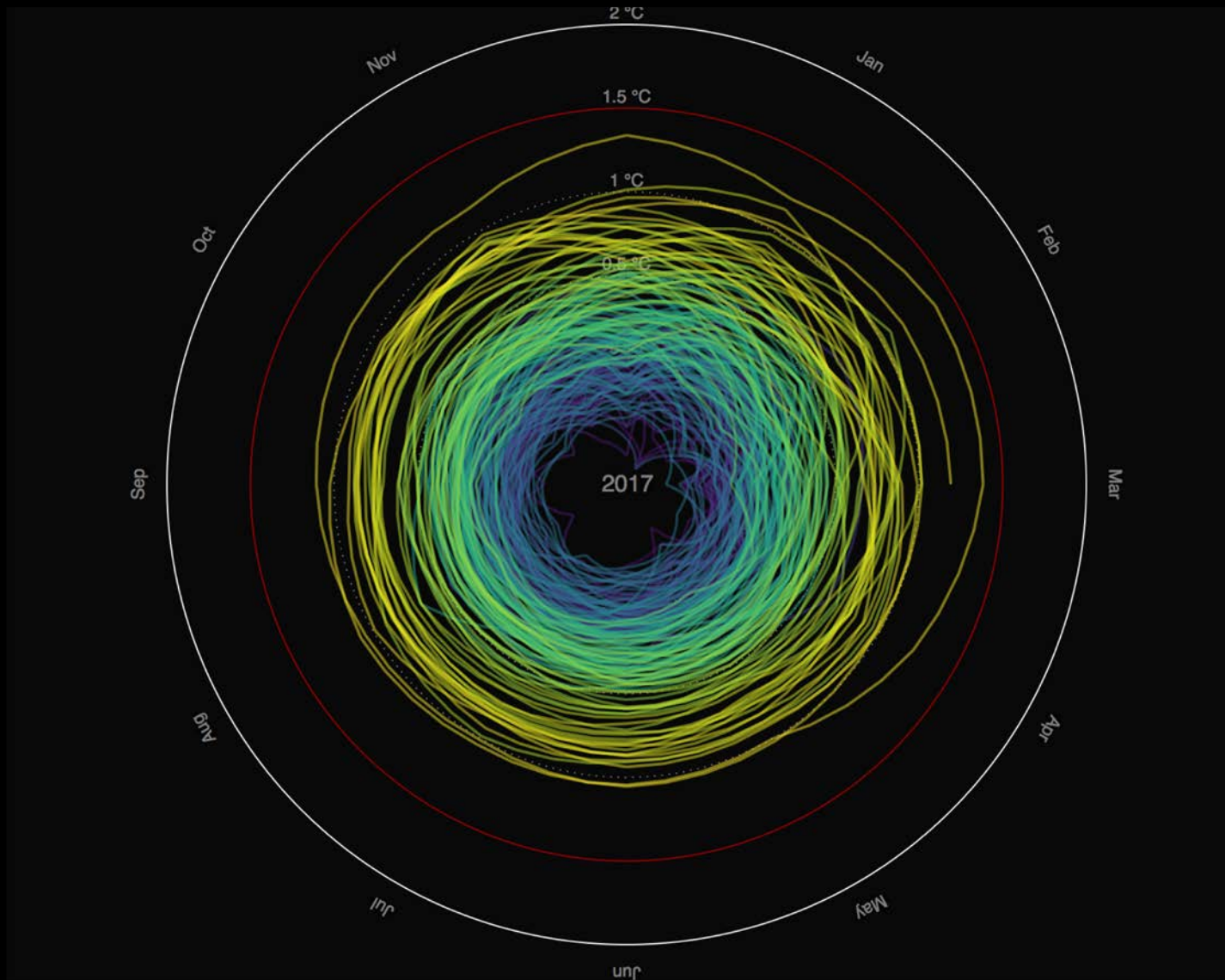
# CO<sub>2</sub> concentration spiral: the insulation thickens!



CO<sub>2</sub> concentration spiral 1851-2014 (ppm), by Gieseke & Meinshausen,  
Available on <http://pik-potsdam.de/primap-live>



# Temperature spiral



Global Mean Temperature in °C relative to 1850 – 1900

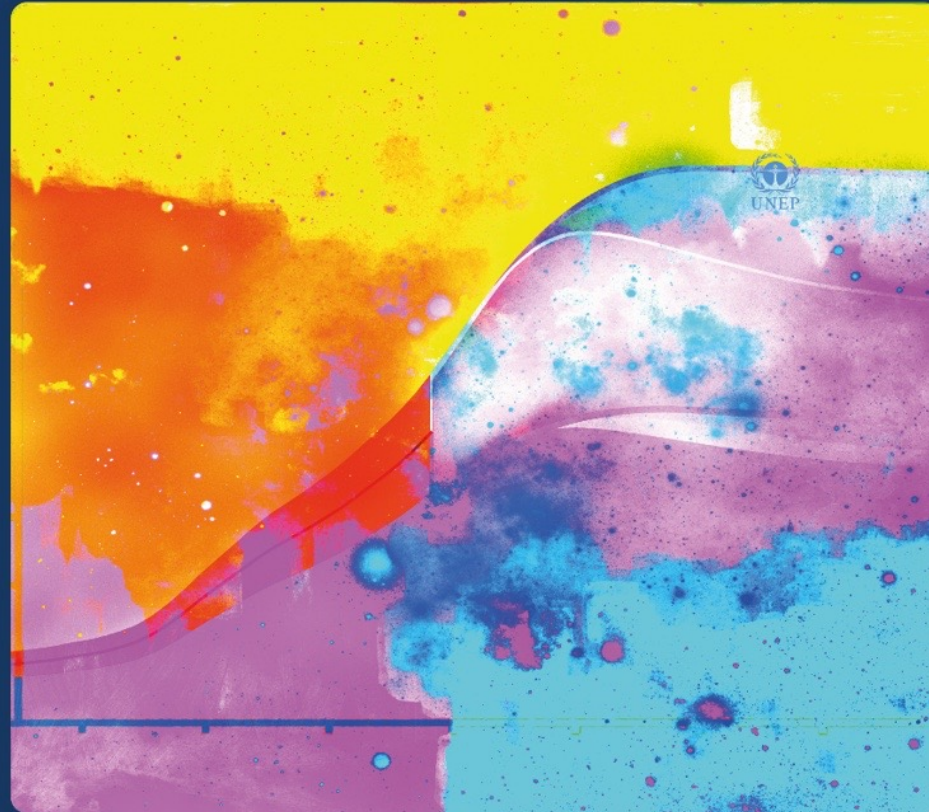
Graph: Ed Hawkins (Climate Lab Book) – Data: HadCRUT4 global temperature dataset

Animated version available on <http://openclimatedata.net/climate-spirals/temperature>

# The SR15

# Global Warming of 1.5°C













An IPCC special report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty.





