



Teaching climate change for responsible individuals and pro-active companies

Arnaud Delebarre, May 2021

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Arnaud Delebarre, 2021



To teach or not to teach ?

1. Teaching may be a mean to avoid being proactive:

Teaching used to pretend acting

Teaching used to procrastinate

Teaching used to give the burden to future generation

Teaching used to denounce the wrong man

2. Pedagogy as a method for non-participative management

Managers and decision makers may argue a misunderstanding due to a lack of pedagogy instead of recognize a disagreement

Teaching climate change ?

Need of Teaching:

Climate change kinetics: reality vs feeling

Surveys vs actual threats and actual carbon footprints

Individual and collective actions to meet the 2015 objectives

Teaching: To whom ?

Pupils ? Students ? Milleniums ? Boomers ? Decision Makers ?

Teaching: What ?

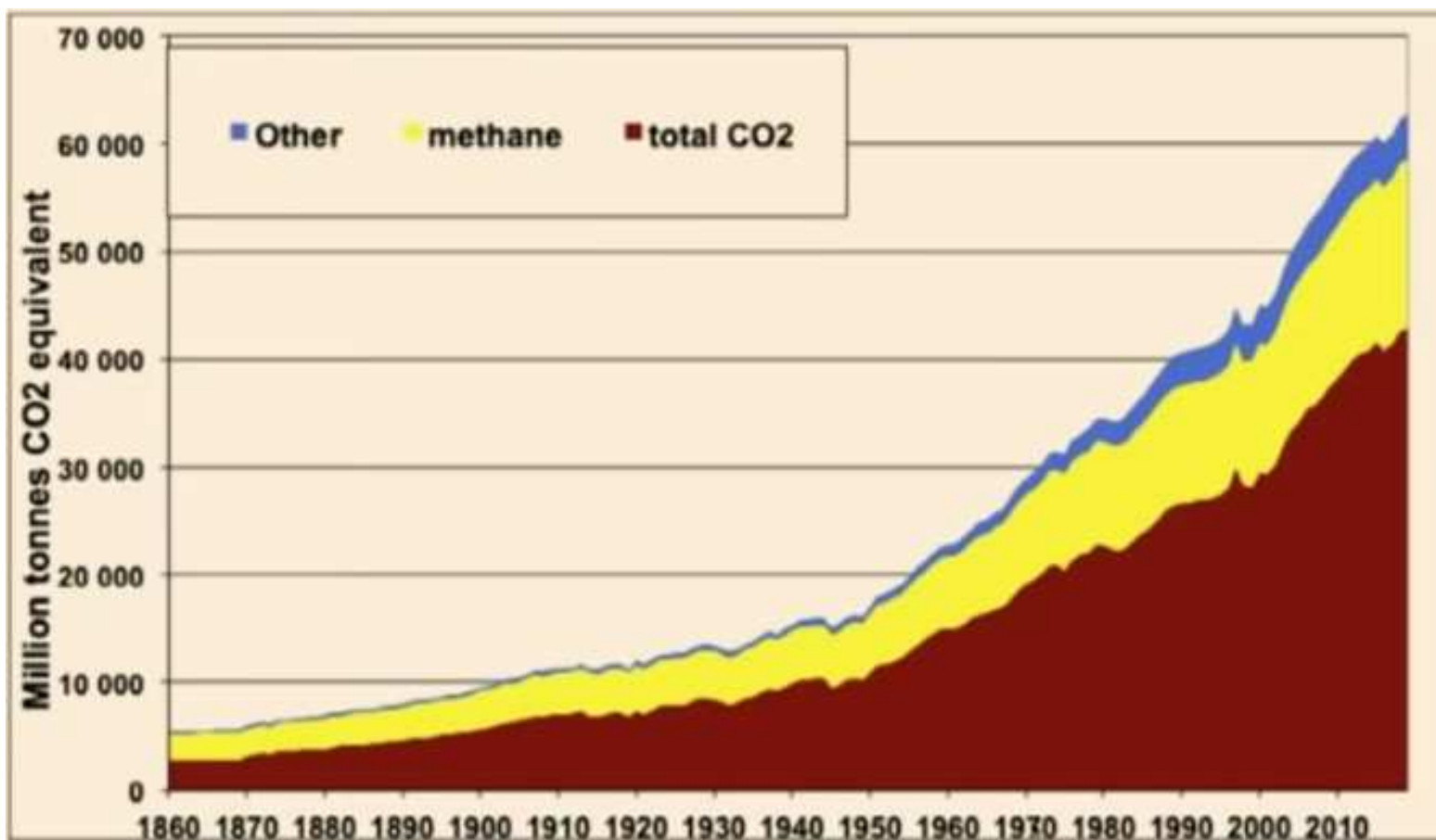
Data on Energy and Climate. Indicators. Impact of Actions.
Project Management and Controversy Analysis

Teaching: How ?

Hands-on learning - MOOC - Field Experience - Auto-evaluation

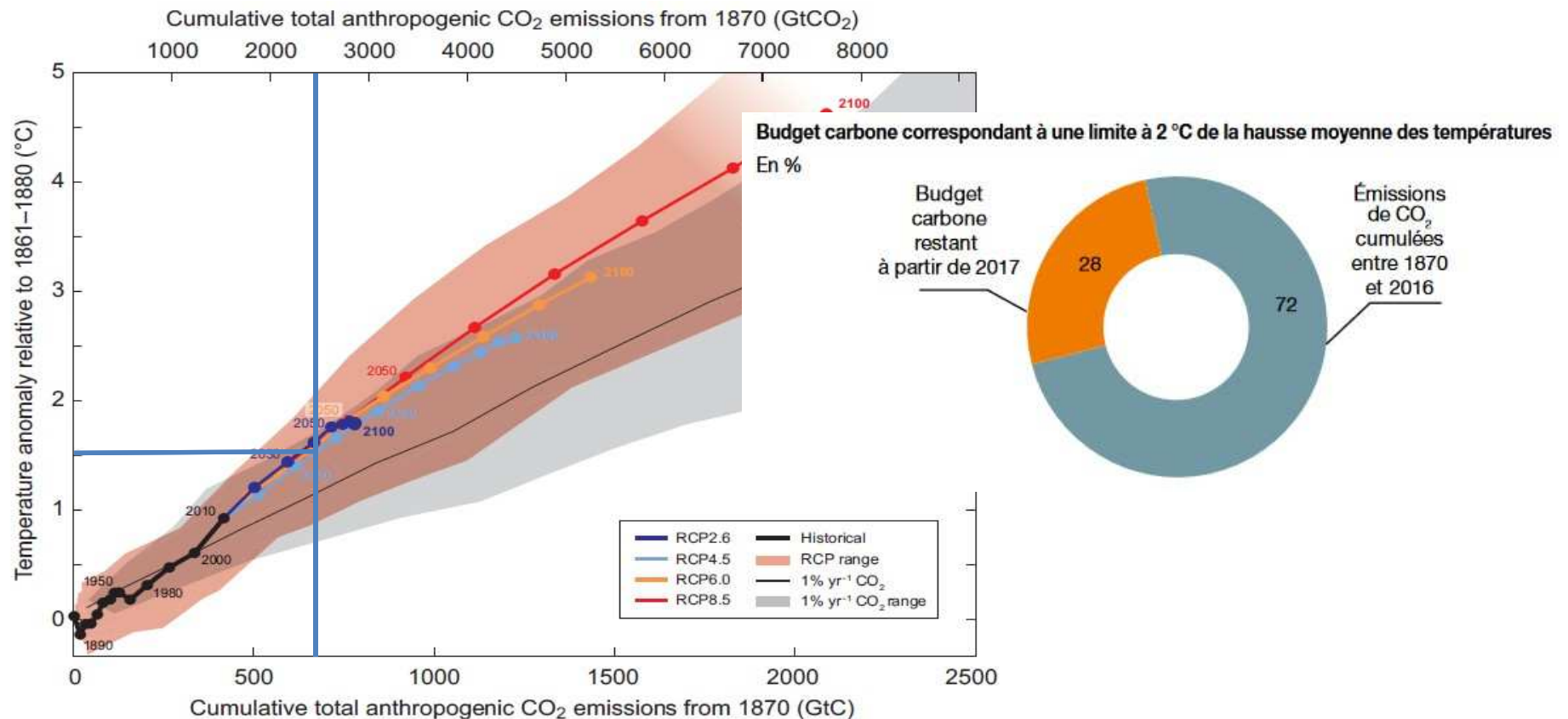
Neither new methods, nor new processes nor consumption sobriety, nor digitalisation seem able to inhibit GHG emissions

