Changing Climate Change

Global Climate Tax

NOW

Disrupting Climate Change

Foreword

Climate change is here. The science is clear: we are heading for disaster.

For reasons not always easy to understand, politicians/politics is either unwilling or unable to face the challenge, let alone finding meaningful solutions.

The discussion often turns in endless circles: preventing climate change yes, but… The economy. It is too expensive. Consumers don't want to change: inactivity can be explained, partially, with wrong perceptions and insufficient information.

The global climate youth movement has, in very short time, altered the public agenda and the urgency around climate change.

The climate youth is calling for net zero emissions by 2030 considering the science, a very realistic demand. The net-zero-target has been the basis for this report: is that target realistic, and how can it be achieved without negatively affecting the economy, or financially hurting the lower income segments of the population.

A global climate tax on all GHG gases and substances, fiscally neutral redistributed amongst the citizens and invested in building a clean renewable energy infrastructure not negatively affect the economy. The cash-back and the investments are stimulating the economy, while the higher efficiency of electric vs fossil applications will lower the global energy cost.

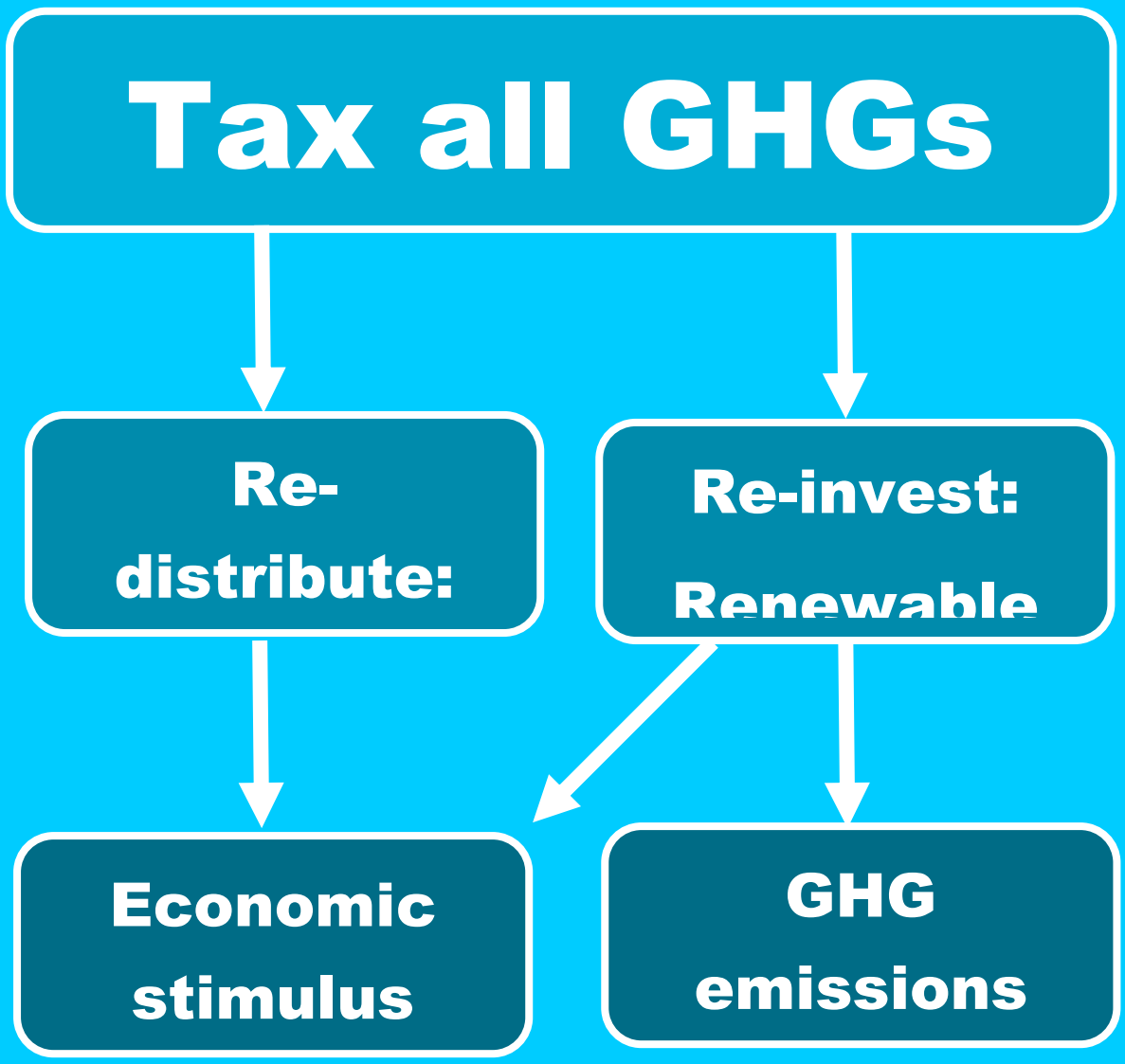
Every economics student knows – the economics of climate change is really simple: just add a price.

A global climate tax is a solution that could actually work.

The youth climate youth movement is an actor that could make change happen. Politicians seem yet unable to realise the determination of that movement: it is meaning business. While older generations might still have the - probably wishful - thinking that climate change will not really affect their lifestyles, for the younger generations, this is about survival. They won't go away.

Global Climate Tax

NOW!


Tax all GHGs
Re-distribute:
Re-invest: Renewable
Economic stimulus
GHG emissions

1 Teaser

1 - Tax

Everywhere:

We tax GHG emissions.

We'll put a climate tax on coal, oil, gas and every other substance affecting the climate system. Just like a VAT.

We'll start at U$ 50 per ton of CO_2, increasing by 50U$ every year. At the he same rate, in every country, all around the World.

2 - Receive Back

Don't worry. You'll get your

Cash back.

50% of the climate tax revenues are paid back to the people. In cash. You'll have more money in your hands than before.

We'll invest in

Renewable energy

50% of the tax revenues invested in renewable energy will replace all fossil fuel by 2050

3 - Enjoy

We will be at

Zero GHG by 2035

Thanks to the massive tax-generated investment, all fossil energy is replaced by renewables by 2035

We'll pay less for the bill

Cheaper energy

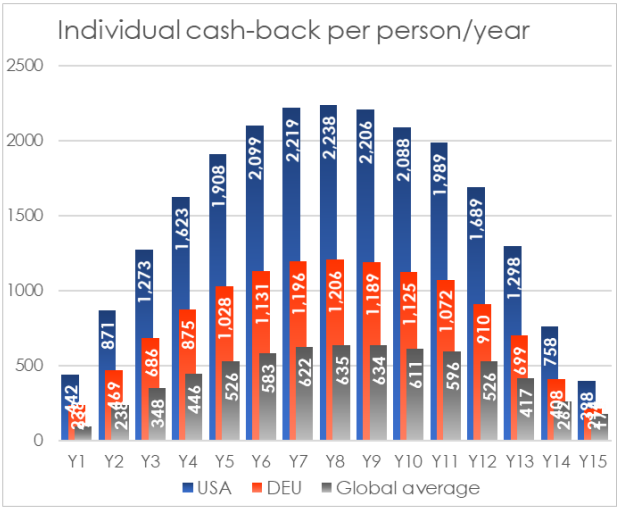
Thanks to lower cost and higher efficiency of electricity, global energy cost will be reduced by nearly 50%

Yes, you'll have to pay a bit more…

Year	Year 1	Year 2	Year 4	Year 10
Climate tax (U$ per ton CO2 equivalent)	50	100	200	500
Electricity generated from coal (U$/kWh)	0.01	0.03	0.06	0.14
Gasoline (U$/gallon)	0.14	0.28	0.56	1.39
Air transport cost increase (%)	2%	4%	7%	18%
Beef cost (U$/kg)	0.69	1.38	2.76	6.9
Milk cost (U$/ltr)	0.02	0.05	0.09	0.23

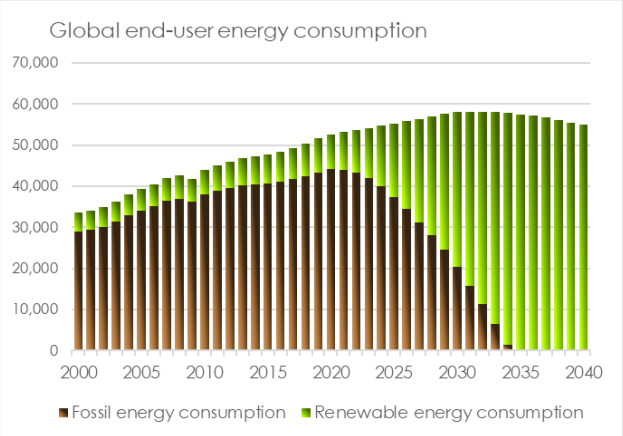
Yes, some things will get more expensive. Gasoline for example. But chances are you'll be driving an electric pick-up in 10 years time – powered cheaper that today's gasoline

…but you get plenty of cash, too



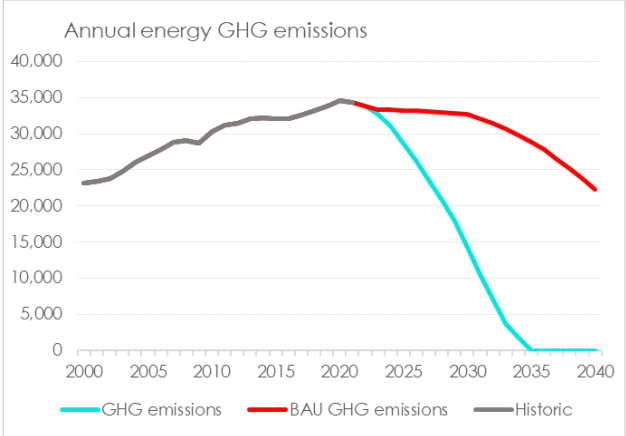
Every single person receives more than U$ 7'000 over 15 years. EVERYBODY. If you are American, you'll receive between 500 and 2'200 dollars each year - and more than 23'000 in total.

Tax revenues build renewables



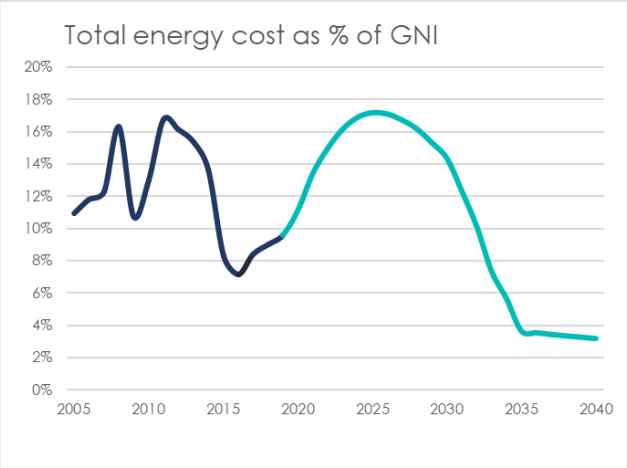
Half the climate tax is used to build a renewable energy infrastructure. By year 15 (2035), there will be sufficient renewable energy to replace all Co2-emitting fossil fuels: gasoline, coal, natural gas.

Zero CO2 emissions by 2035



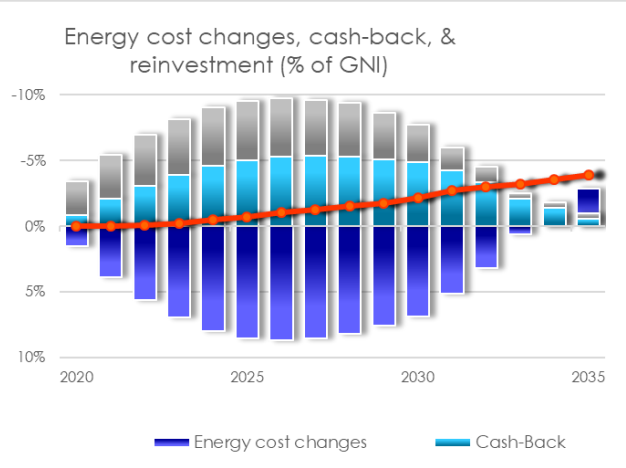
By 2035, there is enough renewable energy to replace all fossil fuels. There will be no – ZERO - GHG emissions from energy after 2035.

Cost goes up – but then way down



Global energy cost will initially rise. Yes. But not above levels seen as recently as 2008 and 2010. And after the transition period, global energy cost will be much lower than today.

Economy: positive net-impact



Rising fossil energy cost are offset through cheaper renewable energy, and the cash-back that stimulates the economy. The net impact on the global economy will be positive as early as Year 3 of the global climate tax.