# HALF A DEGREE OF WARMING MAKES A BIG DIFFERENCE:

EXPLAINING IPCC'S 1.5°C SPECIAL REPORT

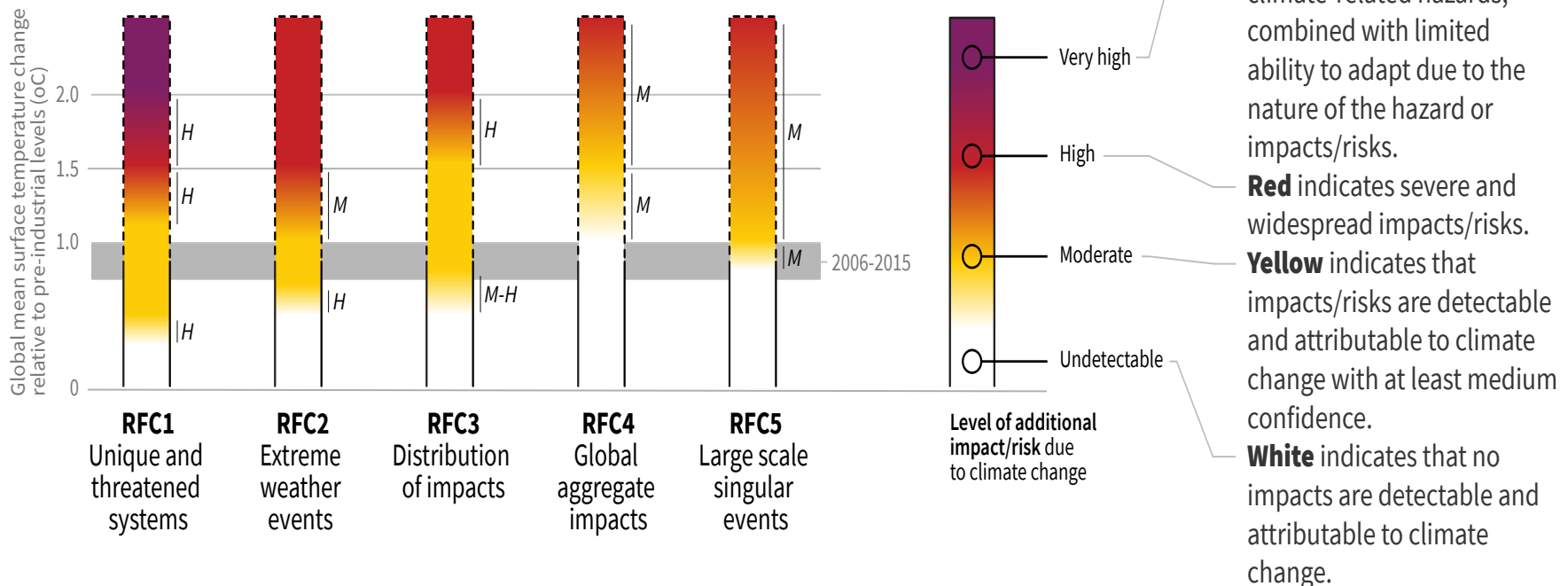
	1.5°C	2°C	2°C IMPACTS
<b>EXTREME HEAT</b> Global population exposed to severe heat at least once every five years	 <p>14%</p>	 <p>37%</p>	<b>2.6x</b> WORSE
<b>SEA-ICE-FREE ARCTIC</b> Number of ice-free summers	AT LEAST 1 EVERY <b>100 YEARS</b> 	AT LEAST 1 EVERY <b>10 YEARS</b> 	<b>10x</b> WORSE
<b>SEA LEVEL RISE</b> Amount of sea level rise by 2100	 <p>0.40 METERS</p>	 <p>0.46 METERS</p>	<b>.06M</b> MORE
<b>SPECIES LOSS: VERTEBRATES</b> Vertebrates that lose at least half of their range	 <p>4%</p>	 <p>8%</p>	<b>2x</b> WORSE
<b>SPECIES LOSS: PLANTS</b> Plants that lose at least half of their range	 <p>8%</p>	 <p>16%</p>	<b>2x</b> WORSE
<b>SPECIES LOSS: INSECTS</b> Insects that lose at least half of their range	 <p>6%</p>	 <p>18%</p>	<b>3x</b> WORSE

Responsibility for content: WRI

# How the level of global warming affects impacts and/or risks associated with the Reasons for Concern (RFCs) and selected natural, managed and human systems

Five Reasons For Concern (RFCs) illustrate the impacts and risks of different levels of global warming for people, economies and ecosystems across sectors and regions.

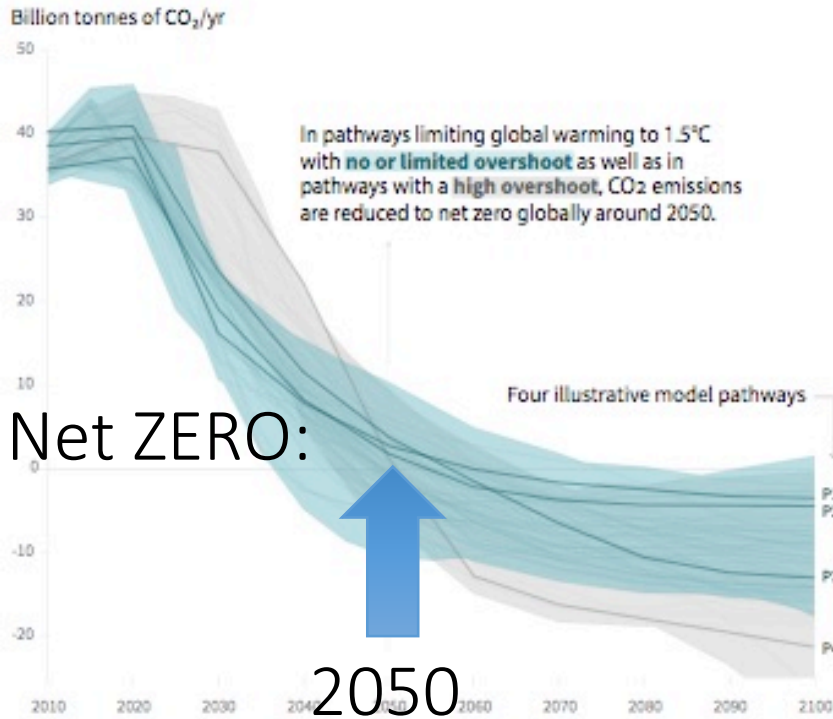
## Impacts and risks associated with the Reasons for Concern (RFCs)



## Global emissions pathway characteristics

General characteristics of the evolution of anthropogenic net emissions of CO<sub>2</sub>, and total emissions of methane, black carbon, and nitrous oxide in model pathways that limit global warming to 1.5°C with no or limited overshoot. Net emissions are defined as anthropogenic emissions reduced by anthropogenic removals. Reductions in net emissions can be achieved through different portfolios of mitigation measures illustrated in Figure SPM3B.

### Global total net CO<sub>2</sub> emissions



#### Timing of net zero CO<sub>2</sub>

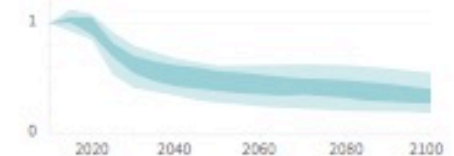
Line widths depict the 5-95th percentile and the 25-75th percentile of scenarios



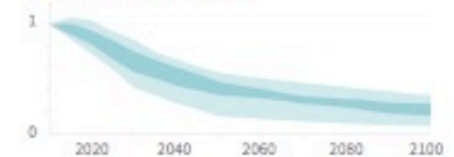
### Non-CO<sub>2</sub> emissions relative to 2010

Emissions of non-CO<sub>2</sub> forcers are also reduced or limited in pathways limiting global warming to 1.5°C with **no or limited overshoot**, but they do not reach zero globally.