Did education have or may have any influence on this curve or its evolution ?



Is the Carbon budget compatible with education kinetics ?

- From one side : the classical lullaby: grown-up take care of their children
- But kinetics of climate change implies of acting faster to adopt a sustainable "Representative Concentration Pathway (RCP)



Surveys about Climate Change Perceptions and Actions

- 23 % of French do not "believe" in the warming"
- 36 % of the 18-24 year French individuals
- 48 % think it is too late to invert the trend
- 62% regulation constrain is the only solution
- Individual actions that they would accept:
 - 61% would prioritize local products
 - 51% buy less with a better quality, adopt recycle and exchange
 - 27% buy less electronic devices ; train instead of plane for long distance

	% D'accord	Sexe		Âge					CSP		
		Homme	Femme	18-24 ans	25-34 ans	35-49 ans	50-64 ans	65 ans et plus	CSP +	CSP -	Inactif
Seule la contrainte législative est efficace pour réussir la transition énergétique et obliger tout le monde à changer ses habitudes de consommation	62%	60%	63%	64%	64%	62%	58%	61%	62%	63%	63%
Je pense qu'il est aujourd'hui trop tard pour inverser le cours du réchauffement climatique	48%	48%	47%	47%	53%	51%	45%	43%	44%	57%	43%
Je ne crois pas au réchauffement climatique	23%	26%	21%	36%	28%	20%	21%	20%	24%	25%	22%

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Is the Carbon budget compatible with education kinetics ?

Kinetics of the teaching vs role or fate of the learners

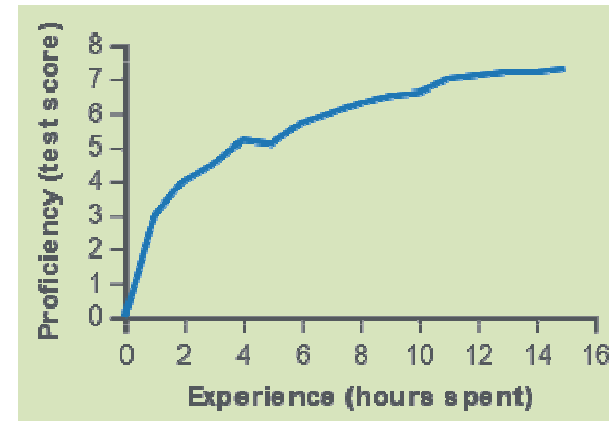
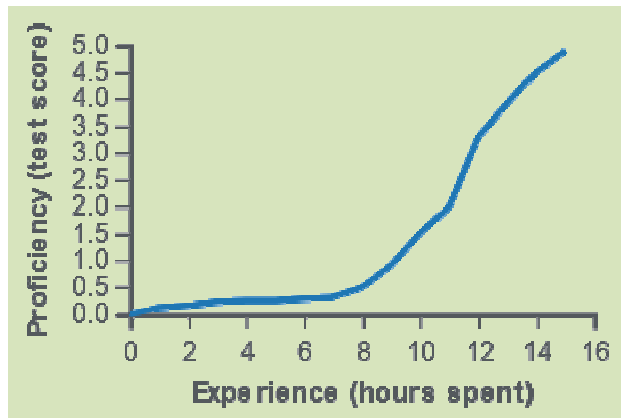
Teaching to individuals being already in decision making positions

Teaching to generations that will be in position in a rather far future

Teaching to young generation who then will educate their parents or teaching to teachers to accelerate the process

"Quand on devient parent, notre conscience écologique s'aiguise. Puis, les enfants deviennent à leur tour des ambassadeurs de l'écologie [...] ce sont eux qui font [alors] la leçon." N. Vallaud-Belkacem (April 2021)

The rate at which trainees learn a new skill ! Provided they learn !



Being against activists to procrastinate a bit more ?

Examples of opinion leaders: Alain Finkielkraut "*refuses to kneel before Greta Thunberg*". Even, she is only asking to read IPCC reports.

Gretaphobia/Youthphobia because they question and criticize our behaviour



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Alain Finkielkraut, France Inter, 9/2019. Watrelot, AOC, 8/2019

Teaching the pointed guilty population fraction ?

Local 2021 regional elections campaign: any correlation between individual carbon footprint and his/her carbon LCA and its vote ?