2 Executive Summary

2.1 The climate tax statement:

1. All GHG gases & substances are taxed

2. The tax is levied EVERYHWERE, globally, at the same rate per ton of CO_2 equivalent

3. The tax is gradually introduced, starting at 50 U$ per tCO2eq, increasing U$ 50 every year, to allow the economy to adjust, to a minimum of U$ 500/tCO_2e in 2030 and U$ 1000/tCO_2e by 2035 (10 & 15 years after implementation)

4. The tax is levied & redistributed at country level, at the point of emissions (end-consumer, similar to VAT)

5. ALL tax revenues are redistributed, completely fiscal neutral
    a. 50% cash-back, re-distributed regressively (low income brackets receive higher cash-back) to balance the temporarily increasing energy bill
    b. 40% for building renewable energy infrastructure (excluding nuclear, bio-fuels and carbon capture technologies)
    c. 10% for R&D and mitigation

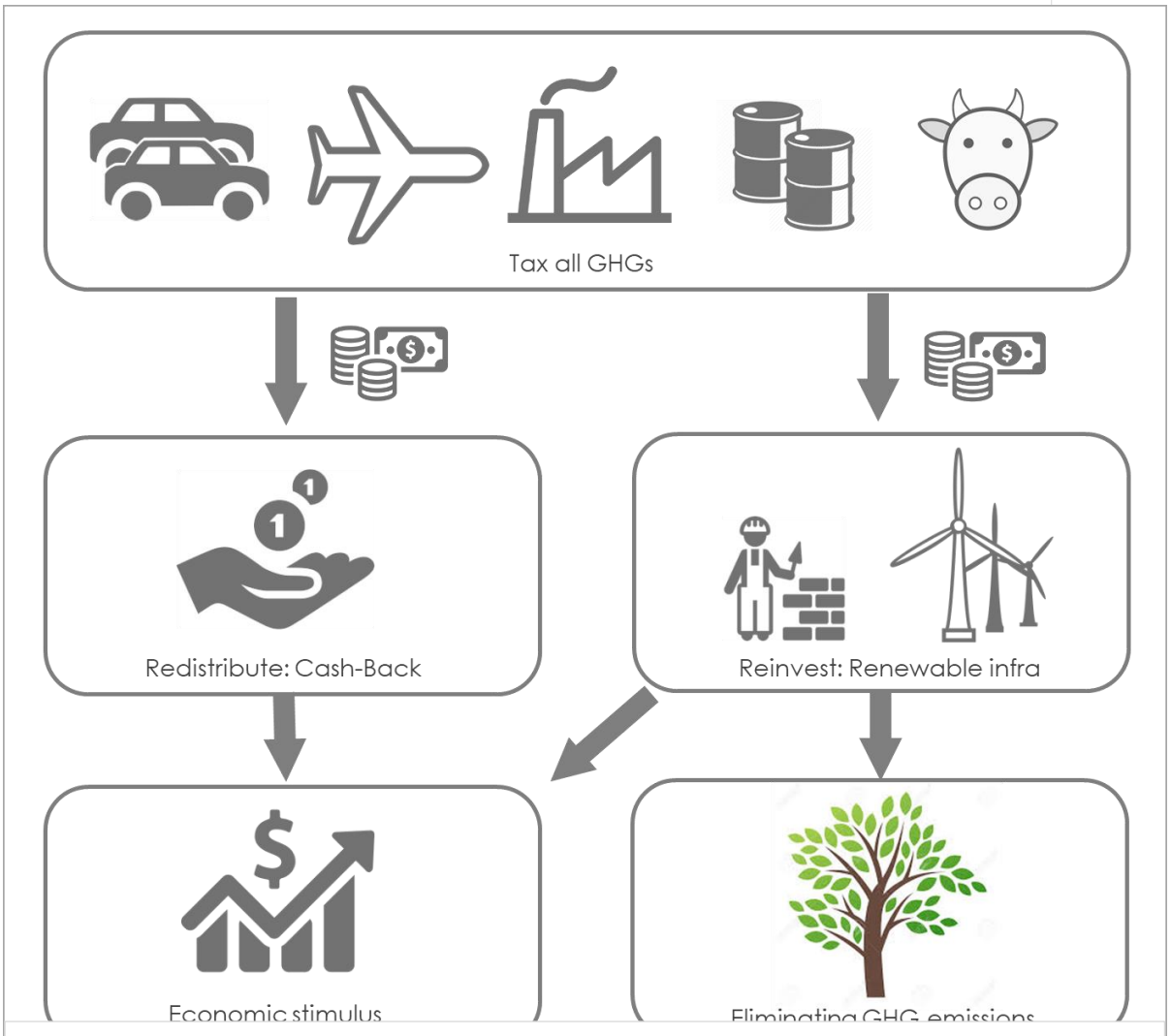
6. Agriculture contributes 15-25% of global GHG emissions. Meat and dairy products therefore need to be taxed according to their associated CO_2e emissions

7. Countries that do not participate in a global climate tax scheme are taxed a flat import tariff of at least 30% on all imports. These tariffs will be redistributed to the population as cash-back

2.2 Summary

Climate change is a market failure. A global climate tax resolves this failure. The implementation of a global climate tax has the following outcomes:

- Depending on the climate tax per tCO_2e and the rapidness of increasing the initial tax level, the World could produce sufficient renewable energy to cover all energy requirements by 2031-2035. However, due to technical constraints (lack of commercial electric airliners) and agricultural requirements, GHG emissions are expected to continue into the 2040's, albeit at a low level of appr. 3-7% compared to today.
- Considering all aspects, including economic aspects, **we suggest a global climate tax to start at U$50 per ton CO_2 equivalent, rising by U$ 50 each year to U$ 500/tCO_2e after 10 years** and 1'500 after 15 years
- The global energy bill will be 30-50% lower after the transition (2-4% of global GNI, equivalent to U$ 1.5 trillion, available for other purposes)
- During the transition, global energy costs will rise to between 10-20% of global GNI (depending on rapidness of increasing the tax). However, since 100% of tax revenues are directly reimbursed as cash-back or re-invested into the economy, the economy is expected to gain monument.



The economics of climate change is simple: tax the cost & redistribute

2.3 A Global Climate Tax: The Scheme

SolAbility has been commissioned to evaluate feasible ways to actually achieve results in combating climate change – including weighting the impacts of potential schemes on economic development, political feasibility, and of course emission reductions.

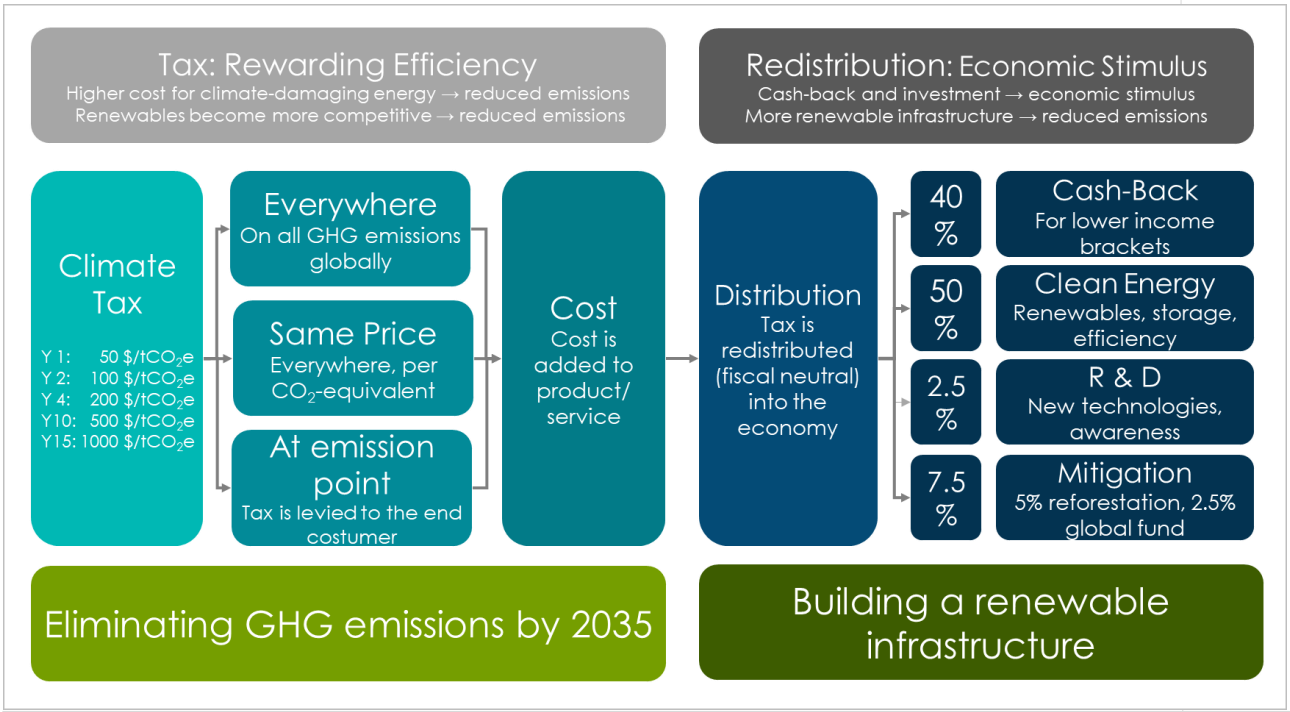
Several approaches have already been implemented and tried: cap & trade systems, CDMs local/national trading/taxing systems, certain subsidies and tax breaks, agreeing on emission reduction targets internationally, ..., - *but none of them have made a significant difference*.

This evaluation finds that the simplest and economically most feasible way to achieve meaningful reductions in a meaningfully short period of time is ***taxing emissions – but globally***. At the point of emissions. And then ***re-inject the tax revenues in the economy*** – through cash-back for the below-average income segments of the population, and investment in clean energy infrastructure, storage, and efficiency.

The concept of the global carbon tax is based on two simple principles:

1. Taxing GHG emissions, everywhere, equally.
2. Re-injecting all tax revenues in the economy (no additional government spending), at the national level (the climate tax *has* to be fiscal neutral)

And 3), impose a flat import tariff on all goods from countries that do not participate in the global climate tax, e.g. 30%



Tax all GHGs & redistribute 100% of tax revenues into the economy

Taxing GHG emissions means higher cost. It also means rewarding higher efficiency. Higher cost of fossil energy will lead to

- Higher efficiency: meaningful emissions taxes kicks off an innovation drive in the economy for more efficiency and new technologies, reducing energy and material consumption
- Higher investment in viable and clean alternative technologies, thus further driving down price of renewable energy through economics of scale and increasing the renewable share in the global energy mix
- Reduced emissions

Re-injecting the climate tax revenues in the economy through cash-back and investments will lead to

- Rapid further expansion of installed renewable energy generation capacity and associated technology (e.g. storage)
- Driving down cost of clean energy technology
- The cash-back element increases consumer spending, thus serving as an economic stimulus

2.4 Why it works

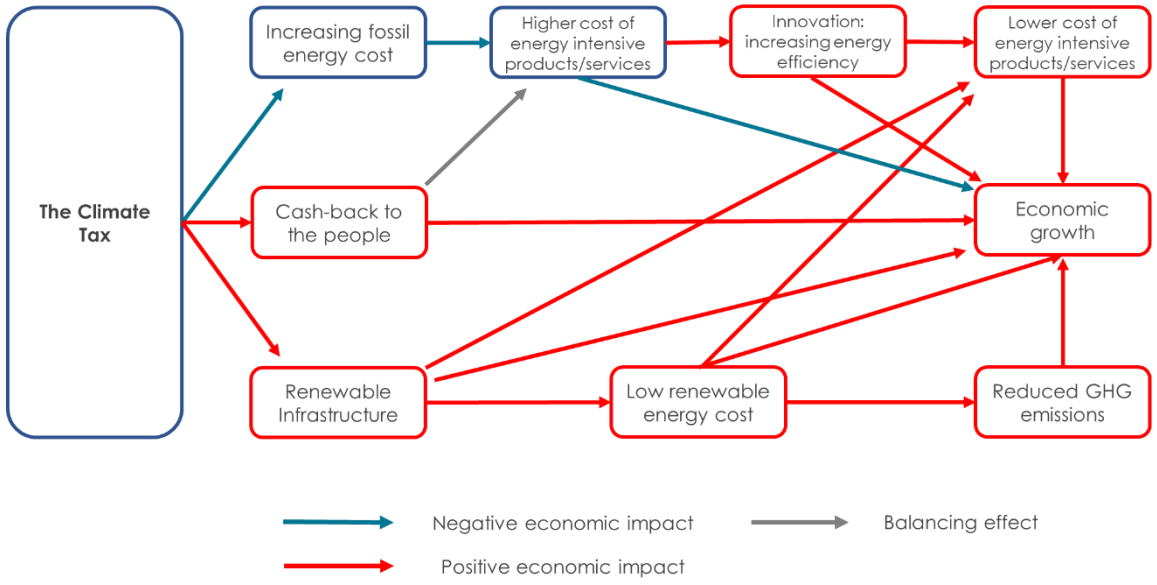
The economics of climate change is simple: attaching a price to carbon dioxide. Another established wisdom is that it is better to build the new before scrapping the old.

Here is why the global climate tax works:

- GHG tax increases cost of fossil energy. The cost pressure is an incentive to become more efficient (innovation drive), as well as looking for alternatives
- Fossil energy and energy intensive products/services will become more expensive – incentive to save energy
- Regressive cash-back will increase purchase power of low-income brackets, maintain the purchase power of the middle class, and not affect the high-income brackets. More cash in the hands of the lower-income brackets equals higher spending, equals growth for local businesses
- Electricity generated form wind and the sun is cheaper than fossil generated electricity already now. The investment in renewable energy infrastructure is further lowering cost of clean energy: the energy of choice will be renewable
- The investments in the renewable energy infrastructure will create more jobs than will be lost in the fossil industry

A group of leading economists – including 25 Nobel laureates and 4 former fed heads – are urging the USA to introduce a domestic carbon tax. Unfortunately, they have been largely ignored by decision and law makers.

The global climate tax goes a step further – by lifting the tax to the global level. Application of the same tax, globally, excludes potential economic disadvantages for businesses operating in countries that do vs. competitors operating in countries that do not have such taxes.



Schematic overview of the economic impacts of the global climate tax: the economic benefits outweigh the additional costs

2.5 Zero GHG Emissions by 2031-2036

For the purpose of this report, 4 different scenarios of implementing a global climate tax have been analysed: "Soft", "Medium", "Hard", and "Emergency". They differ from modest and "soft" introduction and increase of the tax (U$ per ton of CO_2 equivalent), to a drastic and step introduction ("emergency") of a global tax on GHG emissions.