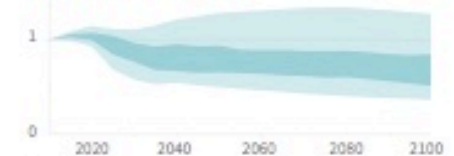
#### Methane emissions



#### Black carbon emissions



#### Nitrous oxide emissions



# Greenhouse gas emissions pathways

- To limit warming to 1.5° C, CO<sub>2</sub> emissions fall by about 45% by 2030 (from 2010 levels)
  - Compared to 20% for 2° C
- To limit warming to 1.5° C, CO<sub>2</sub> emissions would need to reach 'net zero' around 2050
  - Compared to around 2075 for 2° C
- Reducing non-CO<sub>2</sub> emissions would have direct and immediate health benefits

# Remaining carbon budget in 2018

(Source: IPCC SR15)

- The remaining carbon budget of 580 GtCO<sub>2</sub> for a 50% probability of limiting warming to 1.5°C, and 420 GtCO<sub>2</sub> for a 66% probability (medium confidence)
- The remaining budget is being depleted by current emissions of  $42 \pm 3$  GtCO<sub>2</sub> per year



# Greenhouse gas emissions pathways

- Limiting warming to 1.5° C would require changes on an unprecedented scale
  - Deep emissions cuts in all sectors
  - A range of technologies
  - Behavioural changes
  - Increase investment in low carbon options

## Greenhouse gas emissions pathways

- Progress in renewables would need to be mirrored in other sectors
- We would need to start taking carbon dioxide out of the atmosphere (Afforestation or other techniques)
- Implications for food security, ecosystems and biodiversity

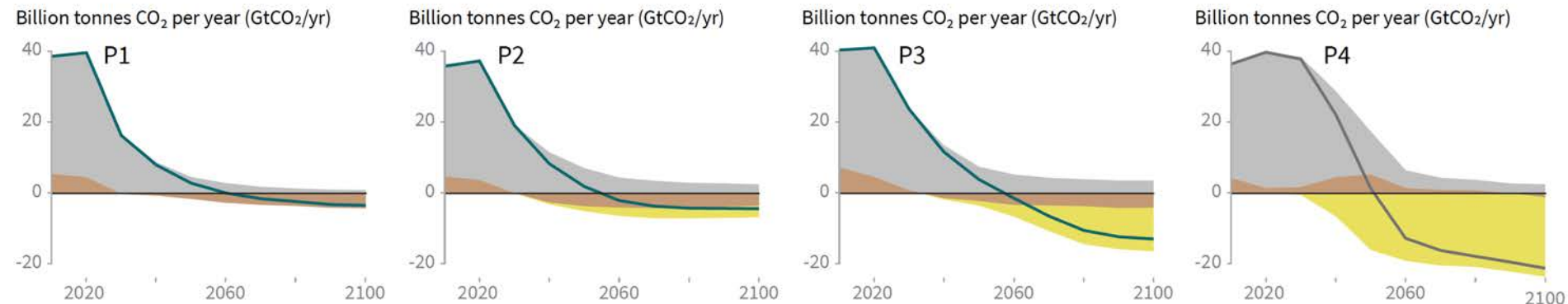
# Greenhouse gas emissions pathways

- National pledges are not enough to limit warming to 1.5° C
- Avoiding warming of more than 1.5° C would require carbon dioxide emissions to decline substantially before 2030

# Four illustrative model pathways in the IPCC SR15:

## Breakdown of contributions to global net CO<sub>2</sub> emissions in four illustrative model pathways

● Fossil fuel and industry ● AFOLU ● BECCS



**P1:** A scenario in which social, business, and technological innovations result in lower energy demand up to 2050 while living standards rise, especially in the global South. A down-sized energy system enables rapid decarbonisation of energy supply. Afforestation is the only CDR option considered; neither fossil fuels with CCS nor BECCS are used.

**P2:** A scenario with a broad focus on sustainability including energy intensity, human development, economic convergence and international cooperation, as well as shifts towards sustainable and healthy consumption patterns, low-carbon technology innovation, and well-managed land systems with limited societal acceptability for BECCS.

**P3:** A middle-of-the-road scenario in which societal as well as technological development follows historical patterns. Emissions reductions are mainly achieved by changing the way in which energy and products are produced, and to a lesser degree by reductions in demand.

**P4:** A resource and energy-intensive scenario in which economic growth and globalization lead to widespread adoption of greenhouse-gas intensive lifestyles, including high demand for transportation fuels and livestock products. Emissions reductions are mainly achieved through technological means, making strong use of CDR through the deployment of BECCS.

# Four illustrative model pathways in the IPCC SR15:

Global indicators	P1	P2	P3	P4	Interquartile range
Pathway classification	No or low overshoot	No or low overshoot	No or low overshoot	High overshoot	No or low overshoot
CO <sub>2</sub> emission change in 2030 (% rel to 2010)	-58	-47	-41	4	(-59,-40)
↳ in 2050 (% rel to 2010)	-93	-95	-91	-97	(-104,-91)
Kyoto-GHG emissions* in 2030 (% rel to 2010)	-50	-49	-35	-2	(-55,-38)
↳ in 2050 (% rel to 2010)	-82	-89	-78	-80	(-93,-81)
Final energy demand** in 2030 (% rel to 2010)	-15	-5	17	39	(-12, 7)
↳ in 2050 (% rel to 2010)	-32	2	21	44	(-11, 22)
Renewable share in electricity in 2030 (%)	60	58	48	25	(47, 65)
↳ in 2050 (%)	77	81	63	70	(69, 87)
Primary energy from coal in 2030 (% rel to 2010)	-78	-61	-75	-59	(-78, -59)
↳ in 2050 (% rel to 2010)	-97	-77	-73	-97	(-95, -74)
from oil in 2030 (% rel to 2010)	-37	-13	-3	86	(-34,3)
↳ in 2050 (% rel to 2010)	-87	-50	-81	-32	(-78,-31)
from gas in 2030 (% rel to 2010)	-25	-20	33	37	(-26,21)
↳ in 2050 (% rel to 2010)	-74	-53	21	-48	(-56,6)
from nuclear in 2030 (% rel to 2010)	59	83	98	106	(44,102)
↳ in 2050 (% rel to 2010)	150	98	501	468	(91,190)
from biomass in 2030 (% rel to 2010)	-11	0	36	-1	(29,80)
↳ in 2050 (% rel to 2010)	-16	49	121	418	(123,261)
from non-biomass renewables in 2030 (% rel to 2010)	430	470	315	110	(243,438)
↳ in 2050 (% rel to 2010)	832	1327	878	1137	(575,1300)
Cumulative CCS until 2100 (GtCO <sub>2</sub> )	0	348	687	1218	(550, 1017)
↳ of which BECCS (GtCO <sub>2</sub> )	0	151	414	1191	(364, 662)
Land area of bioenergy crops in 2050 (million hectare)	22	93	283	724	(151, 320)
Agricultural CH <sub>4</sub> emissions in 2030 (% rel to 2010)	-24	-48	1	14	(-30,-11)
in 2050 (% rel to 2010)	-33	-69	-23	2	(-46,-23)
Agricultural N <sub>2</sub> O emissions in 2030 (% rel to 2010)	5	-26	15	3	(-21,4)
in 2050 (% rel to 2010)	6	-26	0	39	(-26,1)

NOTE: Indicators have been selected to show global trends identified by the Chapter 2 assessment. National and sectoral characteristics can differ substantially from the global trends shown above.