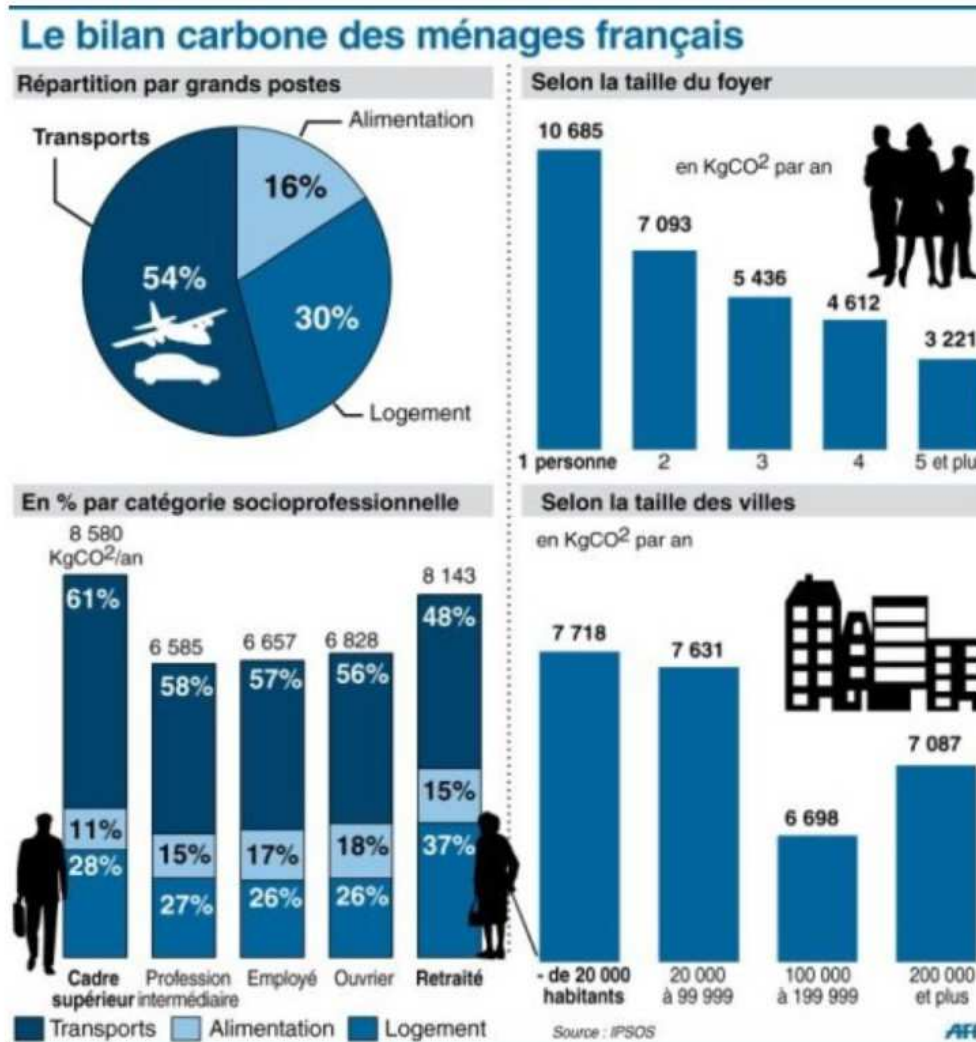


Teaching to the most emitting fraction of population ?

Youngest French: 8.4 tCO₂e/year : single, mobile...

Oldest French: 9 tCO₂e/year live in large house, use plane

35 - 44 year old: 6 tCO₂e/year



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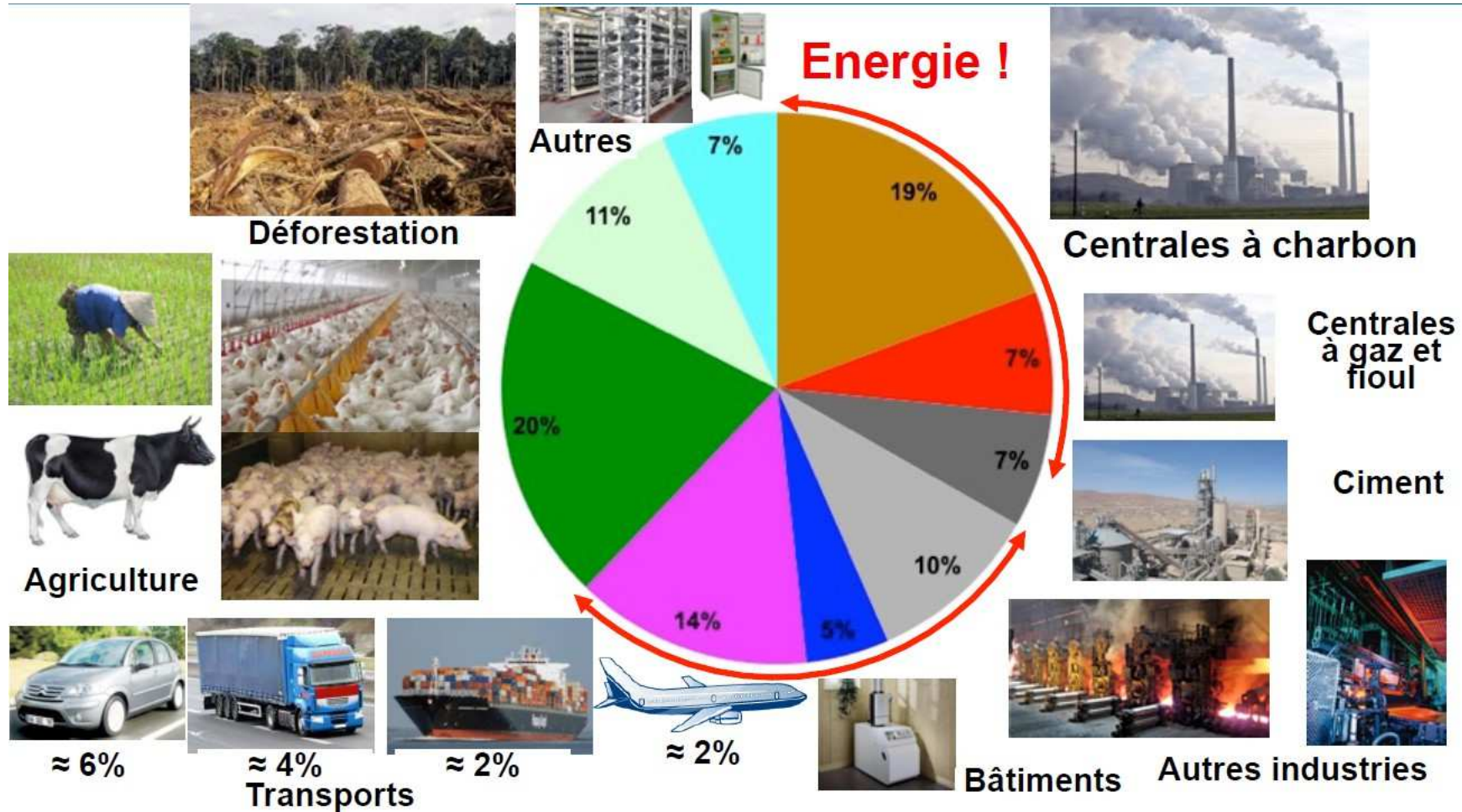
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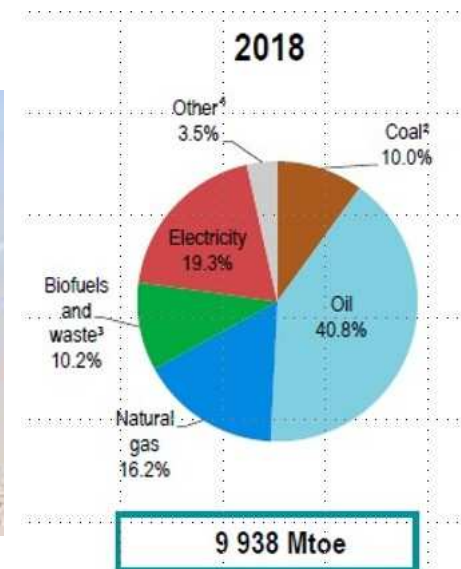
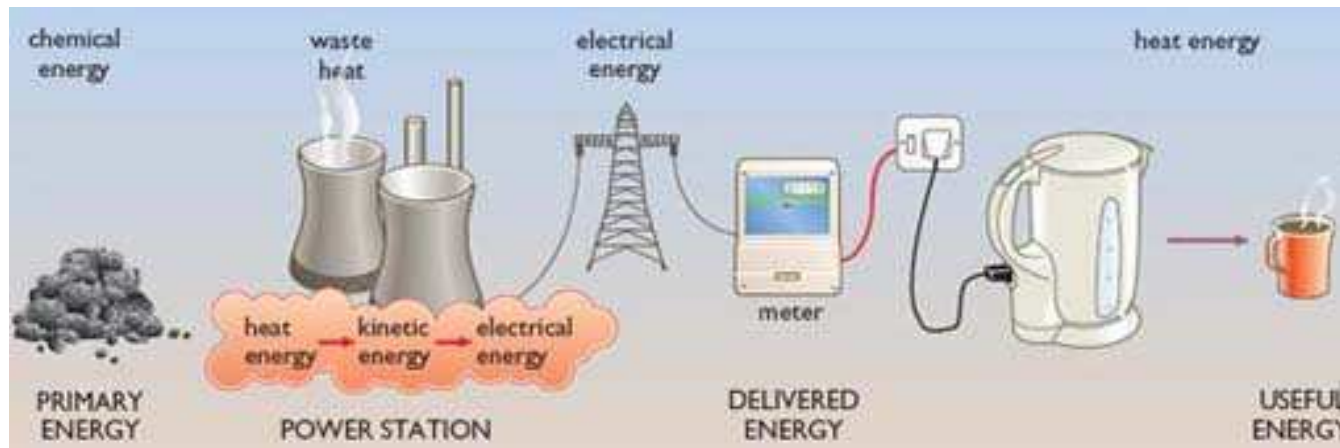
Data on sources of Greenhouse Gas (GHG) emissions