Scenario		2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Soft	U$/ton CO_2e	50	75	100	125	150	183	225	250	300	350	400
Medium		50	100	150	200	250	300	350	400	450	500	550
Hard		75	150	225	300	375	450	525	600	675	750	800
Emergency		100	200	300	400	500	600	700	800	900	1000	1100

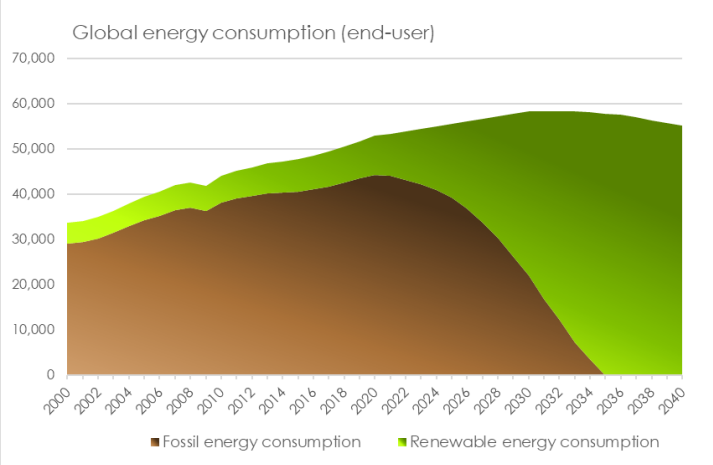
Key assumptions made for all 4 scenarios:

- Population, GNI, and global end-user energy consumption are increasing at the average growth rate of the past 10 years
- Price of crude oil (and natural gas & coal) will grow with inflation from current levels, but start slightly falling after 2025 due to sinking demand
- Cost projections of renewable electricity are based on historic trends and forecasts by international energy agencies (IEA, IRENA), conservatively projected into the future
- Each new renewable generated end-user energy unit will replace a fossil end-user energy unit. Initially mainly gasoline will be replaced (electric cars), later also coal-, oil-and finally gas-power power plants. This leads to a theoretical zero-fossil usage in 2031-2035. In reality, some fossil energy consumption is likely to continue into the 2040s for special uses

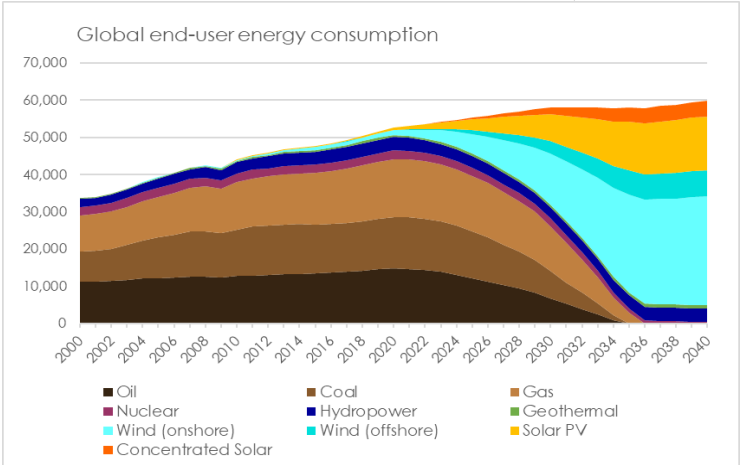
- The operating life of nuclear power plants nearing decommissioning in the 2020s will be extended until sufficient renewable capacity is available. Nuclear plants currently under construction are included in the calculations, but no further plants are built thereafter
- Until batteries capable of temporarily storing sufficient renewable electricity will be available, existing fossil generation capacity will be used and/or retrofitted to provide electricity from gas generated by surplus renewable electricity (power to gas to power) when the wind does not blow/the sun does not shine

Energy-related GHG emissions reduction

In theory, fossil energy usage could be replaced completely by renewable energy by 2031 (emergency scenario) to 2036 (soft scenario). This is under the assumption that each new additional renewable energy unit replaces a fossil unit. However, for some uses, fossil energy carriers will be used for somewhat longer.

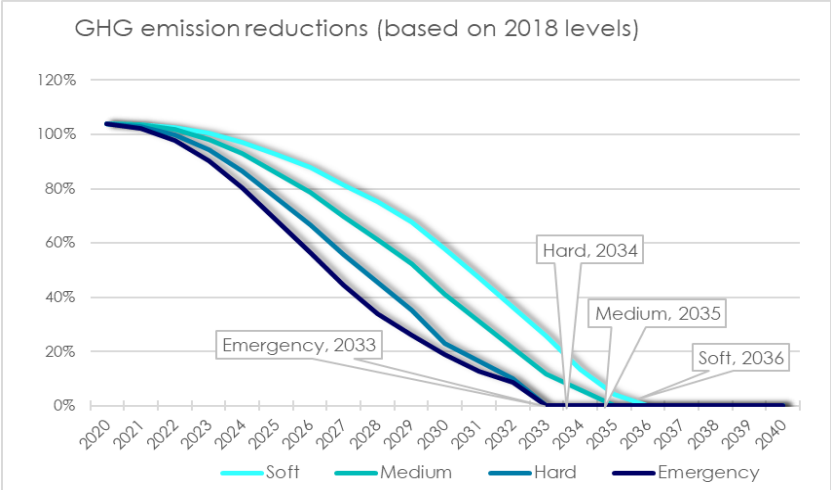


Fossil vs. renewable energy usage (soft scenario): fossil energy consumption could be replaced completely by 2035



Global energy mix (soft scenario): wind & solar energy to cover most energy demand

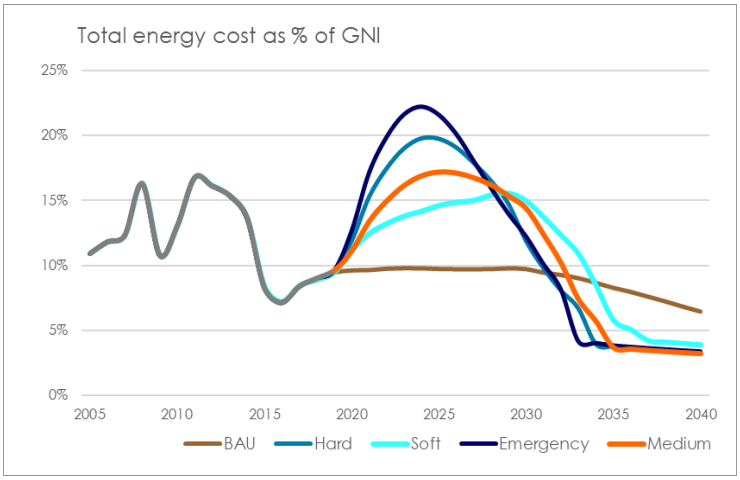
This means that energy-related GHG emissions could be completely eliminated by 2031-2035 (depending on size of global climate tax). However, considering technical constraints to replace liquid fuels for special applications, it is probable that some energy-related GHG emissions will continue into the 2040s, albeit at a very low level. In addition, certain agricultural emissions seem impossible to eliminate, in particular emissions from rice paddies. Taken together, these emissions are expected to represent approximately 5% of 2018 global emissions.



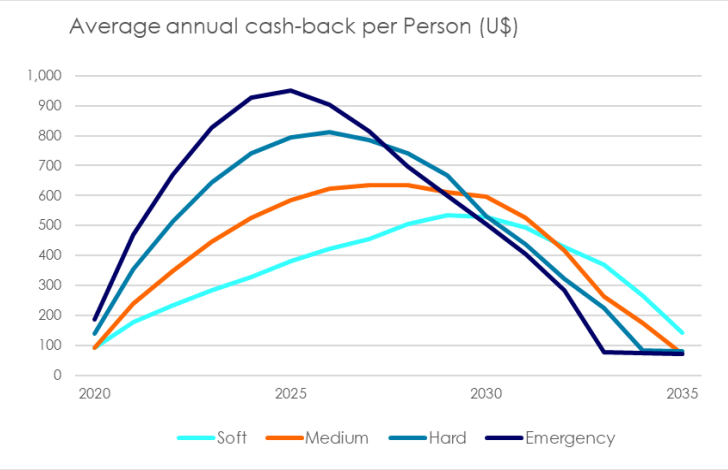
Potential energy emission reduction based on availability of renewable energy: depending on the scenario between 2031-35

2.6 The global climate tax: economic stimulus

Tackling climate change is not expensive, on the contrary: it is a huge development and business opportunity – probably the biggest business opportunity since WW2. Jobs lost in the fossil energy industry will be more than compensated in new industries (the renewable energy industry), higher purchase power and the investments facilitate innovation & growth, and the total global energy bill will be lower after the transition period of 5-10 years by 1-2% of global GNI (or GDP) – that U$ 900 billion plus available for other purposes, every year.

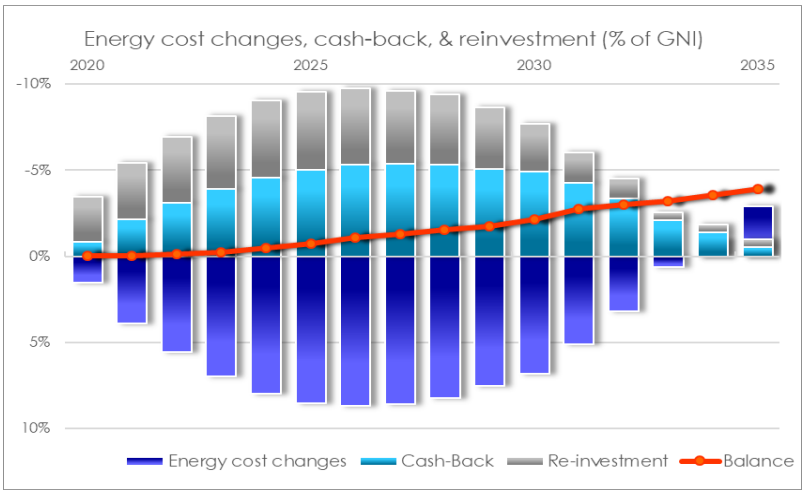


Global energy cost as % of before, during and after the global climate tax for the different scenarios



Cash-back per person and year – for each global citizen, in U$ per person

In the short term, and during a transition period of 5-10 years, the prices of energy intensive goods and services will increase. In parallel, the global cost for energy demand is rising as a result of the tax. However, in the soft and medium scenario, the cost does rise above fluctuations seen in recent years due to changes in crude oil spot prices, i.e. the global economy should be able to absorb and not be negatively affected by increased energy cost.



Energy cost changes according the proposed "Medium Scenario": energy cost rises by less than 10% (below energy costs seen in 2008 and 2010), and do not surpass investments and cash-back generated.

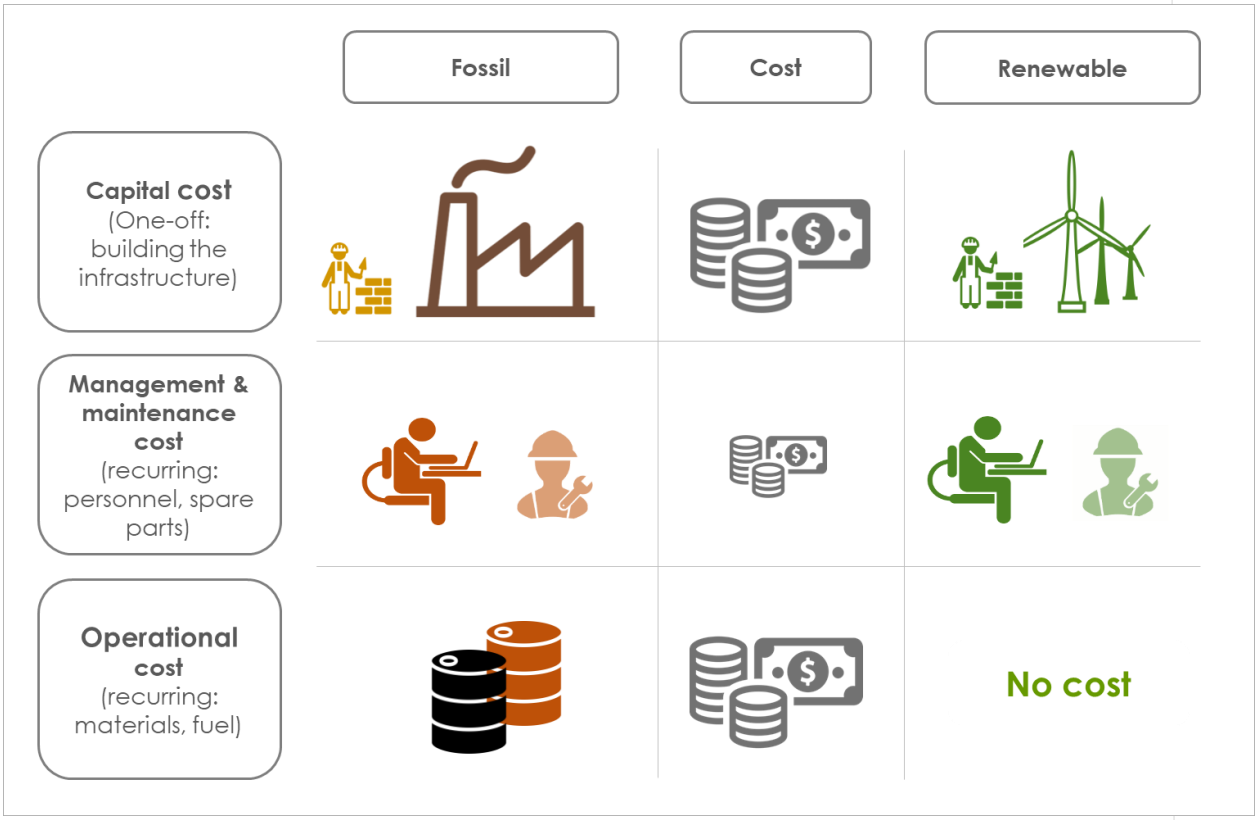
The net impact on the global economy is expected to be positive as early as Year 3 of the tax introduction

In addition, redistributing the tax revenues will ensure the level of purchase power of citizens remains equal, and for lower income brackets increase purchasing power. Investing 40% of the tax revenues leads higher availability and falling cost of alternatives (renewable electricity, lowering the total energy cost.

The re-imbursement to the lower incomes brackets leads to higher consumer spending, while the technology/infrastructure investments will more than replace the fossil industry, both in terms of jobs and growth. The overall impact of the global climate tax is expected to be ***positive after a maximum of two years, and from there on, very positive.***

A global carbon tax essentially makes money go around faster. It frees capital for combating climate change through rapid dissemination of renewable energy and intelligent efficiency technologies while simultaneously phasing out climate-damaging energy forms. The cash-back in the hands of the below-average income segments will put the additional money back into the macro-economy. The implications of the global climate tax on the global economy is positive.

Why renewables will soon be significantly cheaper than fossil energy - anyway



Generating electricity has three major cost parts: building the infrastructure (power plant, turbines, …), maintenance (employees to run & maintain the infrastructure), and operational cost (fuel). ***With renewable energy, there is no fuel cost.*** Wind is – measured by Levied cost of electricity – already now the cheapest electricity source. This cost reality is already reflected in investments in electricity generation infrastructure with more than half of global electricity investments allocated to renewable projects. While cost of renewable energy will further fall with the investments generated through the climate tax, fossil generated electricity becomes more expensive and therefor unattractive for owners and investors.

2.7 Barriers to implementation

There are technical barriers, to achieving a fossil-free world, and there are human barriers to implement a global climate tax. The main technical barrier currently is the still low capacity of batteries to temporarily store electricity, and the lack of batteries able to power commercial airplanes. Until batteries are in place, there are alternatives such as power to gas (e.g. surplus renewable electricity is used to produce natural gas, which powers gas power plants in times of need), albeit with a lower efficiency grade. The cost pressure will accelerate the development of high-capacity batteries and electric air-transport. The technology to produce renewable electricity is already in place, at costs that are more than competitive with fossil energy generation: the technical barriers are not really barriers.