\* Kyoto-gas emissions are based on SAR GWP-100

\*\* Changes in energy demand are associated with improvements in energy efficiency and behaviour change



**For 3 illustrative model pathways that limit warming with no or limited overshoot**

(%rel to 2010)	P1	P2	P3
CO <sub>2</sub> (2030/2050)	-58 / - 93	-47 / -95	-41 / -91
Final energy demand (2030/2050)	-15 / -32	-5 / +2	+17 / +21
Primary energy from coal (2030/2050)	-78/-97	-61/-77	-75/-73
Primary energy from non-biomass renewables (2030/2050)	+430/+832	+470/+132 7	+315/+878

IPCC SR15  
Fig SPM 3b

**Fact n° 7: In the USA alone,  
organizations which sow doubt  
about climate change spend almost  
a billion dollars/year! (Brulle 2014, average  
numbers for 2003-2010)**

The European Union fares a little better, but many Brussels lobbyists try to dilute the EU environmental efforts (see the car industry...)

# The « merchants of doubt » have evolved in their arguments:

- Existence of global warming
- Human responsibility in the warming
- Uncertainties around the science
- More research needed before taking measures
- Cost of decarbonization
- Drawbacks from alternatives

(recent example: so-called enormous needs of cobalt for electric mobility reported on CNN; see critical analysis on <https://www.desmogblog.com/2018/05/02/cnn-wrongly-blames-electric-cars-unethical-cobalt-mining>)

**Fact n° 8: European Union  
spends at least 1 billion euros  
*per day* simply to buy fossil fuels  
outside its borders.**

True, decarbonizing the EU economy will cost, but not doing it could cost much more in impacts. Saving these 400 billions €/year could offer many opportunities

**Fact n° 9: China is waking up to the climate and pollution challenge. It might become the world climate leader if the EU (5% of world population in 2050 ?) does not raise its ambition level in line with the Paris Agreement**

The US economy will become less and less attractive, as it risks missing the decarbonizing trend. Hopefully, climate measures at the level of US cities and states can somewhat compensate federal actions



**Fact n° 10: The present national plans (NDCs) introduced ahead of the Paris Agreement are far from what is needed to respect the 1.5° C objective, and even to stay below 2° C warming**

Please note that the Paris Agreement speaks about 1.5° C and « *well below 2° C* » warming, not 2° C

# Conférence sur les Changements Climatiques

## Nations Unies

COP21/CMP11

### Paris, France



SECRETAIRE EXECUTIVE CCNUCC

PRESIDENT

# The Paris Agreement (COP21, December 2015)

## Vision

« ...strengthen the **global response to the threat of climate change**, in the context of **sustainable development** and efforts to **eradicate poverty** »

## Objectives

### a) Holding the increase in the global average temperature:

- « *to well below 2°C above pre-industrial levels* »
- « *pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change* »

### b) Adaptation and Mitigation

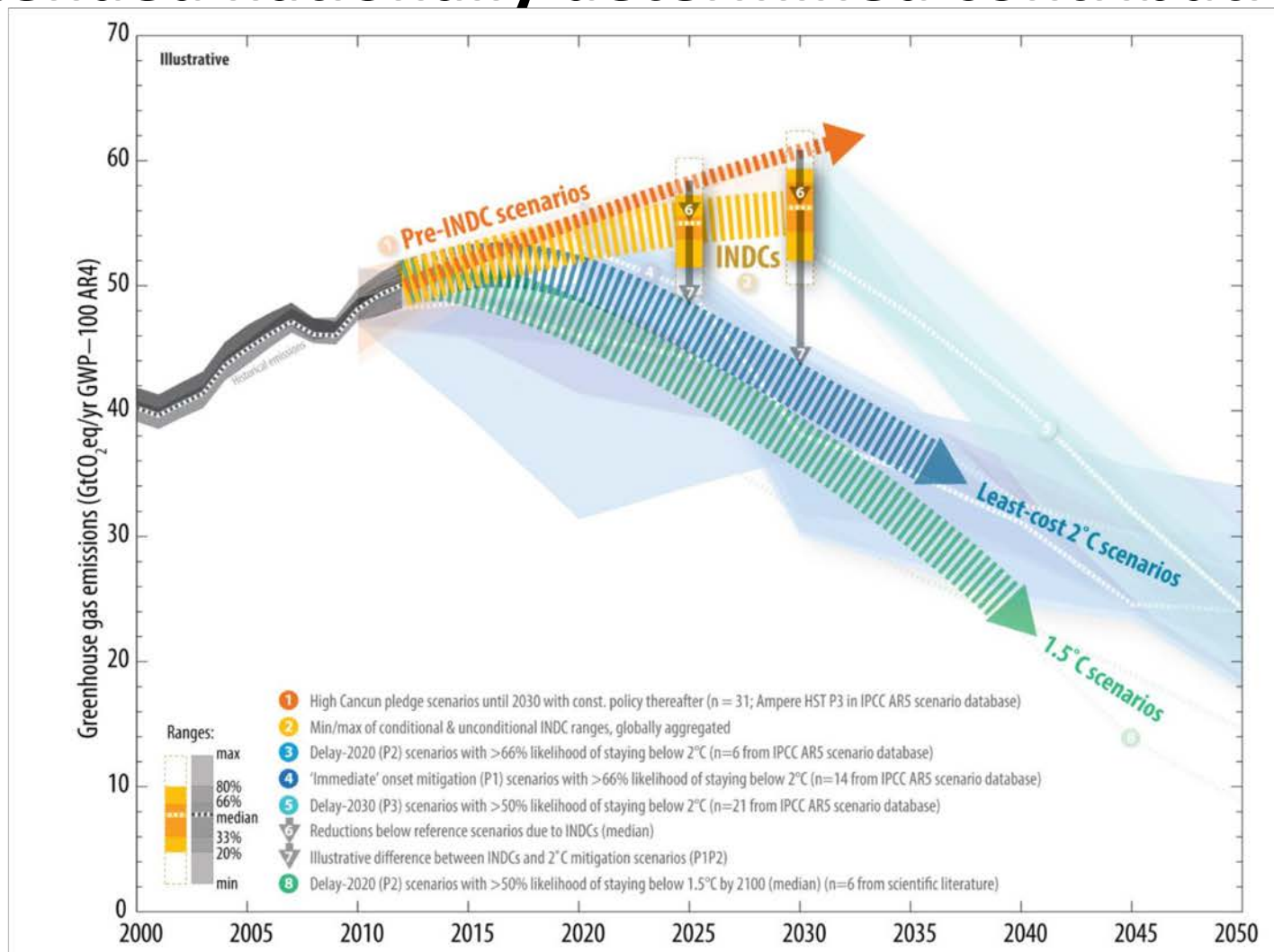
- « *Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and*
- *low greenhouse gas emissions development, in a manner that does not threaten food production*»

### c) Finances

- « *Making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development.* »