- Annual worldwide GHG emissions 2019: 60 Gigatonnes CO₂eq
 - Energy: 19%+7%+(40% of 7%)+10%+5%+14% = 58%
 - Food: 20%+11% = 31 %



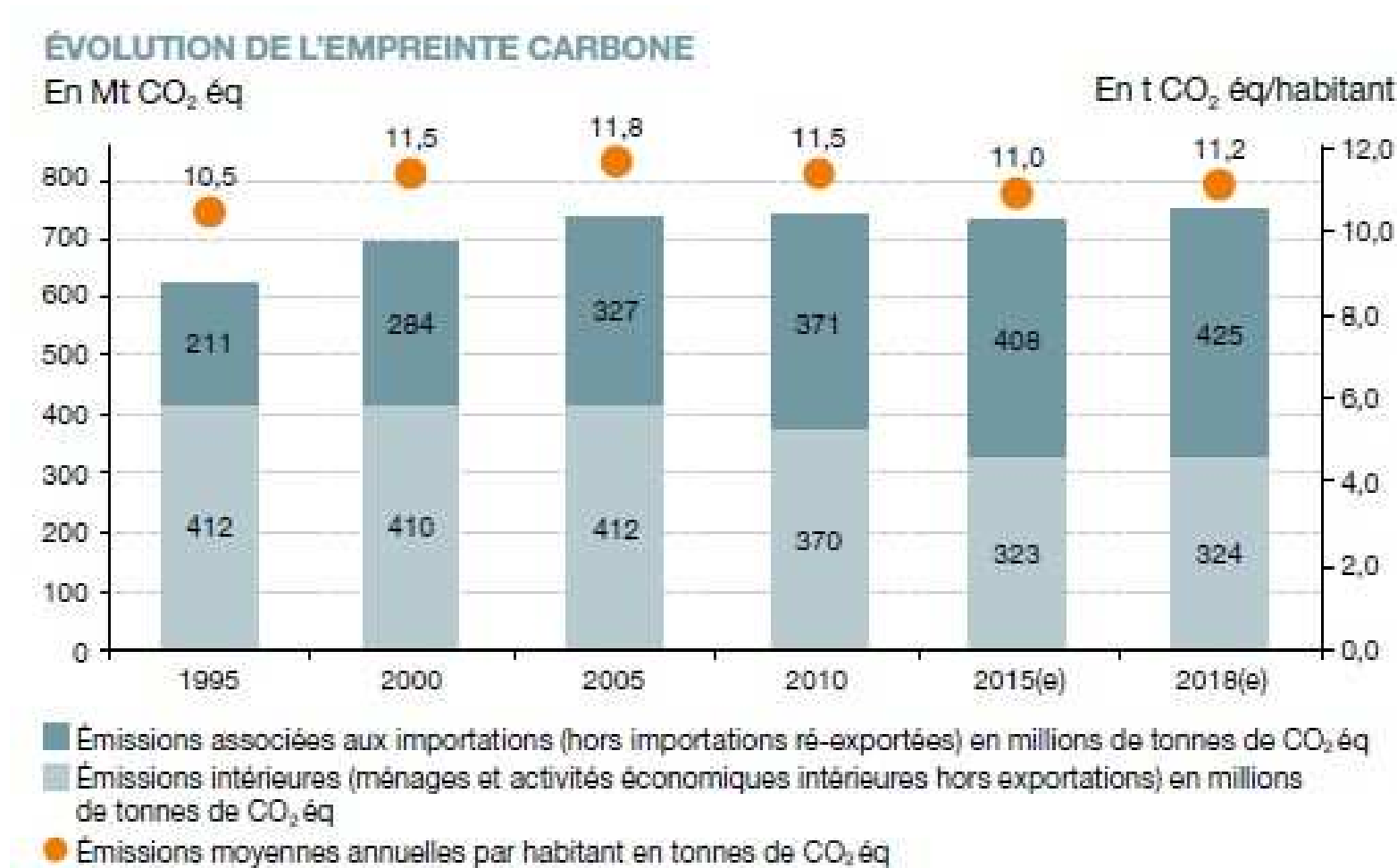
Primary Energy and Useful Energy and their data

- A lot of ignorance about the difference between primary, consumed and useful energy
- Confusion between electricity and energy and their respective shares in the world and in countries
- Low knowledge of energy units: e.g. t.o.e. and kWh