Human barriers present a bigger challenge. International conferences on climate change have concentrated on emission reduction targets. However, how to achieve and manage emissions reductions has never been an issue. No wonder that every single country is failing to achieve even the modest reductions agreed upon under the different climate treaties. There are also local, regional and even international cap-and-trade systems, the Clean development mechanism, and local/regional tax schemes. But ***none of the tried approaches has made a meaningful difference***.

In short: it's the politicians. It's "the markets". And the large corporations that are afraid of a free market without state support and subsidies. And the owners of those corporations. In short – all those who perceive to be profiting from the status quo.

The main human barriers include (but are not restricted to) -

- Lack of political will and believe
- Lack of global agreement
- The influence of large players who consider their business model threated (the fossil industry & OPEC countries)
- The unwillingness of the financial markets to stop investing in, and seeking rent of, investment in the fossil realm
- The lack of a working approach/system to actually achieve emission reductions in practice and across all sectors, with minimal prohibitions and without negative impact on the economy

It is hard to say whether the political inactivity is due to incompetence, unwillingness, or lack of believe in common global action. Regardless of the deeper reasons for the political inactivity: ***it is clear that the current political mainstream – and/or current political figures – will not provide a meaningful solution.***

The solution therefore has to come from somewhere else.

Luckily, we live in the 21st century. In countries that call themselves "democracies". Our leaders and politicians are elected to face up to the challenges of our time. And they are elected to serve and protect the people. So maybe, we can force their hand. ***Our children on climate strike and manifestations can make themselves heard.*** If it is enough of them, globally, they can force the hands of the politicians – so that on the next conference, a global climate tax is agreed and implemented immediately. ***It is to be hoped that the youth movement can accumulate sufficient energy and mobilisation to force the politicians' hands***.

2.8 Conclusions

Climate change is here. Yet there seems to be no solution that politicians are able and/or willing to agree upon. A possible solution that does not negatively affect the economy while financing a clean renewable energy infrastructure is a global climate tax.

- Climate change is a global problem. Climate change can only be tackled on a global level.
- Politics is either unable or unwilling to face the challenges.
- The economics of climate change is simple: there needs to be a **cost attached to GHG emissions**.
- **A fiscal neutral global climate tax** that reimburses citizens (climate dividend) and simultaneously finances the development of a renewable energy infrastructure **could reduce emissions to nearly zero while stimulating the economy**
- A global climate tax could reduce emissions to nearly zero by 2035, while lowering the global cost for energy by 30-50% (2-4% of World GDP)
- For reasons not necessarily easy to understand, such a global agreement currently seems politically impossible.
- OPEC countries, the fossil industry, the air transport industry, and potentially animal farmers are expected to lose income and therefor exercise strong opposition
- **The global youth climate movement** has completely altered the urgency and the discussions around climate change
- Information, awareness and constant pressure from the street seems the only way to force politicians to act.

The climate youth movement is probably the most powerful agent of change.

Climate Change is here.

Climate economics is simple.

The technology is available.

Politics doesn’t have a clue.

3 The challenge

3.1 In a nutshell

So here we are:

- The science is clear. We are heading for disaster
- We need to sharply reduce GHG emissions. And we need to get CO_2 out of the air
- The economy is governed by markets that are not free. The rules of the market are the same as in the kindergarten's sandbox: the most powerful shapes the rules. The markets are heavily influenced by special interest groups, whose power arises form economic size and capital backup – and distorted by subsidies, tax breaks, and tax evasion.
- Markets movements are not God-given. We can direct them, if we want.
- Politicians are either unwilling or unable to change the course.
- There is a complete lack of democratic participation – even in so-called democratic nations. Having the choice to choose between two clowns every few years does not merit the name "democracy".
- Some people are getting angry.

What we need:

- Reduce GHG emissions by 80%, preferably more, by 2030
- Take CO_2 and other GHGs out of the air
- Doing both of the above without economic and social disruption

There are simple and effective solutions available. We already have the necessary technologies, and technology will improve further and become cheaper going forward. Tackling climate change is a huge business opportunity.

3.2 The physics

The science is clear: we are heading for disaster. When more than 90% of the experts agree, there is no more need for discussion. Discussion time is long over-due; it is time for action.

Recent research and observations suggest that climate change is happening faster than previously thought. Not faster actually than many scientists though, just faster than in the moderate scenarios that have been shown around in the media "in order not to scare the public". Scientists have long been aware of possible feed-back effects that accelerate each other (e.g. the melting of the polar ice is uncovering dark water surface that absorbs much more light than ice, leading to warming water, leading to faster melting of the polar ice, leading to less ice/more dark heat-absorbing surface, leading to …).

We are heading for disaster. Fast. Unfortunately.

3.3 The economy

The global economy is entwined with fossil energy. Which unfortunately makes it impossible eliminate or ban all fossil energy consumption tomorrow. However, our economy, and our societies, rely on energy – not on oil or gas or coal. Energy is what we need.

A key flaw of our economy is the failure to truly price things. Costs that are not generated immediately, but at a later stage and maybe somewhere else, are not integrated in the cost of products and services. States and individual than have to carry these costs – in other words: everything with a negative impact on environment and health is subsidised by individuals and states. In other words: the market is distorted in favour of products, services and technologies that have a time- and/or location deferred impact. For example: fossil fuels…

Banning fossil energy tomorrow would bring our societies to a still-stand. Which is why we have to phase them out. We can direct the market to replace old technology faster than the market environment would do normally do (not at least slowed down significantly by globally U£ 5 trillion in direct and hidden subsidies for fossil energy). There are clean and cheap technologies already available today – most of the are set to become significantly cheaper with mass dissemination, industrial production, and economics of scale.

3.4 The politics

Unfortunately, there is not much to say here.

Looking at & listening to the political discourse from a management evaluation perspective leaves on speechless. We wouldn't even know where to begin.

- Politics is either unwilling or unable to face up to today's challenges
- Politicians are failing time and again to agree on emissions reductions, let alone on concrete measurements to reduce emissions
- Responsibility is delegated to unspecified others or into the future
- We are living in the 21st century. It is unbelievable that democratic participation in most countries is restricted to making a decision between 2 or more persons parties or groups – most of which are not really trusted anyway. And that in some countries there is not even a choice between 2 or more people, groups or parties. It is unbelievable that democracy in the 21st century should be on the retreat.
- Rich individuals, the financial markets, and special interest groups, through economic size and financial capital, are able to influence policies and regulations and even investments in their own short-term financial interest

The good news here is: this is not possible. It is not possible that there is no alternative,

All that is required is for sensible people to come together and make simple, sensible decisions.

That is not impossible, is it?

3.5 The required technologies already exist

Technologies to tackle climate change are already in place: renewable electricity generation through wind and the sun. Some, like solar PV, wind energy and smart energy management are already mature technologies. Other exist, but are not yet that advanced – electricity storage, smart grids to manage the grid load, alternative materials, for example – do exist, and will evolve further with the push of a tax on everything GHG. There are other promising technologies still in their beginnings – block-chain, AI, robotics, the manufacturing of new materials and even food (lab-gown meat)– that might help aspects of emission reductions. For all these technologies, it is time to prove their worth.

Energy production:

Electricity from wind (on-shore and off-shore), solar (PV, concentrated solar thermal). Additional energy technologies such as wave and tidal electricity generation exist and are expected to become more competitive in the future, but are unlikely to become major contributors in the global energy mix.

Electricity storage:

While the load density of batteries has been increasing at 5-8% annually over the past few years, but we are still two decades or more away from batteries capable of storing electricity at the scale required if the entire production is to be powered by renewable electricity. However, there are other – albeit less efficient – electricity storage technologies available that can be used until high-load batteries become available, namely converting electricity into other forms of energy: kinetic storage, thermal storage, or using electricity to generate gases (hydrogen, methane), that can be used to produce electricity at the time required, possibly even in existing natural gas power stations. It is also expected that the funding generated form the climate tax available for R&D will increase the speed of development of battery technology.

Tax all GHGs

Everywhere, at the same rate

Re-inject all tax revenues

Cash-back reimbursement

Renewable infrastructure investments

4 The Global Carbon Tax

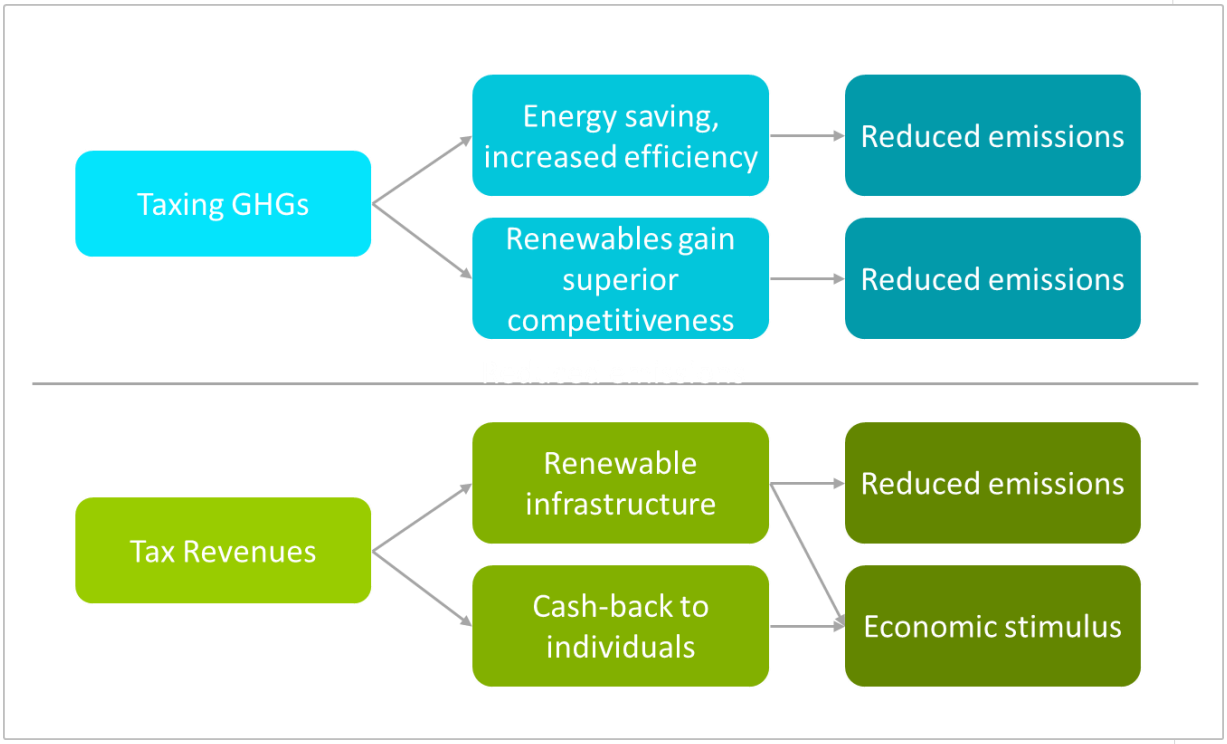
4.1 Simple principle: tax & redistribute

The scheme is simple and consists of two pillars:

- Tax
- Redistribute

A global carbon tax is the most efficient way to direct the markets towards a cleaner energy infrastructure. Renewable energy has become cost-competitive with fossil fuels over the past decade. Eventually, they will overtake fossil energy anyway. A global carbon tax will substantially accelerate the market changes and lead to a renewable energy infrastructure in a much shorter period of time. An energy infrastructure based on renewable energy is equal to reduced GHG emissions.

- Tax all climate active substances
- Use part of tax revenues as cash-back to avert economic backlash
- Use the rest of the tax revenues to build clean infrastructure



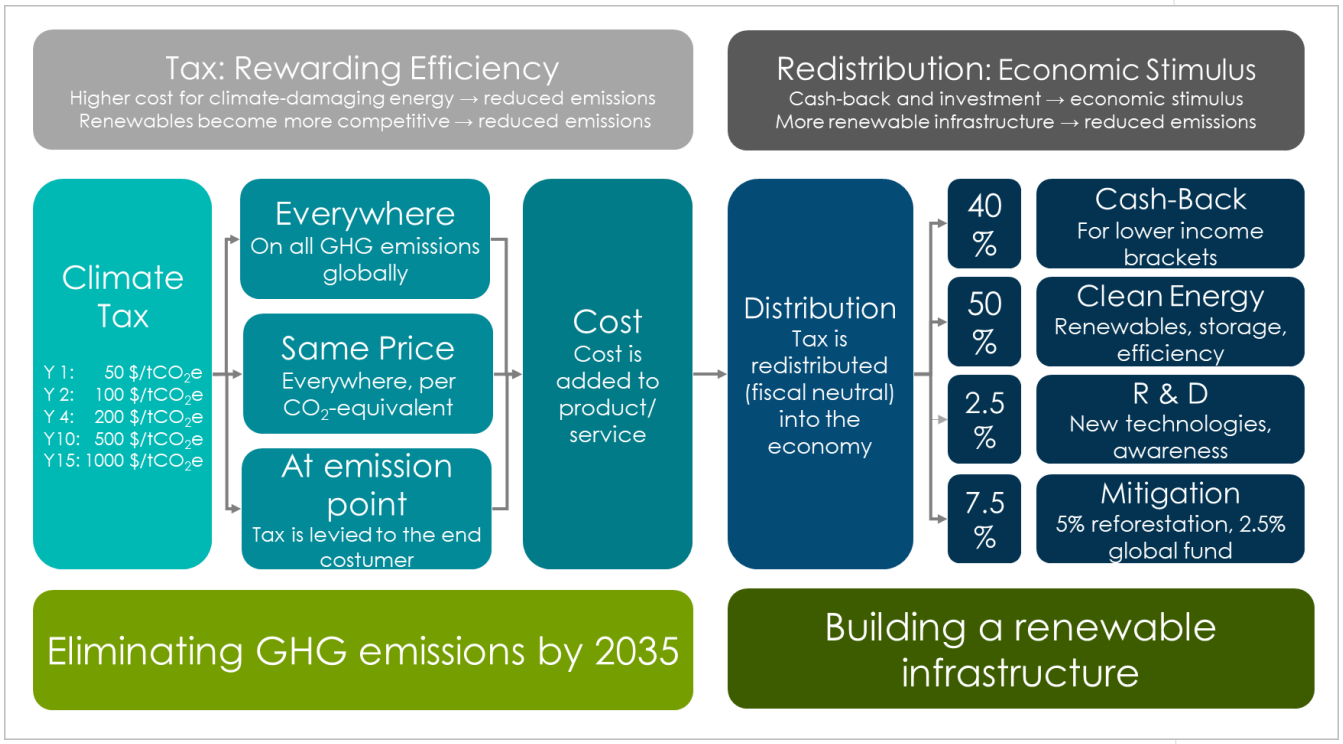
Through this simple scheme, GHGs (CO2) will become more expensive, while clean renewable energy forms become cheaper, tipping the balance in favour of clean energy. The cash-back is an important element of the scheme in order to prevent an economic back-lash, in particular on the lower-income segments of the population.