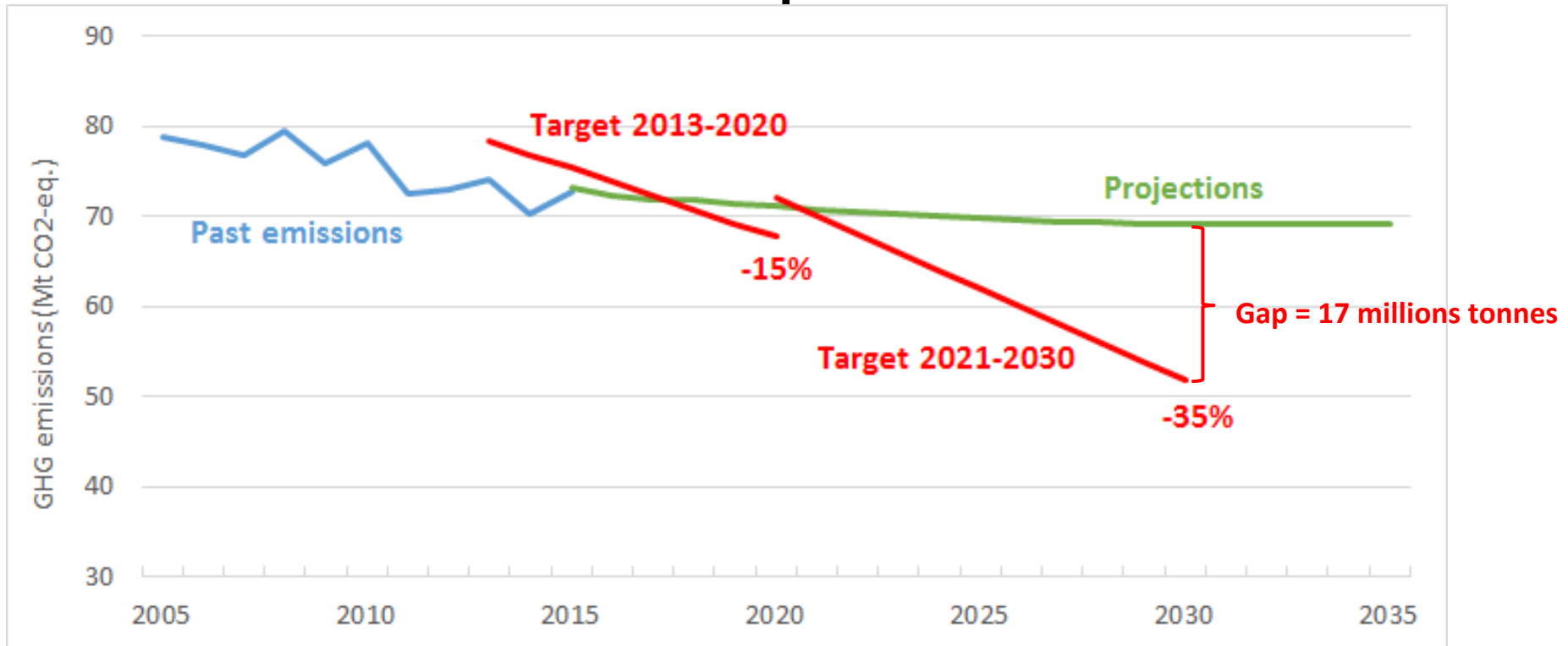
# Comparison of global emission levels in 2025 and 2030 resulting from the implementation of the intended nationally determined contributions



UNFCCC, Aggregate effect of the intended nationally determined contributions: an update

<http://unfccc.int/resource/docs/2016/cop22/eng/02.pdf>

# Objectifs de la Belgique dans le cadre européen



- Evolution des émissions en Belgique et objectifs de réduction (secteurs non-ETS)
- (2005-2015: émissions réelles; 2015-2035: projections)

Source: Commission Nationale Climat (2017)

**(Element) of solution n° 1: The  
survival of humanity and  
ecosystems must become a  
much higher political priority**

... as if we were all running for our life.

# **Solution n° 2: Economic actors must be confronted much more clearly with their responsibilities**

Degrowth of climate-unfriendly activities must be accepted, while growth of activities helping climate protection and poverty eradication must be encouraged



**Solution n° 3: The best understood language is the price. Destroying the environment must become more and more expensive. Collected funds must be used to help the decarbonization, and avoid impacting the poor disproportionately**

EU Emission Trading System, CO<sub>2</sub> taxes, fines, internal CO<sub>2</sub> price (firms do « as if » CO<sub>2</sub> emission was expensive). NB: Price must match the effect desired!

**Solution n° 4: Transition towards  
a clean and sustainable economy  
and energy system must be  
« just », and other synergies with  
the SDGs must be sought**

**Ex : The Polish energy system cannot  
be transformed without facilitating  
the coal miners reconversion**



# SUSTAINABLE DEVELOPMENT GOALS

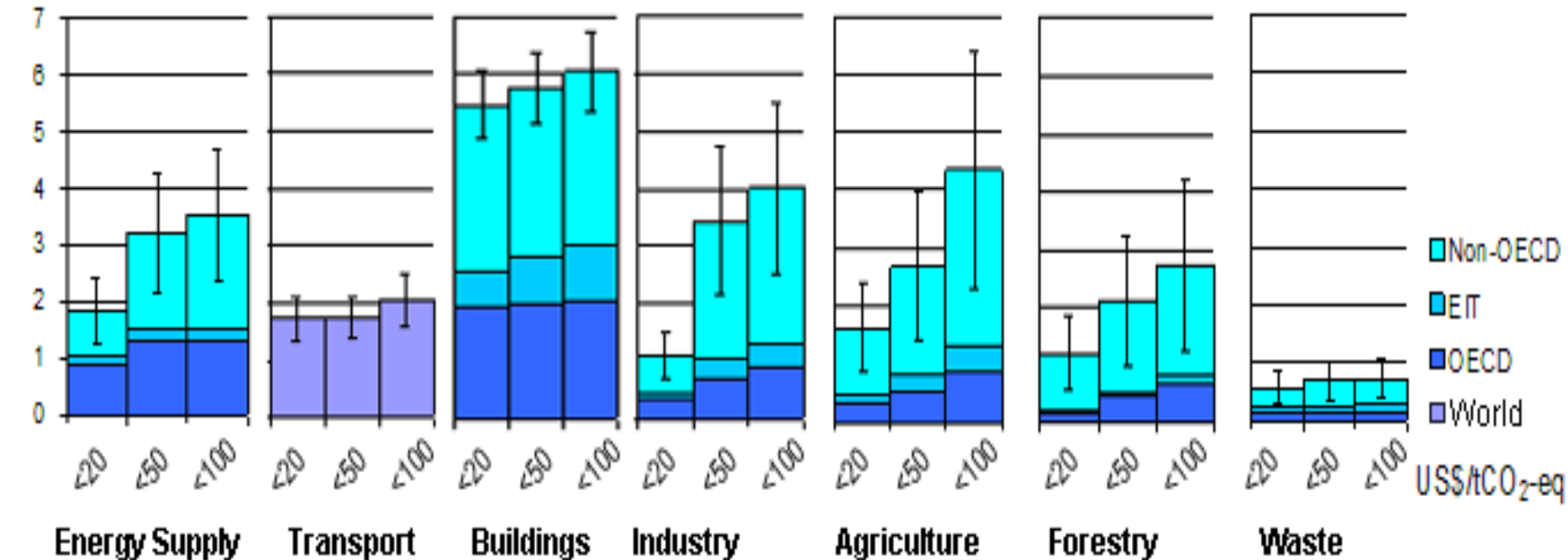


**Solution n° 5: Before looking at how to produce energy cleanly, much more attention must be given to reducing energy demand and efficiency, in all sectors**

All production and consumption patterns must be reconsidered, helped by energy audits, etc.