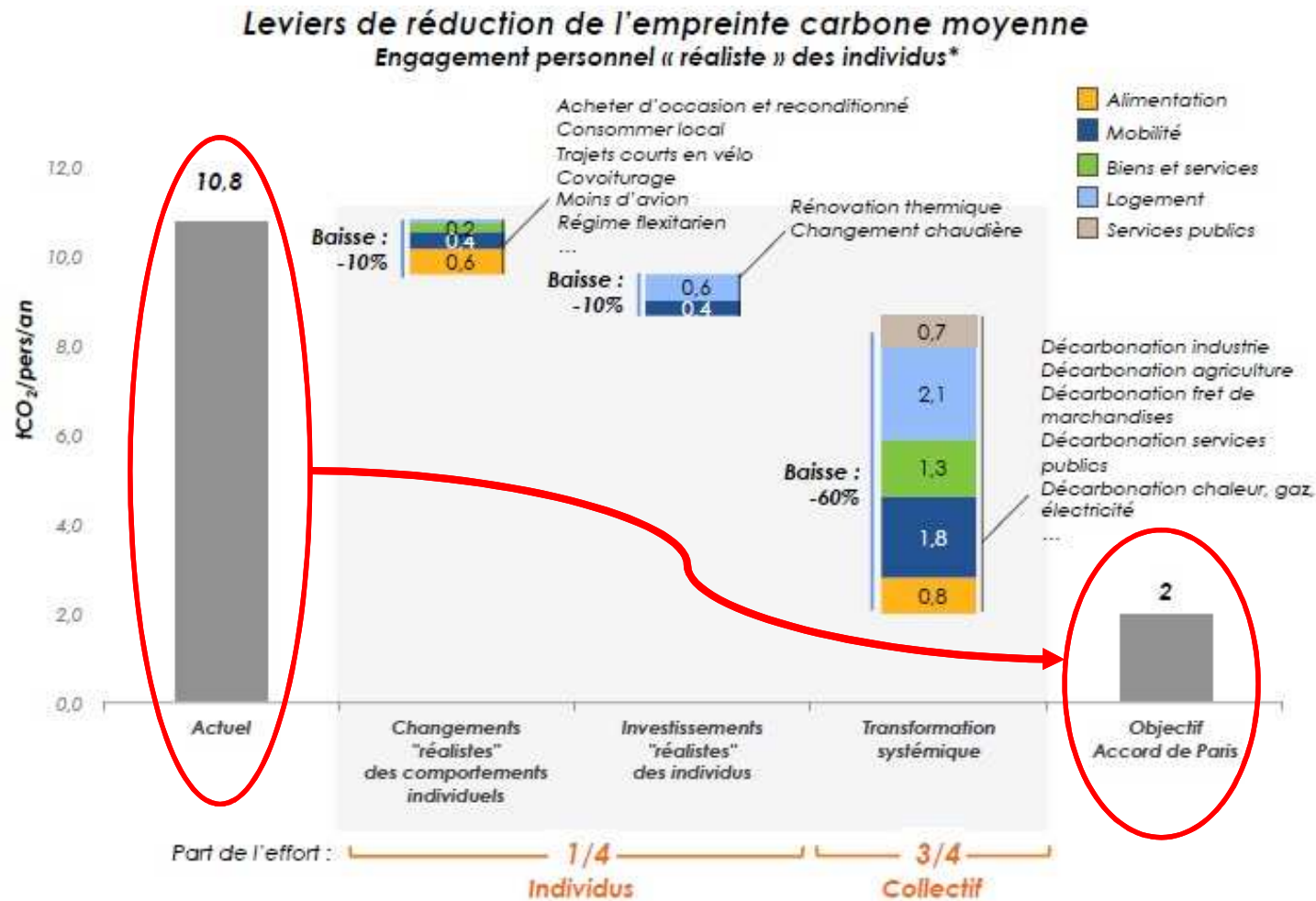
Teaching indicators: GES Inventory and Individual Footprint

National inventory and footprint accounting for imports, inventory per capita. Calculate your own carbon footprint at least every year.



Teaching for Individual and Collective contributions

- Teaching actions to meet Paris agreement. Example with a modest individual effort :
 - 10% individual way of life ; -10% home renovation ; -60% companies & organizations



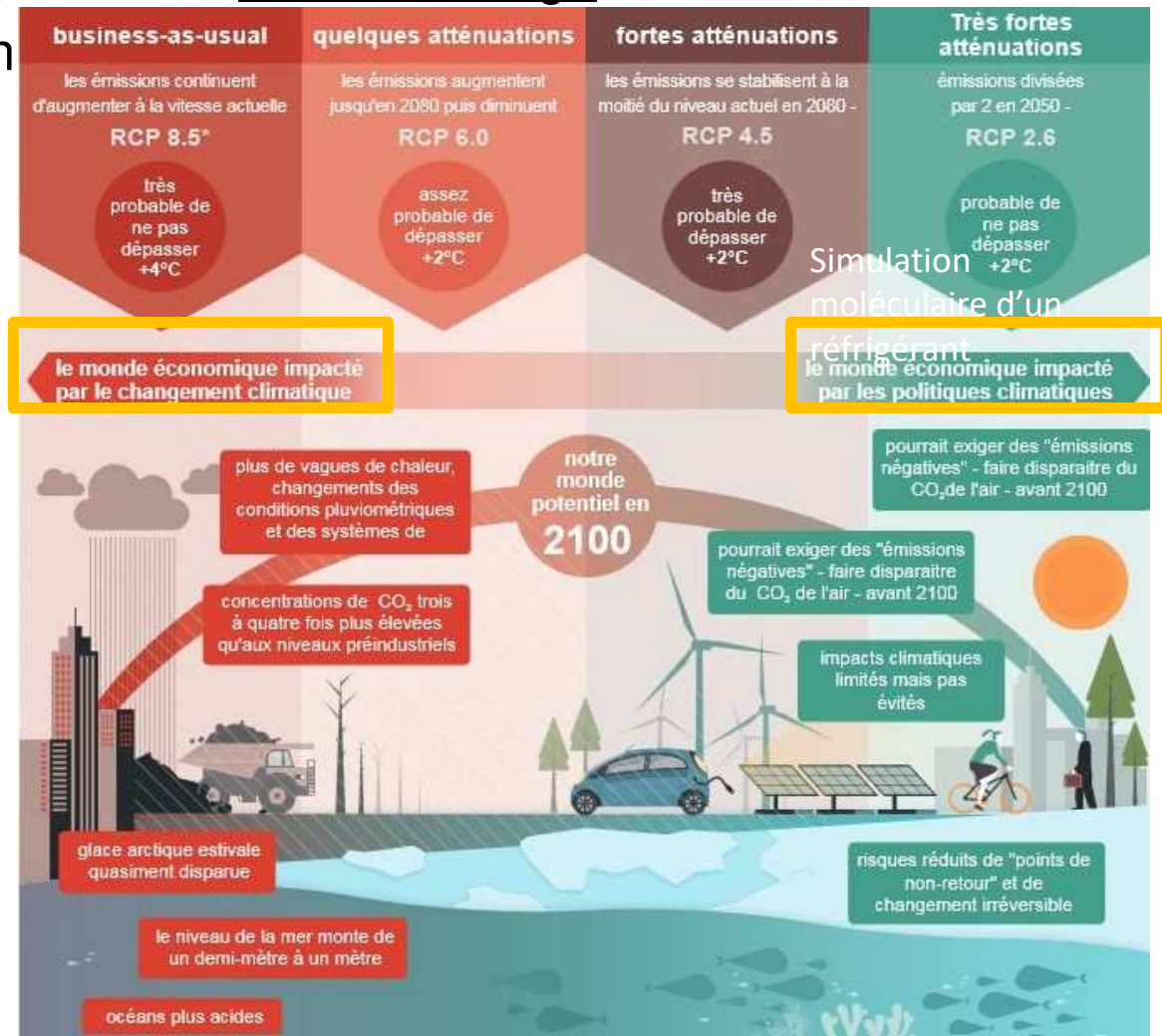
Teaching: Physical Risks vs Transition Risks