It is important that the tax is levied outside of normal government budgets. All tax revenues should immediately be re-injected into the economy.

4.2 The global climate tax scheme

The aim of a Global Carbon Tax is to reduce GHG emissions, rebuild the energy infrastructure, and providing economic stimulus. The working scheme of the Global Climate Tax is based on

- The tax on GHGs is increasing the cost of fossil fuels. The rise in cost is driving energy savings and efficiency, reducing fossil energy consumption and emissions
- Increasing fossil cost further and sharply increases cost-competitiveness of renewable and clean energy, leading to higher investments in renewables. Increasing share of renewable energy in the global energy mix further reduces emissions
- The cost increase is incorporated in the price of goods and services (passed on to private and corporate consumers). It is therefore very important to redistribute the tax to the lower income segments to maintain (or increase) the purchase power of the below-average income segments
- The biggest share of the tax revenues is invested in renewable energy infrastructure (solar/wind/tidal/…) generation and electricity storage (batteries, power-to-gas, power-to hydrogen, …). This investment provides economic stimulus, and reduces emissions. The high investments are balancing off every potential negative impact of rising energy prices on development, while the new renewable infrastructure is replacing fossil energy, i.e. reducing emissions.
- The tax is introduced in stages to allow the economy to adapt. Fast movers will win, laggards lose.



4.3 Details: taxing

The Global Climate Tax (GCT) is based on the following pillars:

- All GHGs are taxed, globally.
- GTC is levied at the same price per CO2 equivalent, globally.
- Taxes are collected (and redistributed) on a national level.
- The GTC is introduced in stages to allow the economy to adapt to the changing developments: fast movers will win, laggards will lose.
- The GCT is levied on all GHG containing products (liquid fuels, gas, coal, but also chemicals with an adverse climate impact, such as fluorinated gases).
- The GCT is ideally levied at the point of the emissions, i.e. at the point of sale to the final consumer, similar or equal as value added tax (VAT) are levied.
- The GTC is incorporated into the price of goods and services (i.e. passed on to customers)
- A single cow produces more than 2 tons of CO_2e per year. Meat and milk production accounts for 20-25% of global GHG emissions. Meat and milk products therefore also need to be taxed according the emissions they generate.

The table below shows the cost implications of a staged introduction of a climate tax on the selected items:

Climate tax (U$ per ton of CO2 equivalent)	Electricity generated from natural gas (U$/kWh)	Electricity generated from coal (U$/kWh)	Gasoline (U$/litre)	Gasoline (U$/gallon)	Cost increase of air transport (%)	GHG tax/kg beef	GHG tax/litre milk
50	0.01	0.01	0.04	0.14	2%	0.69	0.02
100	0.02	0.03	0.07	0.28	4%	1.38	0.05
200	0.04	0.06	0.15	0.56	7%	2.76	0.09
300	0.05	0.08	0.22	0.84	11%	4.14	0.14
400	0.07	0.11	0.29	1.12	15%	5.52	0.18
500	0.09	0.14	0.37	1.39	18%	6.9	0.23
600	0.11	0.17	0.44	1.67	22%	8.28	0.28
700	0.13	0.20	0.52	1.95	26%	9.66	0.32
800	0.14	0.22	0.59	2.23	29%	11.04	0.37
900	0.16	0.25	0.66	2.51	33%	12.42	0.41
1000	0.18	0.28	0.74	2.79	36%	13.8	0.46

Increased cost of raw materials in human history have always led to innovation and a great increase in efficiency. This will also happen under the global climate tax scheme: energy efficiency and the development of alternatives (renewable energy technology, synthetic fuels, …) will greatly increase.

4.4 Details: redistribution

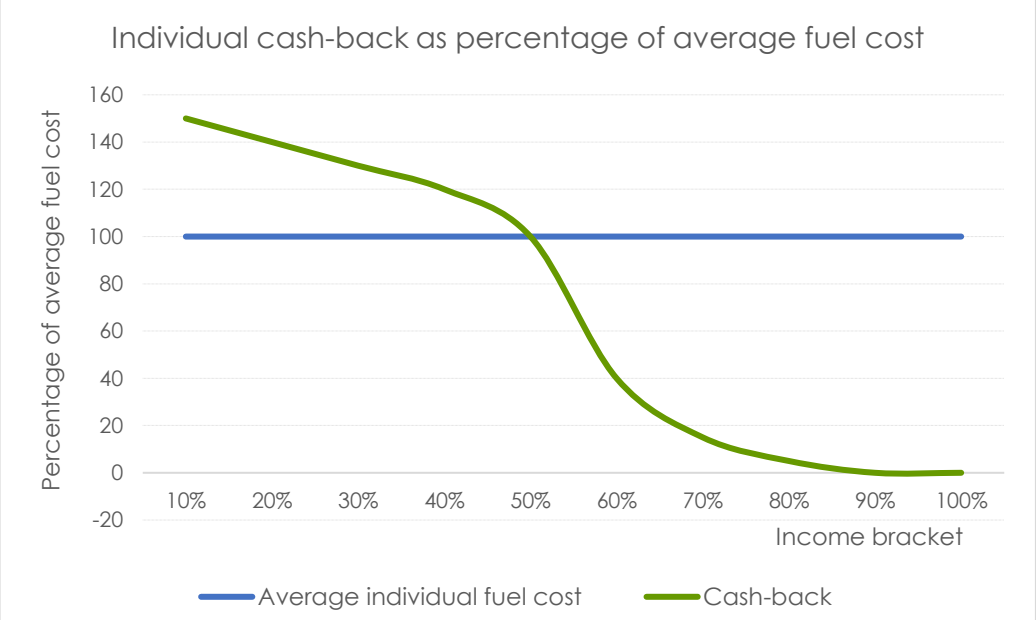
Redistribution of the tax revenues – as collections – is managed at the national level. The redistribution is completely fiscal neutral (none of the tax revenues can be used for normal government budgets. Of equal importance is to keep overhead cost of the tax at an absolute minimum). The re-injecting of the GCT is aimed at 4 major areas:

- 40% Cash-back for below-average income brackets
- 50% Investment in renewable energy infrastructure
- 2.5% Support for R&D for new and promising technology, awareness raising
- 7.5% Mitigation: 5% reforestation (to re-capture CO_2), and support of a global fund (2.5%) dedicated to support the countries most affected by climate change

4.4.1 Redistribution: 50% of climate tax revenues

An important element of the GTC is the economic neutrality of the tax. For low-income income brackets, the new tax and associated increased daily costs might make the difference between decency and poverty. It is therefore of paramount importance to maintain the purchase power of those segments in the form of cash-backs.

It is proposed that the cash-back to below-average income levels is higher than their cost incurred, i.e. a net-positive cash-back. More cash in the hands of the low-income segments is equal to more spending on food, cloth, health, housing, education and recreation, providing a boost to small local businesses.



Distribution of the cash-back element of the climate tax: low-income brackets receive higher sums than high-income segments, increasing purchase power of large population groups, which in turn is expected to stimulate local economies and businesses

4.4.2 Investment: 40% of climate tax revenues

The bulk of the tax revenues is invested in building renewable energy capacity – generation, storage and possibly distribution (smart grids), whereby the state through a fund can either act as owner, builder, investor, or even donor (e.g. solar panels for individuals). Some of these technologies are mature and cost competitive even before

the new climate tax (wind, PV). The investment will lead to acceleration of economies of scale, further reducing cost of renewables. Combined with increasing costs for fossil fuels, these investment lead to a rapid replacement of fossil fuels with clean renewable energy. Main investment:

- Installation of mature renewable energy generation (wind, Solar)
- Electricity storage (batteries, power-to-gas, …)
- Smart grids
- Energy efficiency

Important note: although bio-fuels are carbon neutral (the CO2 they release has been captured by the fuel crop), they require significant natural resources (agricultural land): ***bio-fuels cannot be considered renewable***. Bio-fuels therefore will not be supported from the revenues of the global climate tax.

4.4.3 R&D & education: 2.5% climate tax revenues

Besides installation of new clean energy generation capacity, further research in promising new technologies, energy storage, and energy efficiency is required. 2.5% of the GCT should be reserved for further research and raising public awareness for individual possibilities to save energy.

4.4.4 Mitigation; 7,5% climate tax revenues

Unfortunately, climate change is already here – melting glaciers, the melting polar caps, rising sea levels, and the cumulation of freak weather events are all testimony. The data gathered globally by re-insurance the companies regarding cost is equally to the point.

Mitigating climate change has two aspects

- Getting CO2 out of the air (reforestation)
- Mitigate the worst impacts that are already occurring

Reforestation is the simplest way to get carbon out of the air. Carbon capture & storage (CCS) is complex process, requires significant infrastructure. CCS is a no-go. Instead, we can capture carbon in the most natural way – in the wood of trees. We could even grow fast-growing trees and then dump them in the oceans: wood that is submerged in saltwater cannot react with oxygen, and therefore cannot rot. Wood in the ocean is captured and stored CO_2.

Climate change impacts are being felt in small island states, in countries with low altitude, and in the path of weather extremes. It is therefore proposed to form a global fund to support the worst hit countries (most of which happen to be comparable poor and not highly developed, economically speaking).

4.5 Further measurements to reduce emissions

4.5.1 Government policies & regulations

Governments have, by their power to design policies and regulations, incredible power to change the course of events. Simple regulations can have a significant impact on future emissions. Possible policy measurements include:

- Regulate the fuel efficiency of newly sold cars: **after 2023, only electric vehicles can be sold**. The technology is already available, and 4 years is more than sufficient time for car-makers to adapt their production lines. Equally, installation of new heating equipment using fossil energy should be prohibited after this data
- Defining strong minimum energy efficiency standards for all energy-using appliances
- Define minimum standards for energy efficiency in new buildings (in mature AND emerging economies)
- Prohibition of climate active substances and gases (e.g. fluorinated gases)
- Deforestation accounts for roughly 1500 million tons of CO_2 emissions per year. Deforestation has to be stopped.
- Forests can capture and store CO_2. In order to reduce CO_2 concentration in the atmosphere, the World needs to grow forests.

4.5.2 Taxes on agricultural products

Agriculture is responsible for between 15-20+% of GHG emissions globally. Most of the emissions are related to cattle breeding (meat and dairy production), accounting for nearly 65% of agricultural emissions, i.e. between 10-15% of global GHG emissions. Poultry and pork production each contribute to another 10% of agricultural GHG emissions, i.e. 2-3% of global GHG emissions. Most agricultural emissions are associated with industrial agriculture and land change (eliminating forest areas for agricultural purposes).

Considering the high percentage of global GHG emissions of meat and dairy production, it is only sensible to create incentives to reduce emissions. This can be achieved in several ways

- **Adding a climate change tax on meat and dairy products that** is re-distributed equal to the climate tax – fiscal neutral, in cash-back and investments in non-GHG production processes. The tax can be levied at either the source (tax per animal) or at the consumer point (taxing meat and milk according to the generated emissions)
- **End all subsidies for industrial agricultural**. Instead of providing subsidies to farmers, a "nutritional cash-back" for below-average income brackets should be considered. Alternatively, subsidies should be tied to non-polluting and climate neutral farming practices

The numbers also make it clear that a vegetarian way of life (and even more so, a vegan life-style) is much more climate friendly. However, is cannot be the responsibility of states and regulations to tell people what they eat. Reducing emissions is better achieved through the market incentives.

4.5.3 Carbon sequestration and re-forestation

Unfortunately, reducing emissions to zero will not be sufficient. If the global climate is to be stabilised at a level suitable for our way of life, we will have to get CO_2 out of the air and back into the ground, or stored elsewhere. Engineered technologies to capture and store CO_2 are highly energy intensive, are still completely unproven, and require immense infrastructure to transport and safely store and/or convert the gaseous CO_2. Carbon capture and storage technologies therefore cannot be a realistic option. The most efficient way to absorb and store CO_2 naturally is by soil sequestration, and by growing trees. However, significant land areas would have to be re-forested in order to sequester carbon on the scale required.

- A km^2 of forest can store app. 20'000 tons of CO_2 over 40 years. Reforesting 1% of World surface land could absorb app. 27'000 million tons of CO_2 over 40 years in a natural grown forest. However, after 40 years the carbon absorption capacity of forests is decreasing to nearly zero due to the maturity of the trees.
- Growing forests does not only capture CO_2, but also regulated micro-climate.
- A further-going option are carbon plantations: growing fast-growing trees, dump the tree stems in the ocean after 20 years where CO_2 cannot be released due to lack of oxygen – and then grow new trees on the same land.

Further going action would involve growing trees to capture carbon, and then store them indefinitely where the carbon contained in the wood cannot be released: surrounded by saltwater, on the bottom of the oceans. Due to the absence of oxygen (O_2), wood surrounded by saltwater does not rot. In other words – the carbon captured in the wood will not be released (and, over millions of years, might turn into oil again). The land could then be used to grow new trees and capture even more CO_2 in to free the reforested land to grow more trees that capture CO_2 out of the air. This option is however only realistic if meat and dairy products can be substituted at scale, which would make areas currently used for cattle grazing and animal feed production available for forest growth. However, calculating/estimating the detailed implications and cost feasibility and side-effects of such actions is beyond the purpose and scope of this report.

4.6 Challenges within the GCT scheme

The is a series of management and governance challenges involved in establishing a global climate tax:

- Managing and governance of collecting the tax,
- Management and governance of re-distributing the tax revenues
- The allocation of the tax revenues in specific projects
- Economic challenges, and
- Political challenges

Collecting the tax

The GTC is levied on climate active substances – oil-based substances, gas, cool, but also other substances such as NO_2 (frequently used in fertilisers), F-gases, and all other climate active substances.