# All sectors and regions have the potential to contribute by 2030

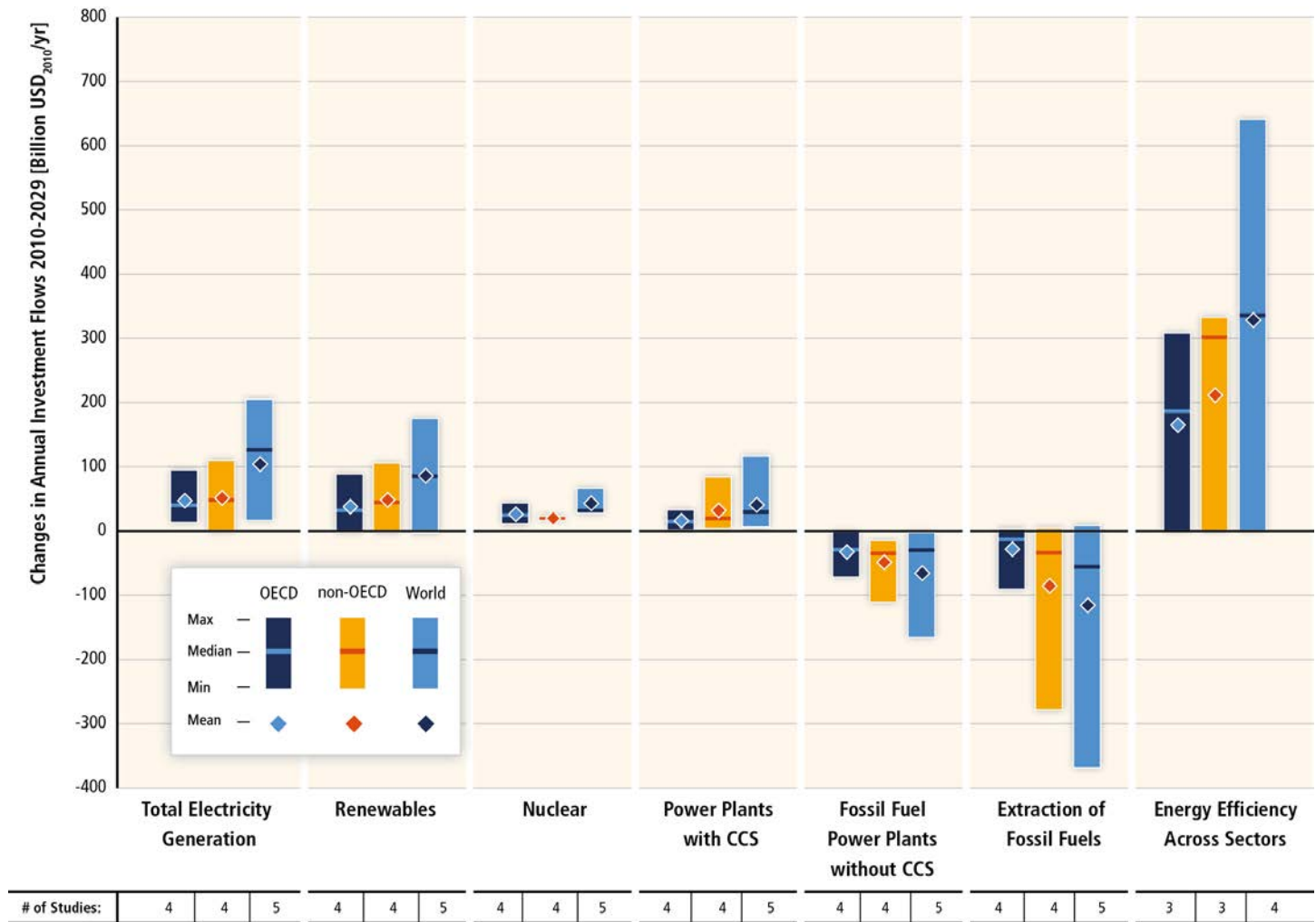
GtCO<sub>2</sub>-eq / year (avoided emissions: the higher, the better)



IPCC AR4 (2007)

Note: estimates do not include non-technical options, such as lifestyle changes.

# Substantial reductions in emissions would require large changes in investment patterns.





- **Substantial reductions in emissions to stay under 2° C would require large changes in investment patterns e.g., from 2010 to 2029, in billions US dollars/year:** (mean numbers rounded, IPCC AR5 WGIII Fig SPM 9)

- **energy efficiency: +330**
- **renewables: + 90**
- **power plants w/ CCS: + 40**
- **nuclear: + 40**
- **power plants w/o CCS: - 60**
- **fossil fuel extraction: - 120**

**Solution n° 6: Building sector: offers many opportunities in energy saving, economic activity, improving wellbeing...**

Trying to practice what I « preach »



Trying to practice what I « preach »



**Solution n° 7: Mobility : much more space and priority to pedestrians, bicycles, and public transport; reduce priority given too long to individual transport in urban planning**

Electrify remaining vehicles (with clean electricity). Fly less, only if essential.

**Solution n° 8: Food and agriculture. A possible change with big positive impact: eat less (red) meat and cheese, of better quality!  
Eat more plant-based food (produced cleanly)<sup>(\*)</sup>**

**...It is good for health as well!**

(\*) See « Beyond-Meat », page 14 of De Tijd, page 13 of L'Écho, 23 November 2018