To teach a minimal culture to balance impacts of decisions of changes of climate policies vs of changes due to climate change ?

Physical risks and transition risks evolve in opposite direction

Less emissive scenario = more rapid societal changes and greater transition risks

More emissive scenario = less restrictive in short term but final addition is higher. "A world at +4°C is not insurable" Axa, 2017



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Teaching and Training Students around the World

- Ateliers AIR (Workshops to Invent a Responsible Future) held at ESSTIN, Engineer School, France:
 - Inviting 3 to 4 Right Livelihood Award Laureates (Alternative Nobel Prize), granted to have developed projects and solutions in a difficult context
 - Animating projects to demonstrate to students how to develop global issues and innovating solutions, and developing social responsibility of students
 - 3 days for 150 student promotion in groups with one RLA Laureate
 - Interviews of students: said they appreciated these opening mind trainings that allow to consider the scientific news from another angle.



- Study a Controversy in Energy and Environment:
 - 30 years ago, MINES Paris proposed the controversy to the students
 - Then exported in some Mastères in Environment
 - Exported in SPEIT, engineer school created by Polytechnique, ENSTA, Telecom and MINES ParisTech to train chinese students "*à la française*"

The objective is not the solving of the controversy but to understand complexity with tools such as documentation, stakeholder identification, mapping interactions between them, identify knots of the controversy

Additional expected skills brought by controversy study:

- To learn by using some project management tools such as the reporting, the planning, team organization, the brain storming
- How to reference documentations in a report by attending part of a self paced MOOC produced by Polytechnique
- To carry out semi-oriented interview methods
- To evaluate the grey part of a project onwards its scientific aspects and understand the gap between a decision, a hierarchical instruction and an influence

Some of the controversies chosen in China and in France

- **Examples of Controversies in Energy and Environment chosen by Chinese students of SPEIT since 2017:**
 - Taishan Nuclear EPR Power Project
 - Does Electrical Vehicle satisfy the Chinese Market ?
 - Are OFO bicycles really environmentally friendly ?
 - Liuwan: A Technical Industrial Landfill Project to get rid of ?
 - L'acier de Tangshan est-il le Bon, la Brute ou le Truand ?
 - La voiture électrique en Chine, pas si propre ?

PLANNING DES SOUTENANCES MINES ParisTech - le 1er février 2018, salle L106



Matin :

10 h 00 - 10 h 30

Tristes mines au pays des menhirs (Bretagne)
Controverse autour des permis de recherches minières accordés en Bretagne
Leonore Charpentier, Goetan Piegay, Jean Baptiste Le Menn

10 h 30 - 11 h

Quand la terre est un trésor : Le Pays Basque à l'épreuve des mines d'or
Lorsqu'une entreprise veut chercher de l'or dans l'arrière pays Basque, la contestation ne se fait pas attendre
Jean Aubusson, Margot Defoort Levkov, Benny Mandhub

11 h 00 - 11 h 30

Centrale de Gardanne : transition énergétique ou biomascarade ? (Bouches-du-Rhône)
Controverse autour de la conversion d'une centrale thermique du charbon vers la biomasse
Julien Bouyssou, Manon Rouleau, Benjamin Karas

11 h 30 - 12 h 00 :

Bacchus ou Eole, enquête à Irancy (Yonne)
Eoliennes contre patrimoine viticole et paysager
Yannis Caubet, Patrick Foltzenlogel, Julie Ginesty

12 h 00 - 12 h 30 :

L'A45 tient elle vraiment la route ? (Loire, Rhone)
Chocs et intérêts contradictoires entre les métropoles de Lyon et St Etienne sur la réalisation de l'A45
Marie Alzon, Emmanuel Large, Clémence Lestra, Kim Nguyen

Après-midi :

14 h 00 - 14 h 30:

Quand Rouen drague la Normandie (Calvados)
L'immersion des boues du port de Rouen au large de Deauville crée la polémique
Caralie Alazet, Romain Badie, Hamza Hennani

14 h 30 - 15 h 00 :

Modernisation du centre de traitement des déchets de Romainville
un projet à jeter à la Poubelle ? (Seine St Denis)
Pas de consensus sur le traitement local des déchets à Romainville
Alice Abbat, Valentin Bouteiller, Charlotte Haguenaer

15 h 00 - 15 h 30 :

Usine toxique ? Montreuil en panique ! (Seine St Denis)
Les tensions s'exacerbent entre parents d'élèves et l'usine de traitement des métaux SNEM de Montreuil suite à l'apparition de cas de leucémies chez des enfants fréquentant les écoles voisines de l'usine
Maxime Chiffolleau, Chloé Le Baron, Julie Olivier

15 h 30 - 16 h 00 :

Haro sur le phyto : Une tempête pour un verre d'eau ? (Vieux Manoir, Seine-Maritime)
La construction d'une super plateforme logistique de produits phytosanitaires sur une nappe phréatique alimentant l'agglomération Rouennaise suscite la colère des habitants.
Quentin Levy Abegnoli, Juliette Nicolas, Perrine Quesnoit