Are the tools/systems to collect the tax in pace in all countries? In most developed economies, VAT system are already in place. In all those countries, collecting the tax can be done without the implementation of new systems/tools; the tax is levied where the VAT is levied. However, in the lesser developed economies, VAT systems might not be in place, and significant volume of the trad is conducted in informal markets. In such circumstances, it is challenging to tax anything, and there is no blue-print how to best handle those situations/countries. It might be sensible to define a grace period of (for example) 3 years to implement the tax in the least developed countries (but only the least developed countries: most of Africa, the least developed countries in South Asia, and Central/South America).

- In the more developed countries, the climate tax s levied together with VAT
- Where VAT systems do not exist, implementation of tax collection is highly challenging. It might be sensible to define a grace period to implement the tax in lesser developed countries.

Distributing the tax

Challenges that might negatively affect the distribution of the **cash-back** include

- Availability and accuracy of data regarding income of individuals to identify the recipients
- Availability of structure to deliver cash or bank transfers without large overhead requirements
- Up-front cash requirements: as soon as the tax kicks in, poorer segments of the population need to be based out to prevent private bankruptcy cases
- Overhead: it is of paramount importance that the overhead costs of re-distribution are kept to an absolute minimum, and based on clear calculations and rules in order to prevent favour-cooking and corruption

The lack of relevant and reliable income data in lesser developed countries, potentially leads to difficulties in identifying the recipients. Distributing the cash might be also be challenging and possibly needs a considerable logistical overhead in countries where the poorest segments of the population does not have bank accounts. It is hoped that e.g. blockchain technology will make such transfers significantly easier in the future

In more developed countries, the structure to identify and pay the relevant people is already in place. Re-distribution of the cash-back element of the GCT to the relevant individuals can be implemented fairly easy.

As soon as the tax is implemented, prices will go up. In the worst case this could push individuals or families that live pay-check to pay-check over the brink. It is therefore very important that the cash-element is already distributed before the tax is introduced. The states therefore need to provide short-term up-front finance until the tax revenues are starting to flow.

Re-investing the tax in energy infrastructure and efficiency:

The state, in some form or another, will have to act as investor, creditor, or even builder/owner of renewable energy, storage, and efficiency improvement projects. This can be done directly or through an external, independent fund. However –

- The allocation of funds needs a completely independent, non-political investment decision/fund allocation processes.
- The size of the funds to be distributed and/or invested is likely to generate inappropriate desires. Corruption prevention – i.e. a strict external auditing of processes and investment decisions – is paramount.
- Overhead cost of planning and distribution have to kept at an absolute minimum
- A very clear definition of what projects, technologies that are or are not eligible for funding is necessary in order to leverage to impact of the investment to a maximum

The economy

Our current World is entwined in fossil energy. Almost all modern life – the economy, transport, private lives – are dependent on fossil energy. The tax is set to increase the cost of certain goods and services. All fossil products (including plastic), transport (of goods and people) and energy intensive products are likely to become more expensive. There needs to be control that producers and service providers do not use the climate tax as fig leave to increase prices beyond what is justified by higher energy prices. A too steep increase in cost of goods also might lead to a short & small inflation.

The National Banks will have to watch inflation tendencies closely – bearing in mind that this is not a normal situation, but an emergency transition period.

Increasing energy prices have historically always lead to an acceleration in innovation. The tax is significantly altering certain elements of the markets. These changes offer high opportunities for clever fast movers. Yes, there will be some losers; some business will disappear. Badly managed businesses that are not able to adapt or didn't see the writings that have been on the wall for more than 20 years might lose out.

However, there will be more new business than business is disappearing.

Politics

There is no question that the support for, and the implementation of, a global implementation of acclimate tax scheme, seem politically impossible. There is no visible political will – so far – to either face nor tackle climate change. Even before the Donald-Departure of Paris, the agreement is a) not even facing to the knee of the challenge, and b) is no country willing to implement the policies required to achieve the modest agreed reductions.

The political barriers to implementation seem unsurpassable. However, a Global scheme might be the egg of Columbus:

- if everyone (all countries) implements the same scheme, the market environment is everywhere the same, the competitiveness of individual nation-economies is not affected.
- Though cash-back and re-injection of capital into the renewable energy economy, the tax scheme is completely fiscal neutral.
- A global climate tax scheme is not only fiscal neutral, but represents also a significant economic stimulus. The economy will not crash, but flourish.

Politics has become unable to come to sensible conclusions and agreements. It seems it is now up to the citizens to force the hand of politics. It is up the children and the students.

For the case that the scheme is implemented, states might be tempted to use climate tax revenues for other purposes than re-investments. All attempts to divert the tax revenues have to be resisted. The climate tax has to be fiscal neutral.

Energy-related GHG emissions eliminated by 2031-2035

Purchase power increased

Global energy cost reduced by 2-4% of global GNI

5 Save the economy, save the climate: implications of the global climate tax

5.1 Zero GHG emissions shortly after 2030

For the purpose of evaluating the feasibility and economic impact of a global carbon tax, we assessed the impact on energy usage, energy-related GHG emissions, and the economy of a progressive global climate tax under 4 different scenarios. The scenarios differ in speed of implementation and the volume of tax per emitted CO_2e. The climate tax under the 4 scenarios was defined the following

GHG tax per ton of CO_2 equivalent (U$/t$CO_2e$)

Scenario		2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Soft	U$/ton CO_2e	50	75	100	125	150	183	225	250	300	350	400
Medium		50	100	150	200	250	300	350	400	450	500	550
Hard		75	150	225	300	375	450	525	600	675	750	800
Emergency		100	200	300	400	500	600	700	800	900	1000	1100

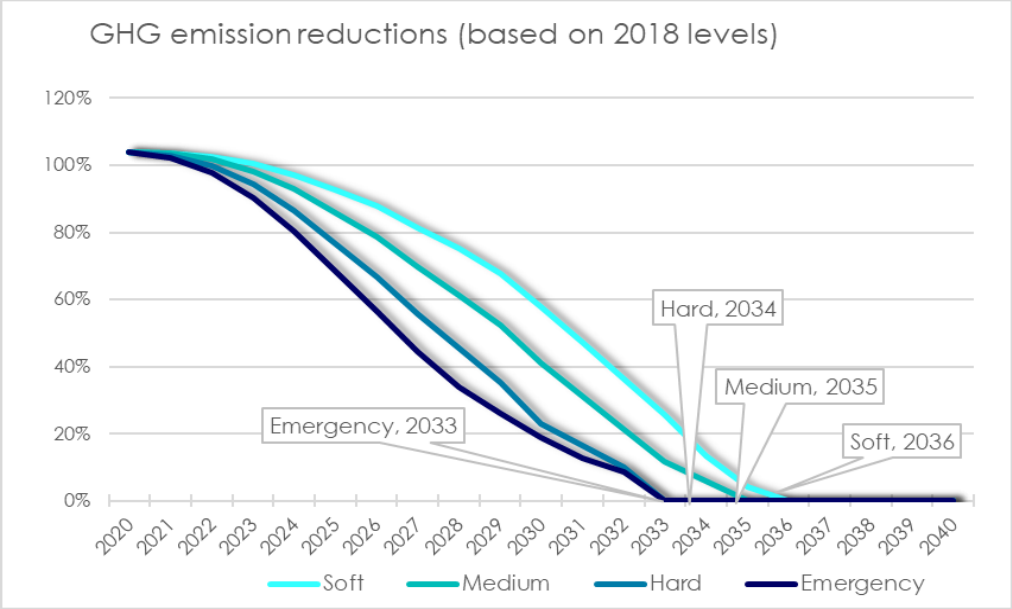
Key outcomes of the global climate tax:

- Energy related GHG emissions can be reduced to 0 (zero) shortly after 2030
- The global energy bill would be significantly lower after the transition to a renewable energy system than before (4% of GNI/GDP vs. before 6-10%)
- Economic stimulus is expected through cash-back and renewable infrastructure investment: more people have more money in their pocket to spend, and the economy will be stimulated with 2%-5% of GNI/GDP worth of in investments for 5-10 years
- More than U$ 1.5 trillion tax revenues available for R&D will accelerate technology improvements
- Renewable energy (electricity) production will increase from 5'000 TWh per year today to more than 50'000 TWh after 2030
- Energy costs in the transition period will peak at 12% of GNI (in the "Soft" scenario; not higher than levels seen in recent years caused by oil price fluctuations) and 20% ("emergency" scenario)
- Thanks to the non-fiscal nature of the tax, all energy cost increase is offset by investments in renewable energy infrastructure and cash-back to individuals
- Additional measurements that should be considered include:

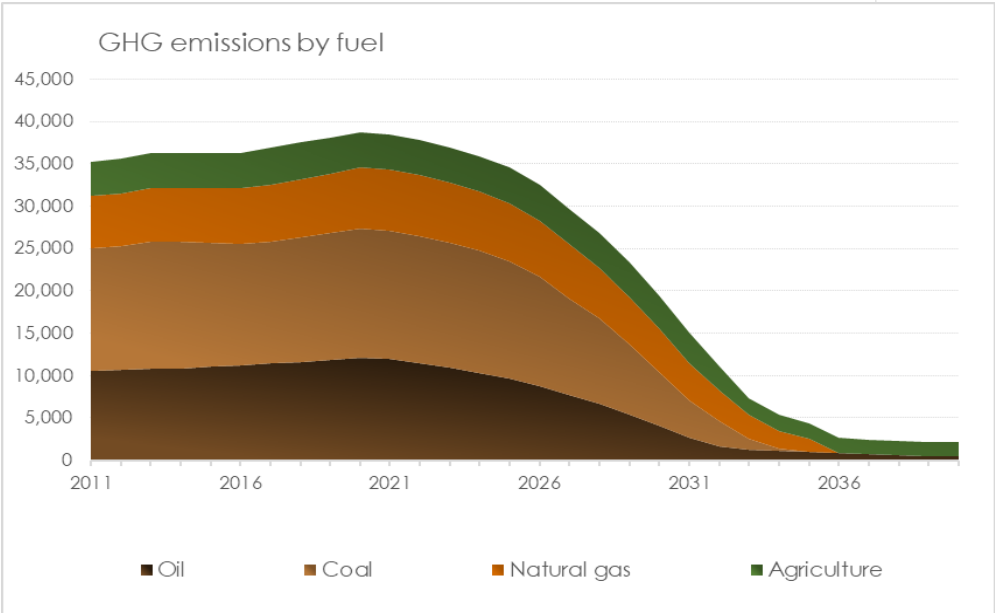
Based on these outcomes of a global climate tax, it seems fairly recommendable to implement some sort of a global climate tax system.

5.2 GHG emission reductions

GHG emissions in GC tax scenarios are calculated based on the assumption that a newly generated renewable TWh replaces a fossil TWh (above demand). New generation has been calculated based on the amount of GC tax revenues and renewable installation costs (derived from historical developments). Under such circumstances, energy emissions will be eliminated completely by 2033 (Emergency scenario) or 2036 (soft scenario).



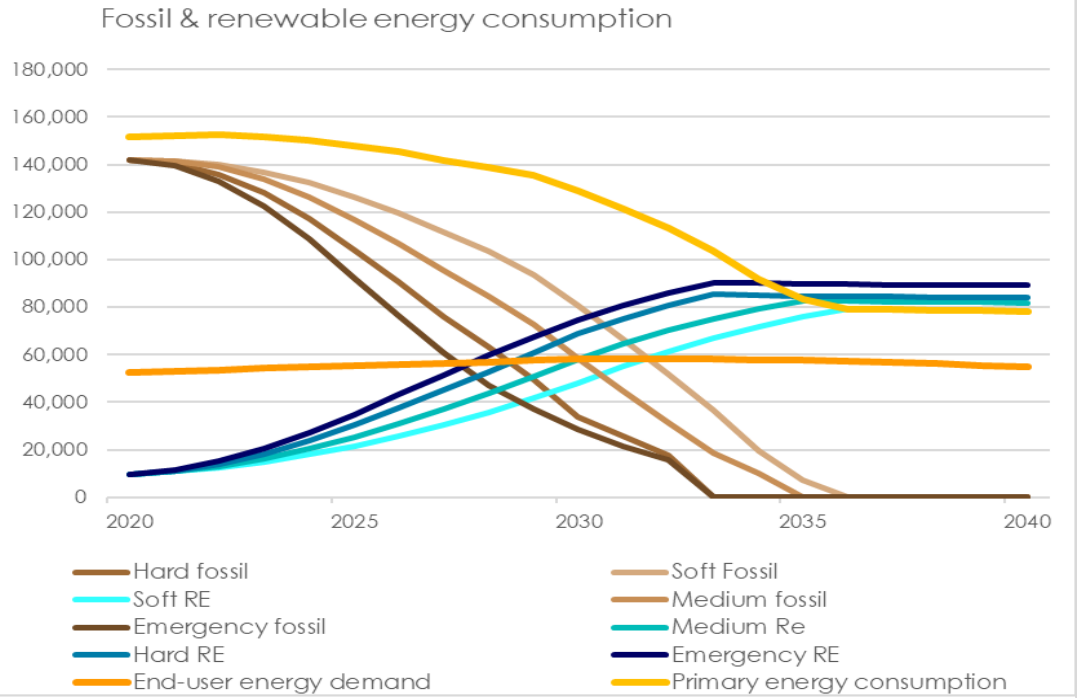
The above scenario only covers energy-related GHG emissions. However, it is possible if not likely that some technologies will not be sufficiently advanced by 2030 (in particular batteries for commercial electric air-transport). It is therefore likely that not all fossil energy can be replaced because of lack technology, even if renewable resources would be available. It is expected that energy-related GHG emissions will stabilise at around 2035 at a very low level (5% of todays emissions), before slowly decreasing towards 2040.



GHG emissions from all sources: some special applications and agricultural emissions will remain, albeit at a very low level

5.3 Energy mix: fossil reduction, renewable increase

The transition from a fossil to a renewable electric energy infrastructure can be implemented faster than most people think. Consumption of electricity could be higher than primary fossil consumption as early as 2025-2028 (year5-8 after initial implementation).