@JPvanYpersele



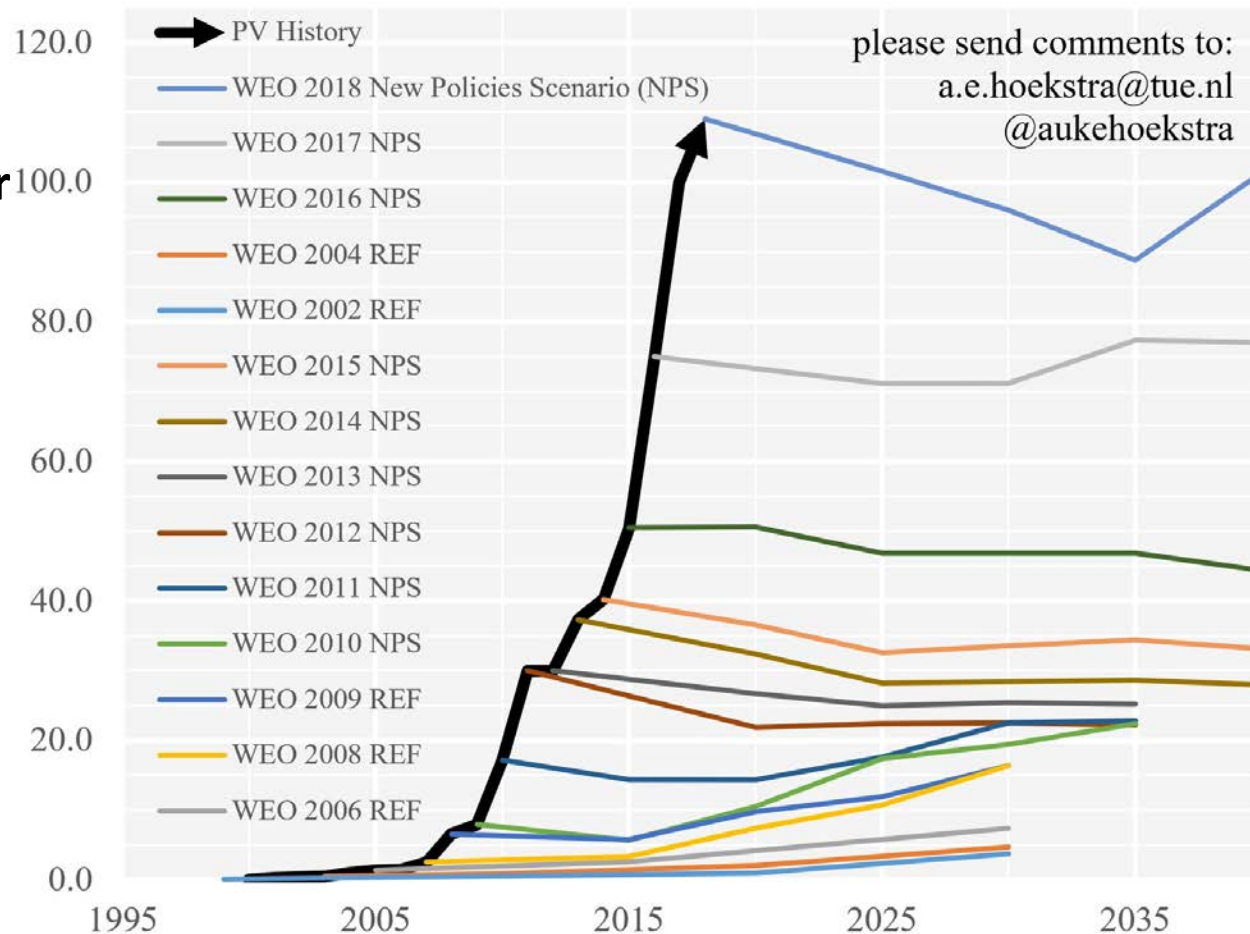
**Solution n° 9: The Sun gives us  
in two hours about as much  
energy as the world uses in *one*  
*year*, all forms of energy  
considered**

The cost of solar kWh is crashing, wind power, heat and electricity storage, and smart grids are moving forward

# The International Energy Agency has missed that point...

Annual PV additions: historic data vs IEA WEO predictions  
In GW of added capacity per year - source International Energy Agency - World Energy Outlook

**GW capacity  
added per year**



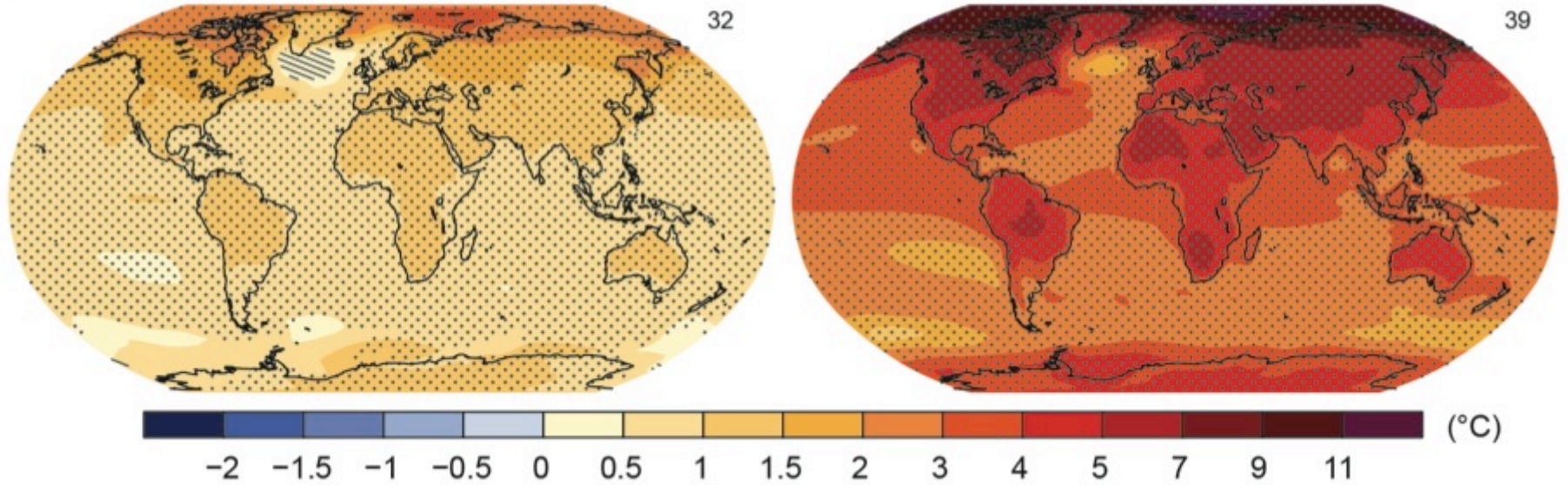
**Solution n° 10: Banks and the  
finance sector increasingly see the  
opportunities in climate-friendly and  
ethical investments promoting the  
17 Sustainable Development Goals**

... but their ethical/green  
investments are still marginal for  
most banks

# RCP2.6

# RCP8.5

Change in average surface temperature (1986–2005 to 2081–2100)



Humanity has the choice



Technology

# Technology alone cannot solve climate crisis, warns ING



Michael Holder

07 December 2018



World set to miss 2030 climate targets as new clean technologies take time to scale, warns ING

Technology could reduce today's global energy-related CO2 emissions by 64 per cent by 2050, but effective policies are urgently needed to ensure unintended climate impacts are avoided, new research by...