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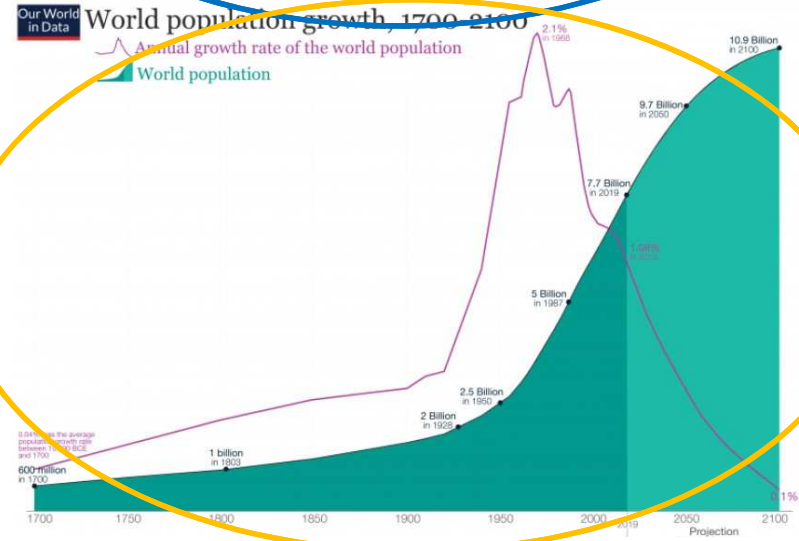
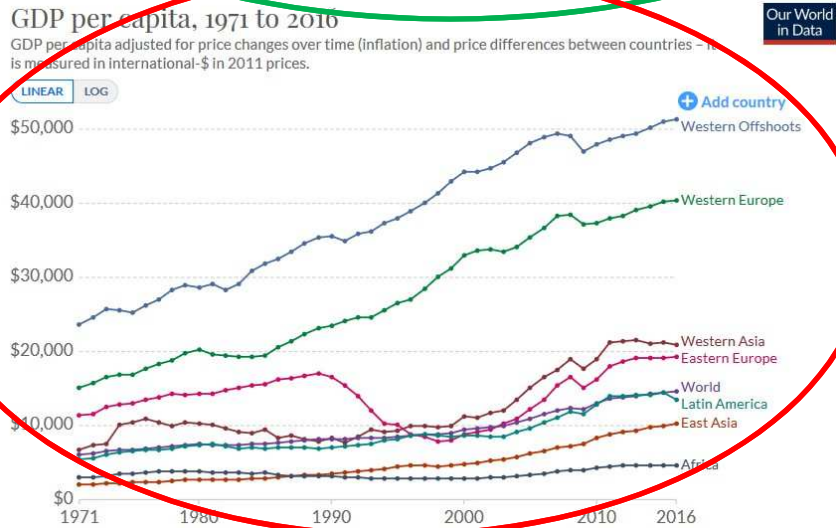
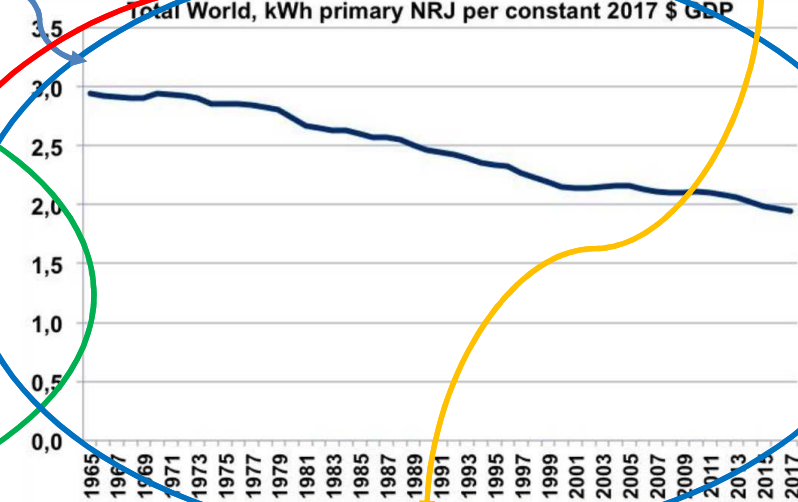
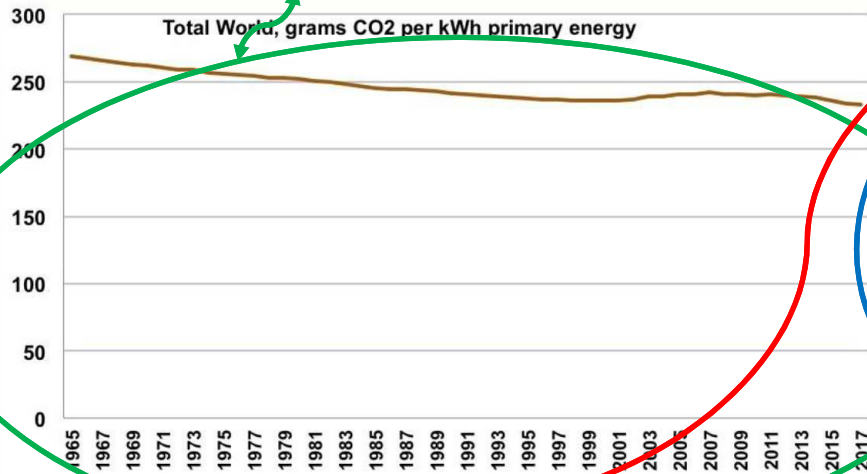
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Conclusion: Influence of Teaching on Kaya's relationship parameters