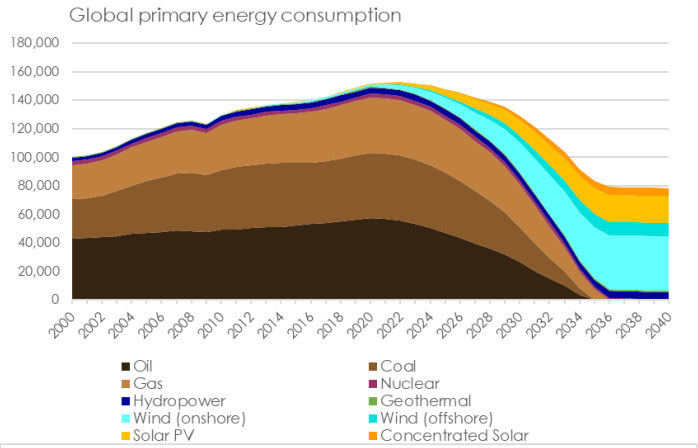


Fossil consumption reduction and renewable increase: between 2025-2030, the break-even point of fossil/renewable will be reached.
Not also the difference between primary energy consumption and end-user energy demand. Due to higher efficiency of electricity, primary energy consumption will decrease significantly while end-user energy demand will grow at a normal rate

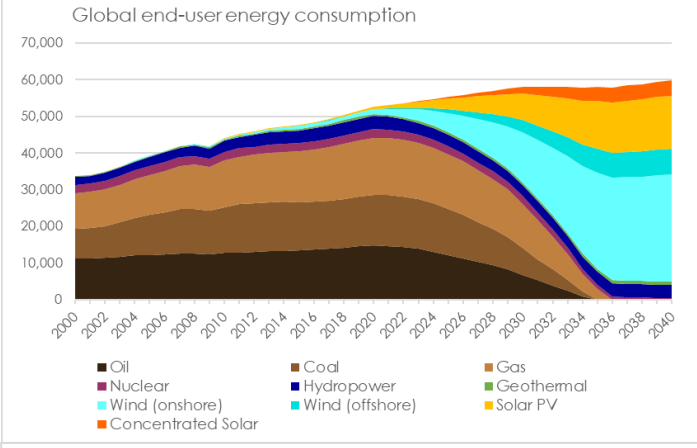
Primary energy and efficiency:

One key reason for the fast reduction of fossil consumption is fairly simple – it is efficiency. The efficiency of the machine that uses energy. Due to physical laws of thermodynamics, the efficiency of fossil energy that have to be burnt o release their energy content (thermal energy carriers) is very limited when transforming energy to movement. The power-to-wheel ration in modern cars for example is roughly 22% - compared to 70-100% in electric motors. In other words: a gasoline powered car uses between 3 to 4 times more energy to achieve the same than an electric car. Or: we need 3-4 times less electricity to achieve the same desired output, e.g. for driving from Paris to Rome. The transition to a renewable energy infrastructure based on electricity means highly improved efficiency.

Primary energy vs final consumption



Primary energy consumption. Due to the higher efficiency of electric appliances, primary energy demand is expected to lower significantly after the transition



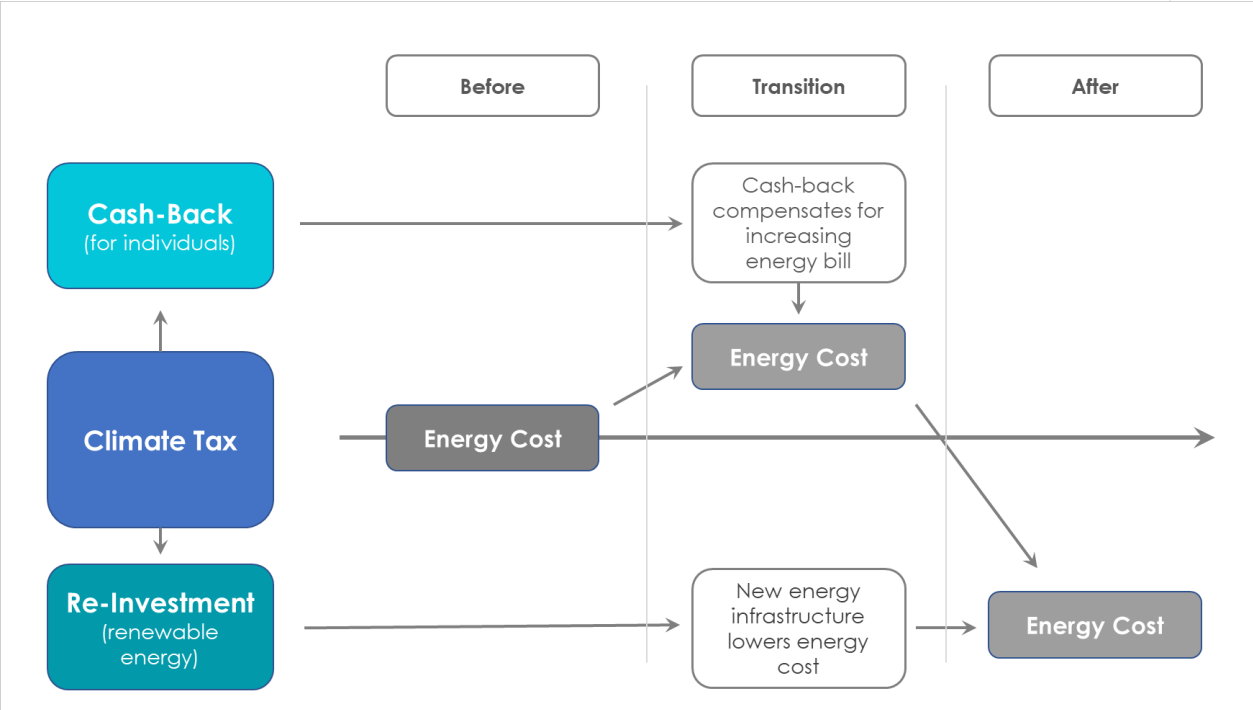
End-user energy: the energy we actually required by consumers. The 4 scenarios have been calculated based on the assumption that energy consumption is set to increase.

The left-hand graph shows "primary" energy, the theoretical energy content of the energy carriers we consume. The right-hand graph shows end-user energy demand. Due to the increase in efficiency, the energy demand of the world can be provided with lesser energy

5.4 The economy: Cost? Benefits!

Contrarily to common perception, a global transition to renewable energy infrastructure is not expensive. The analysis of the different scenarios of implementing a global climate tax on all GHG emissions shows:

- The climate tax is increasing the cost of primary energy fossil energy carriers (oil, gas, coal), creating incentives to increase energy efficiency
- At the same time, climate tax revenues invested in renewable energy infrastructure is driving down the cost of renewable electricity
- **The efficiency of burning fossil energy carriers is limited by the laws of thermodynamics**. Electricity is much more efficient. The more electricity is in the energy mix, the higher the efficiency lower the primary energy consumption and overall energy cost. **More renewable electricity = lower overall energy cost.**
- By 2030-33, financial benefits (lower energy cost) will outmatch additional cost.
- During the transition, energy cost will increase from currently 8% to between 12% and 20% of global GNI. However, because the tax is paid back & reinvested in full, GNI growth will not be negatively affected. If anything, **the climate tax will stimulate GNI growth** through increasing the spending power of low-income brackets and jobs and revenues generated through the building of the renewable energy infrastructure.
- **The global energy costs will be halved**, freeing resources for other development. The average global energy bill 200-2017 was 68.4% of GNI. After the transition, it will be between 3.5-4.5%.
- The world economy will finally be free of the unpredictable fluctuations of the oil price, increasing stability and planning security.



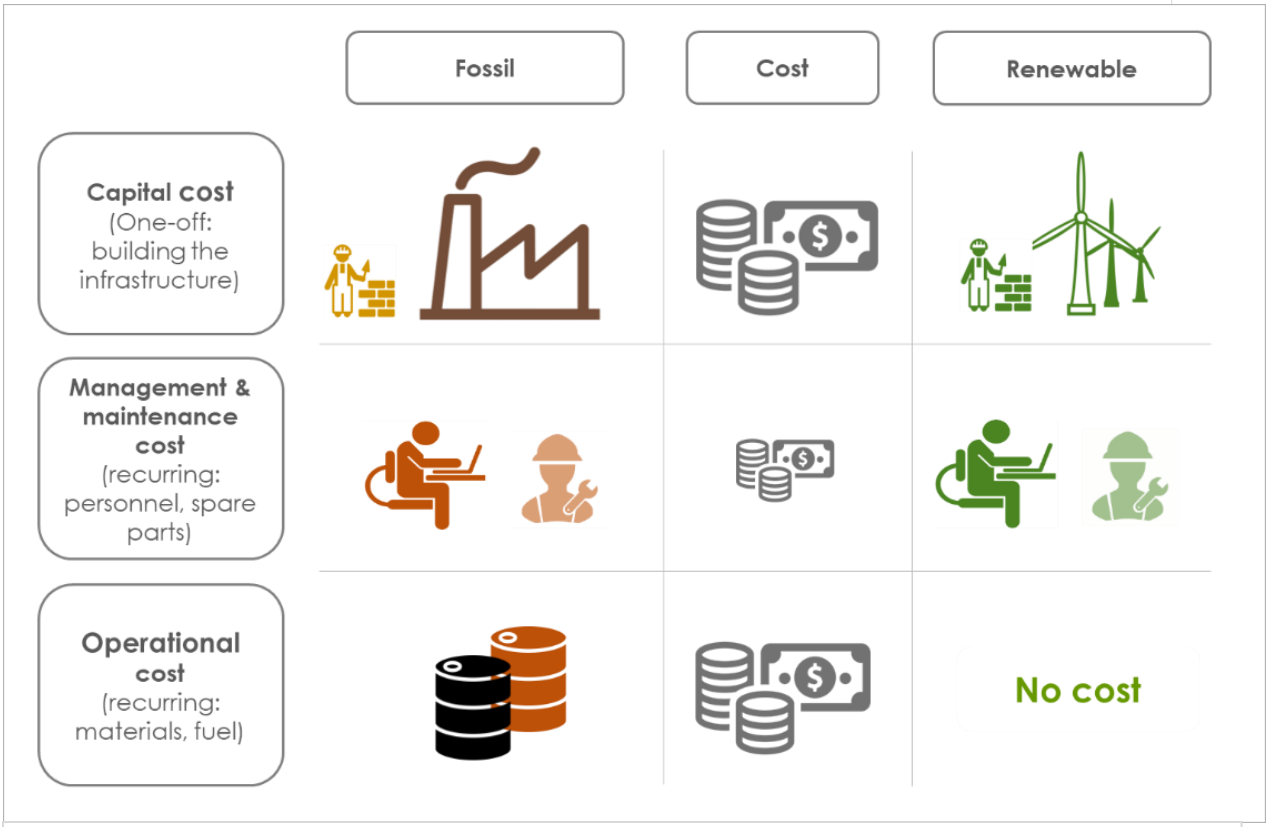
Energy cost are set to increase during the transitional period, but will be lower after the transition. Cash-back to people makes up for the increased energy cost, increasing purchase power of lower income brackets

Renewable are will be cheaper soon anyway

Fossil vs. renewable generated electricity

Generating electricity has three major cost parts: building the infrastructure (power plant, turbines, …), maintenance (employees to run & maintain the infrastructure), and operational cost (fuel). ***With renewable energy, there is no fuel cost.***

Why renewables will soon be significantly cheaper than fossil energy – anyway:

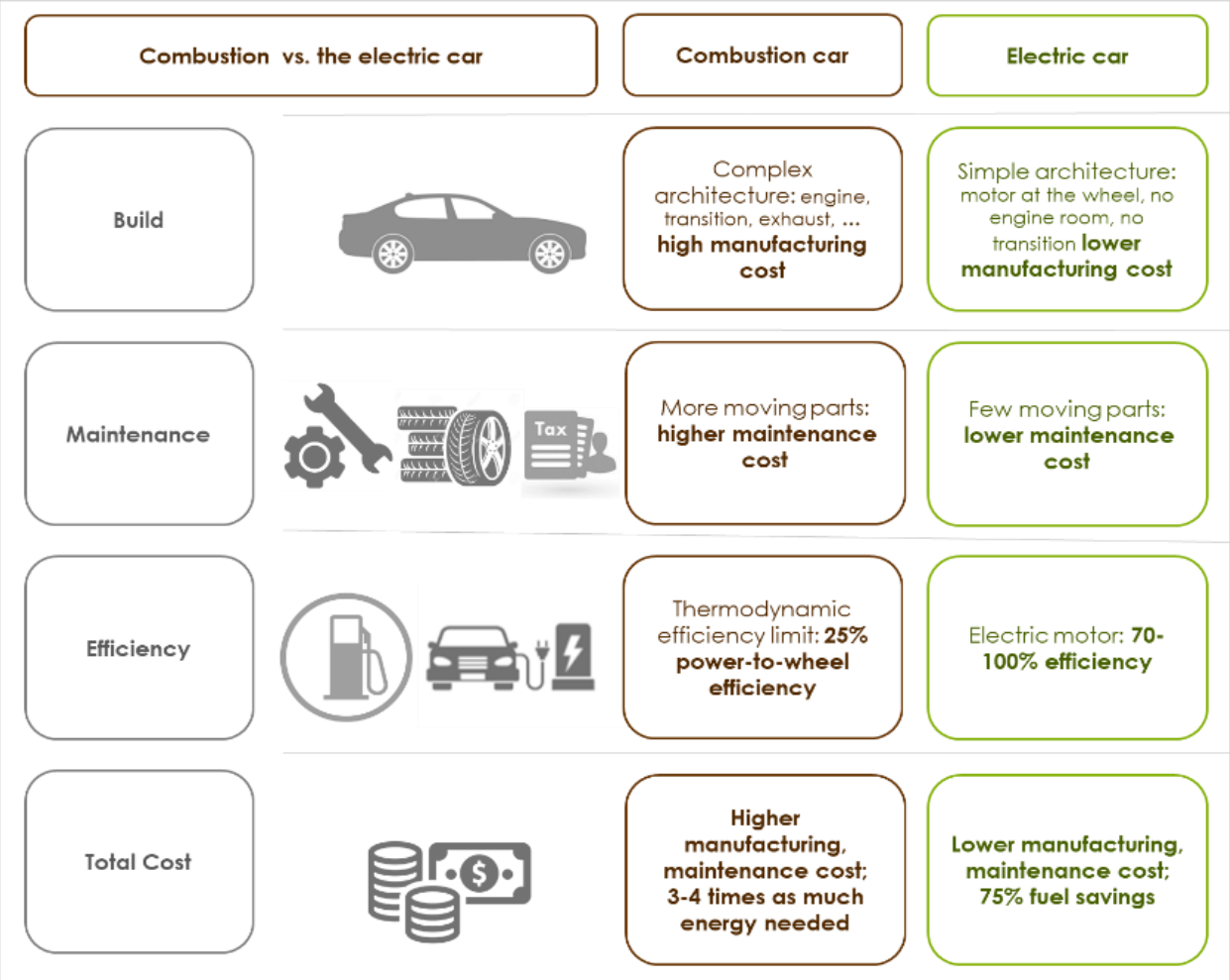


Cost comparison of fossil vs. renewable electricity generation: operational cost are high for fossil generation, but close to zero for renewables

Wind-generated electricity is – measured by levied cost of electricity – already now the cheapest electricity source. This cost reality is already reflected in investments in electricity generation infrastructure with more than half of global electricity investments allocated to renewable projects. While cost of renewable energy will further fall with the investments generated through the climate tax, fossil generated electricity becomes more expensive and therefor unattractive for owners and investors.