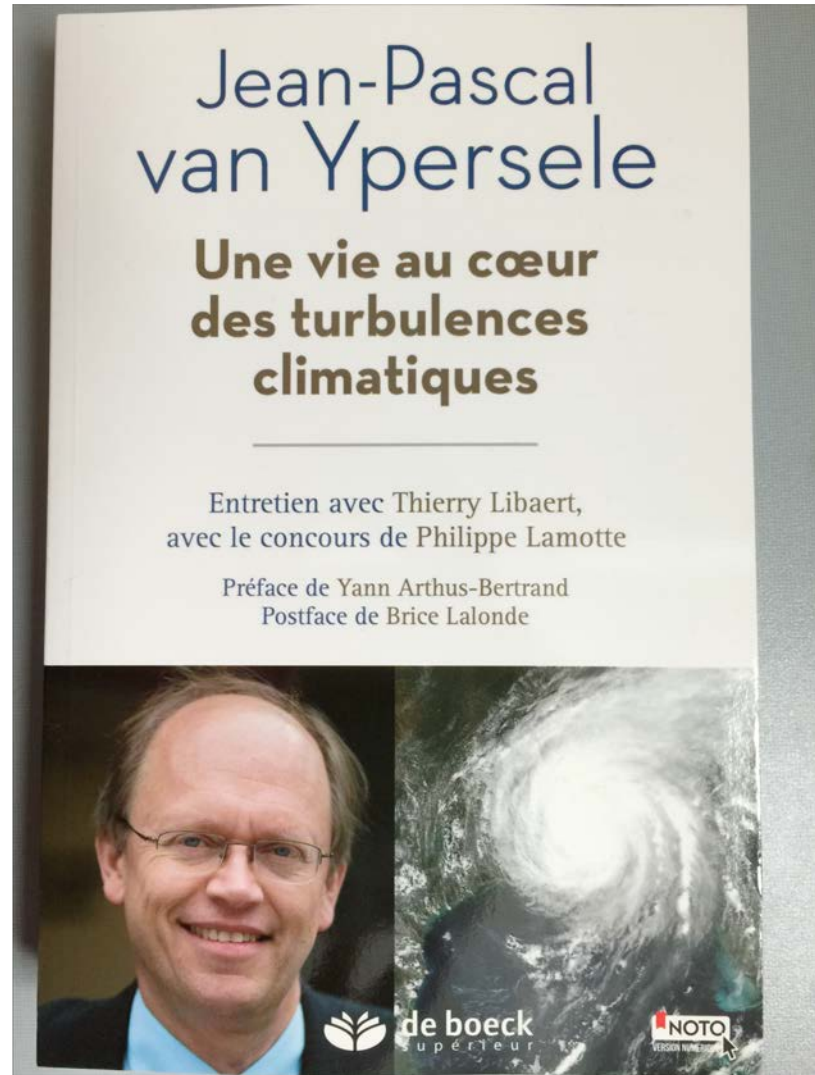
**Pour en savoir plus:**

**Lisez mon livre, où  
j'aborde tous ces sujets**

**Publié chez De Boeck  
supérieur**

**Préface: Yann Arthus-  
Bertrand**

**Postface: Brice Lalonde**



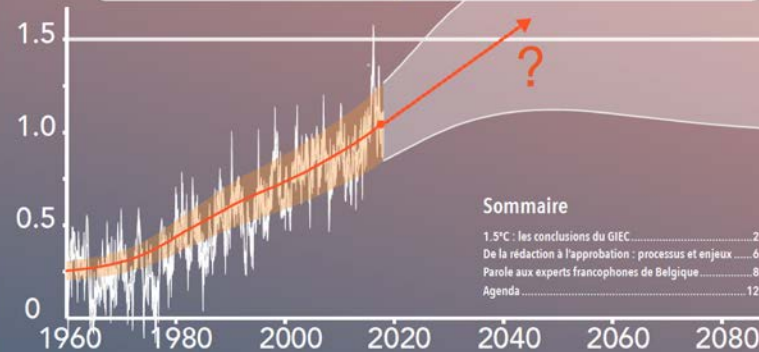


**Bij EPO (2018)**

**Voorwoord:  
Jill Peeters**



## Le rapport spécial du GIEC Réchauffement planétaire de 1.5°C



**P**our de nombreuses populations et écosystèmes, il est essentiel de limiter le réchauffement à 1.5°C ou de ne dépasser ce niveau que temporairement. Et c'est potentiellement encore réalisable. Le 6 octobre 2018, l'Assemblée Plénière du GIEC a adopté le Rapport Spécial sur un « Réchauffement planétaire de 1.5°C », qui fait le point au sujet des impacts et scénarios correspondant à ce niveau de réchauffement.

Ce rapport conclut que pour limiter le réchauffement climatique à 1.5°C, il faut des transformations radicales et rapides dans tous les domaines de notre société. Il précise que ces changements sont sans précédent en termes d'échelle, mais pas nécessairement en termes de rapidité.

L'origine du rapport est une demande formelle au GIEC de la part des Parties à la Convention cadre des Nations Unies sur les changements climatiques (CNUCC) lors de l'adoption de l'Accord de Paris, en 2015 (21<sup>e</sup> Conférence des Parties, COP21). La COP21 avait aussi indiqué que le rapport du GIEC devrait identifier le niveau auquel les émissions mondiales devraient être ramenées en 2030 pour contenir l'élévation de température en-dessous de 1.5°C.

Le rapport a été adopté à l'issue d'une semaine de discussions intenses au sujet de la formulation du Résumé à l'intention des décideurs, sur la base des chapitres et du projet de résumé rédigés par les scientifiques - qui ont toujours le dernier mot en ce qui concerne le contenu. Il forme une base scientifique essentielle pour les prochaines négociations internationales dans le cadre de la CNUCC, qui auront lieu à Katowice (Pologne) en décembre 2018 (COP24).

Dans cette Lettre, nous donnons d'abord un aperçu des conclusions du rapport, ensuite un aperçu du processus d'approbation et des enjeux associés. Pour ouvrir le débat et fournir un ensemble de points de vue, nous avons ensuite donné la parole aux experts francophones de Belgique, qui nous ont aimablement fait part des commentaires que vous trouverez en troisième partie. L'agenda indique les prochaines périodes de relecture de rapports du GIEC et annonce deux événements à venir en Belgique.

Nous vous en souhaitons une bonne lecture,  
Jean-Pascal van Ypersele, Bruna Gaino et Philippe Marbaix

Image de fond : extrait adapté de la figure SPM1 du Rapport spécial





# 'Sauver le climat' : les bases

Écrit pour les jeunes (et moins jeunes), avec des liens vers des ressources utiles



*Suite à l'intense mobilisation des jeunes, les changements climatiques ont fait l'objet de beaucoup d'attention au cours des derniers mois. Éléves du secondaire, étudiants, professeurs, parents et grand-parents sont descendus dans la rue pour montrer leur désarroi face à la lenteur de l'action vis-à-vis des changements climatiques.*

*Nous nous réjouissons de cette mobilisation, car notre rôle nous met encore plus fréquemment que l'ensemble de la population en position de témoin des risques que font courir les changements climatiques, ainsi que de l'ampleur des efforts nécessaires pour mettre en œuvre les objectifs qui se sont fixés les membres des Nations Unies à Paris en 2015 (COP21).*

*Une démarche essentielle en faveur de ces jeunes est de les aider à se former, à appréhender les principaux éléments de la problématique du climat, et plus largement, de l'influence de nos activités sur notre environnement et sur le futur de l'humanité. L'éducation est un des instruments essentiels pour évoluer vers une société plus durable et plus juste.*

*Pour y contribuer, nous présentons ici une brève synthèse de la problématique et une sélection de références commentées. Nous espérons que cette Lettre aidera enseignants et élèves à disposer d'une base d'information solide et ainsi à prendre leur part dans la solution à ce problème planétaire : agir à leur niveau et favoriser l'action dans leur entourage et au niveau sociétal.*

*Plusieurs témoignages d'élèves ou de professeurs sont également présentés.*

*Nous vous souhaitons une bonne lecture !*

Jean-Pascal van Ypersele, Philippe Marbaix et Bruna Gaino

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This gives me  
hope:

Well-  
informed  
young people  
speaking  
truth to  
power



With @GretaThunberg at COP24





Joel Pett, USA Today

# To go further :

- [www.climate.be/vanyp](http://www.climate.be/vanyp) : my slides (under « conferences)
- [www.ipcc.ch](http://www.ipcc.ch) : IPCC
- [www.skepticalscience.com](http://www.skepticalscience.com) : answers to the merchants of doubt arguments
- [www.wechangeforlife.org](http://www.wechangeforlife.org) : 250 Belgians experts speak on climate & biodiversity
- [www.plateforme-wallonne-giec.be](http://www.plateforme-wallonne-giec.be) : IPCC-related in French, Newsletter, latest on SR15, basic climate science
- **Twitter: @JPvanYpersele & @IPCC\_CH**

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