$$CO_2 = [CO_2/energy] * [Energy/wealth] * [wealth/capita] * [Population]$$

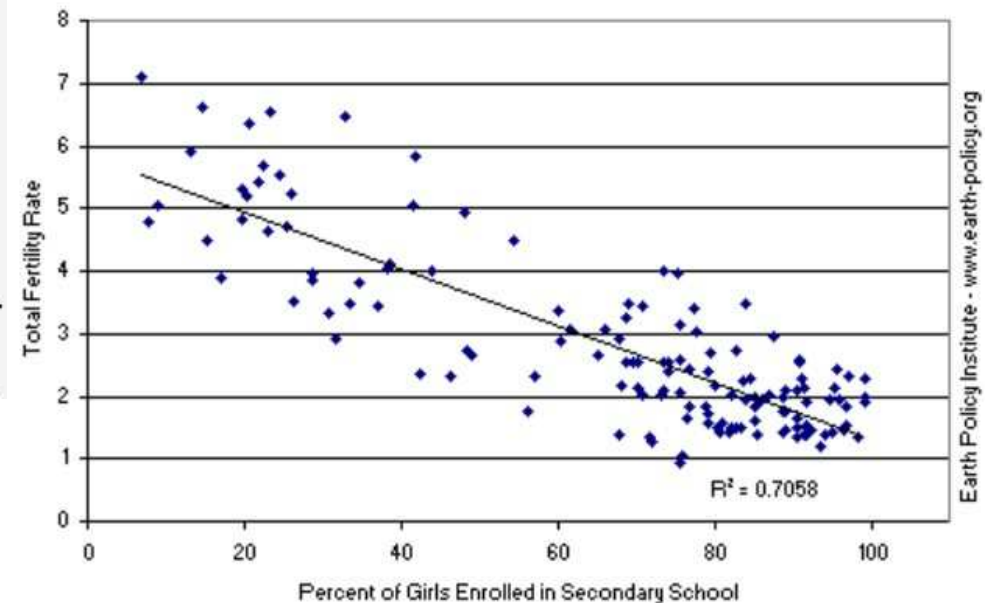
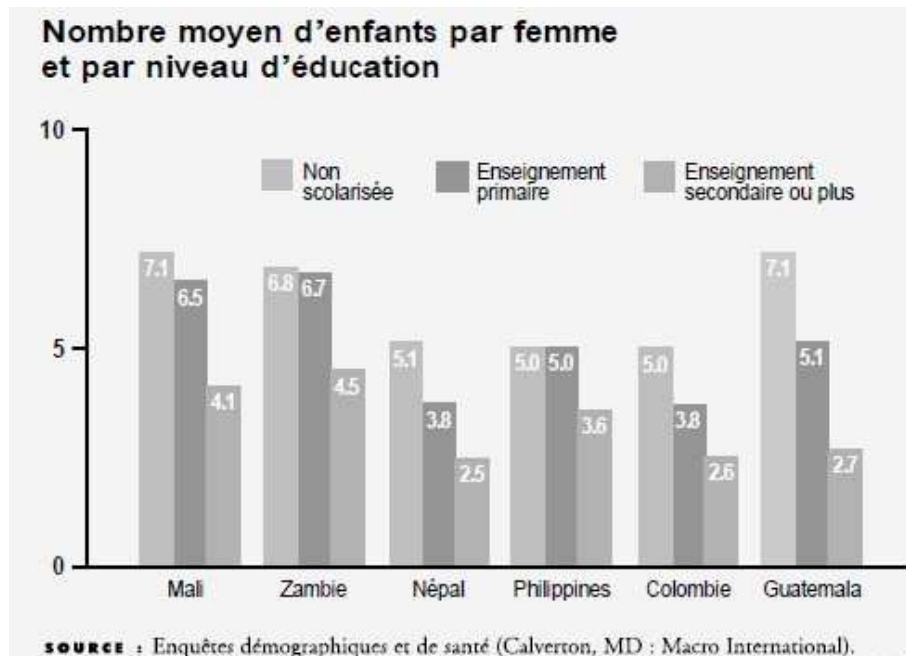


Conclusion 1: Education is the best contraceptive method

Teaching may control the parameter [Population] of Kaya's equation

The Guardian, July 2017: Want to fight climate change? Have fewer children

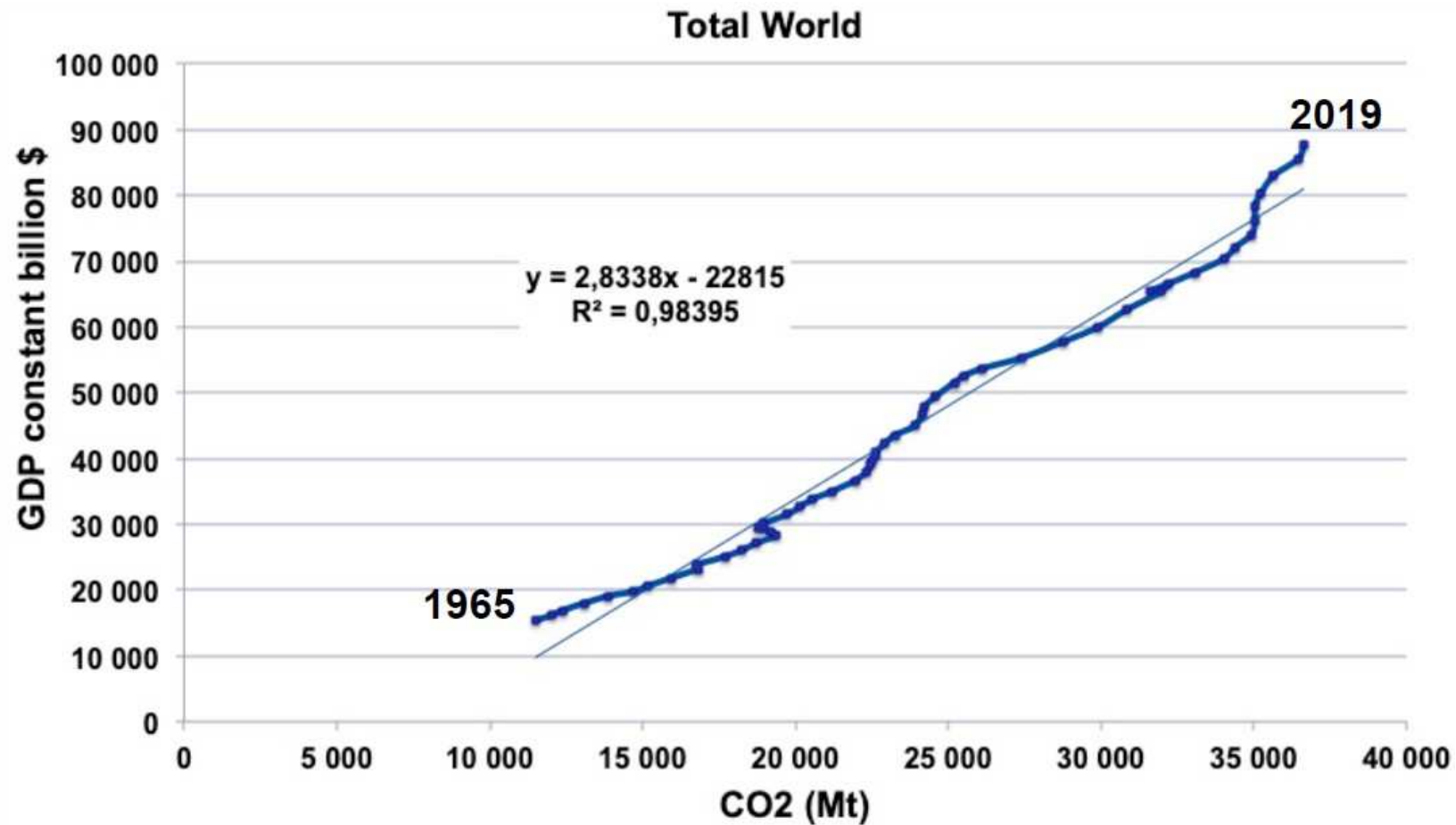
After Wynes, 2017: One fewer children avoids 58.6 tonne CO₂eq/year vs 2.6 for living car free



Conclusion 2: Teaching decision-makers relation GDP vs CO2

Jancovici advises 20 hour training to executives to learn the relation between CO2 and GDP and fundamentals of climate change

Id est: the two first terms of Kaya's equation $[\text{CO}_2/\text{Energy}] * [\text{Energy}/\text{wealth}] = \text{CO}_2/\text{wealth}$



Last word: Teaching processes producing less CO₂ per energy

Training engineers to design processes emitting less CO₂ in the atmosphere by Energy unit. Example of CCS which is at present 0.1% of CO₂ emissions

Id est: the first term of Kaya's equation [CO₂/Energy]

Jevons paradox: if you divide gasoline/100km by 2, will you spend 2 times less or will drive 2 times more km ?