Electric vs. gasoline car

The same applies for the combustion engine – the efficiency of combustion engines is defined by the laws of thermodynamics. A gasoline-powered car has an average power-to-wheel efficiency rate of less than 25% (slightly higher with diesel engines), vs. 70-100% for electric motors: combustion cars require 3-4 times more energy than a comparable electric car. Over time, combustion cars will therefore no longer be competitive and would disappear anyway. The climate tax is accelerating this process by shifting the cost-balance quicker in favour of electric vehicles.



Schematic cost comparison of gasoline vs electric car

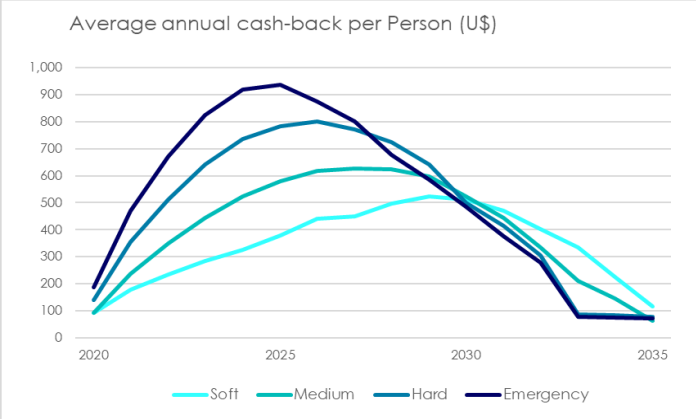
Climate tax is driving efficiency, lowering overall cost

Taxes on goods increase prices, somewhere. The climate tax will increase the cost of fossil energy carriers, liquid fuels and fossil-generated electricity for private and commercial use – affecting the energy bill of private households and increasing the prices of energy-intensive products and services. Higher cost induces human ingenuity and driving efficiency, lowering consumption.

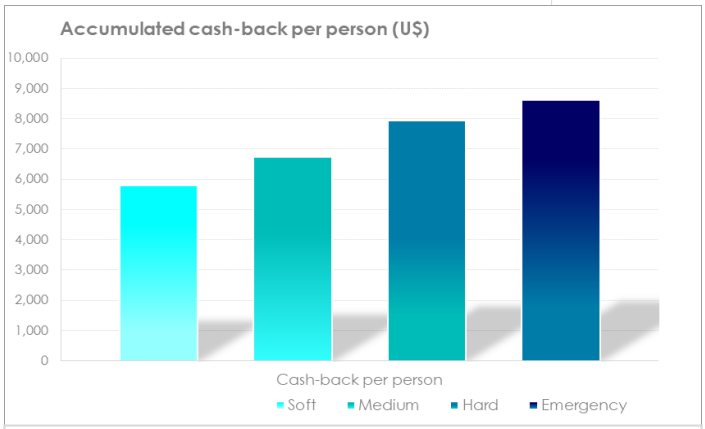
However, all of the taxes will be - fiscally neutral!! - reinvested in the economy: as cash-back to people, and as infrastructure investment in renewable energy and electricity storage. This mix will not only absorb the increased cost of fossil energy and energy intensive products/services, it will generate jobs and stimulate economic growth, even during the transition period.

Cash-back: more cash in hands = higher growth

The cash-back covers the increased cost of goods and services of daily usage, in particular fuel, gas, and heating oil. If, as suggested here, the cash-back is progressively distributed towards the lower income brackets, the cash-back puts more money in the hands of the lower income levels than their increased cost, contributing to an economic stimulus of local businesses where the additional available cash will be spent.



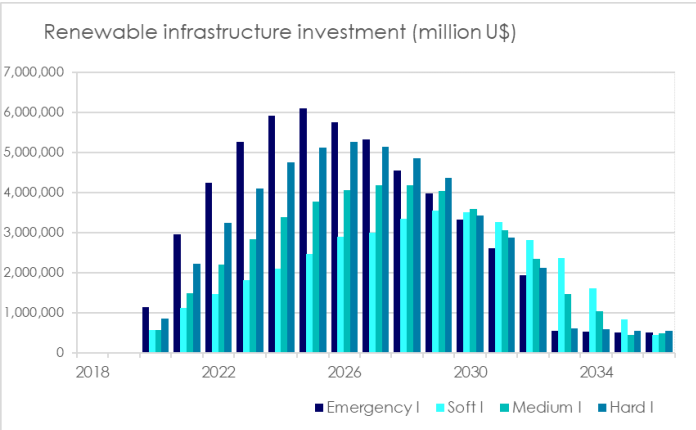
The average annual cash-back per world citizen depends on the scenario, ranging from U$100-500 per year (soft scenario) to U$ 200-900 (emergency scenario)



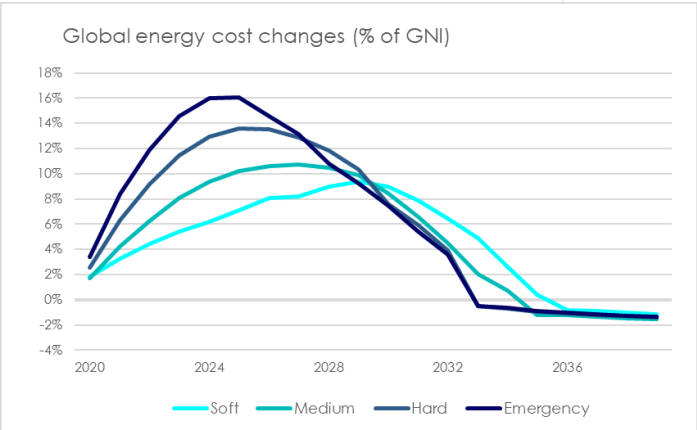
Accumulated cash-back per world citizen ranges from U$ 500-9000. The cash-back differs significantly from country to country – in countries with high current fossil energy consumption, the cash-back will be higher

Renewable electricity is reducing global energy costs

Tax revenues invested in renewable energy infrastructure lowers the cost of renewable electricity, both absolute and relative to fossil energy cost. Thanks to the higher efficiency of electric appliances vs. fossil combustion, lesser primary energy will be required to achieve the same final output (e.g. electric vs. gasoline vehicle), further lowering overall energy costs. By 2030-2033 (depending on the scenario), the financial benefits of the climate tax will outmatch the cost of the increased cost. After the transition, the global energy bill will be 4-5% of global GNI – 25% to 35% less than the average of the last 15 years, (6.5% of global GNI).



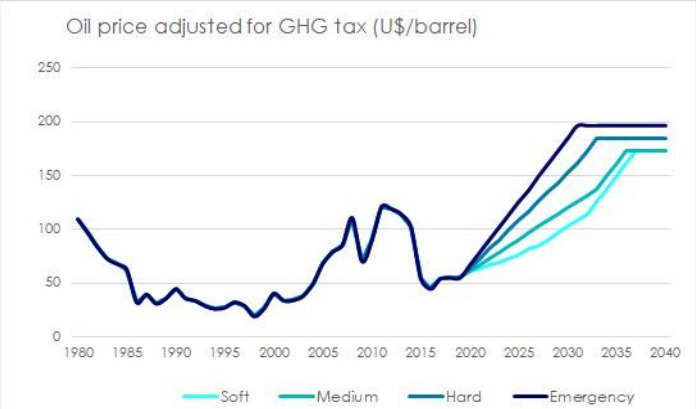
Investments in renewable energy infrastructure generated from the global climate tax



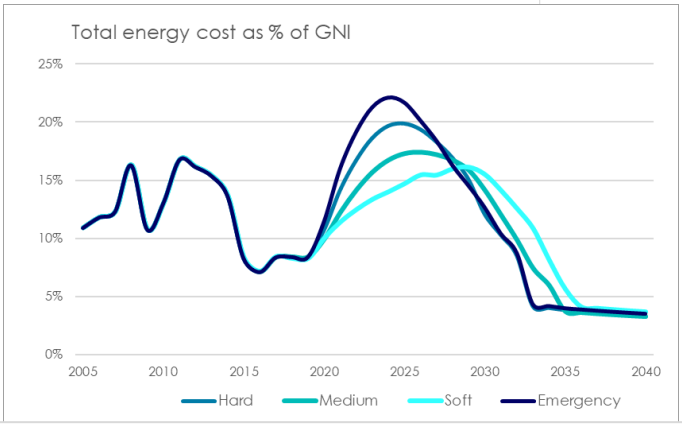
During the transition, the increase of energy cost is offset by the immediate redistribution (cash-back & investments): After the transition point, the global energy bill is 1% of global GNI lower than before

Ending global dependency on oil price fluctuations

The global oil price is subject to significant fluctuations. The oil price has gone from less than U$ 25 per barrel in 1998/99 to U$ 110 in 2008, and more than U$ 120 per barrel in 2011/12 – only to drop again to below U$ 50 in 2016. This means that the global economy can adjust fairly well to changing energy prices and costs: since 2000, the global energy bill has gone up and down between 4% and 11% of global GNI, without negatively affecting the global economy.



Spot-price of crude oil is subject to significant and not always rational (i.e. geopolitical) fluctuations, negatively affecting the stability of the economy. Under the global climate tax, the price of crude will increase to U$ 200 – by which time, cheaper alternatives are sufficiently available



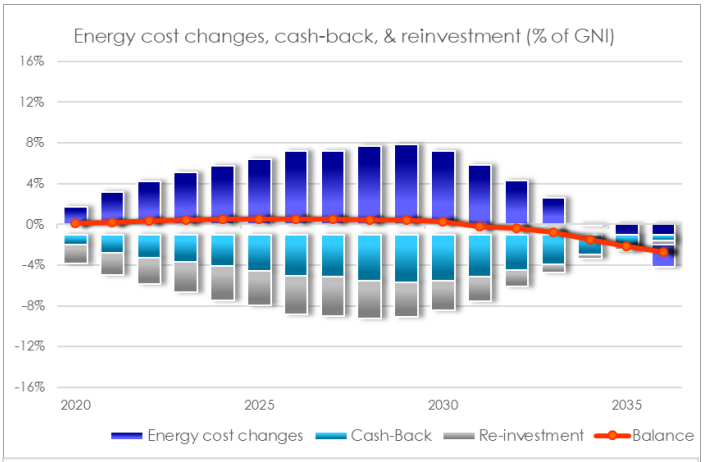
Global energy cost after the transition are below current levels and will remain stable, increasing planning security, stability, and eliminating the need for complicated hedging insurance

In addition, the tax levied on GHG emission will be initially low before progressively being increased over time. The staged introduction leaves the economy sufficient time to adapt to the changing cost environment. In other words: the economy has the ability to fairly easily absorb the initial increase of the energy costs due to a climate tax can be absorbed easily. In the lowest scenario analysed for this study ("soft" and "medium" scenario), global energy costs do not rise above the cost levels seen in 2008, 2011 and 2012 (or 1980, for that matter).

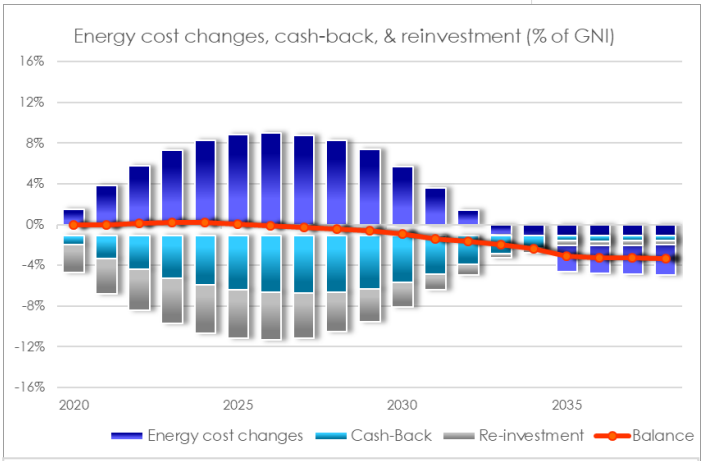
After the transition – depending on the scenario between 2027 and 2030 – the global energy bill will be 2-4% less of global GDP, or between 30-50% lower in absolute terms. As an added benefit, the world will be free of the fluctuations of the oil price, which are often geopolitical induced.

Cost & benefit effects

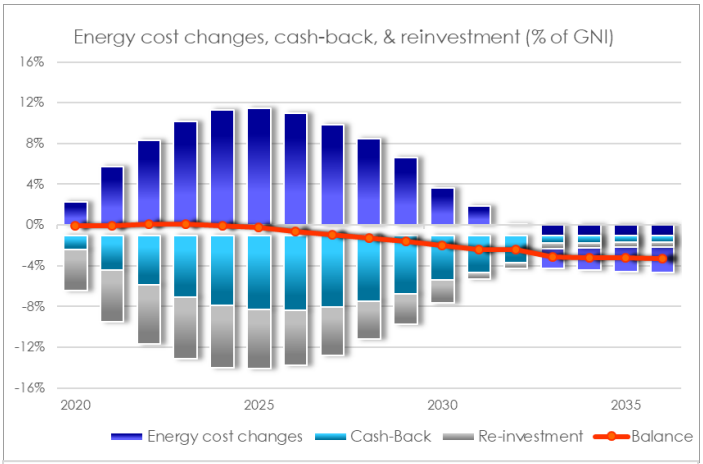
The climate tax increases cost, in the short term. Depending on the scenario, absolute cost impacat short-term differ significantely – from 7% (soft scenario) to 15% (emergency scenario). However, all additional costs are offset by the cash-back to citizens and the investments generated to build a renewable energy infrastructure.



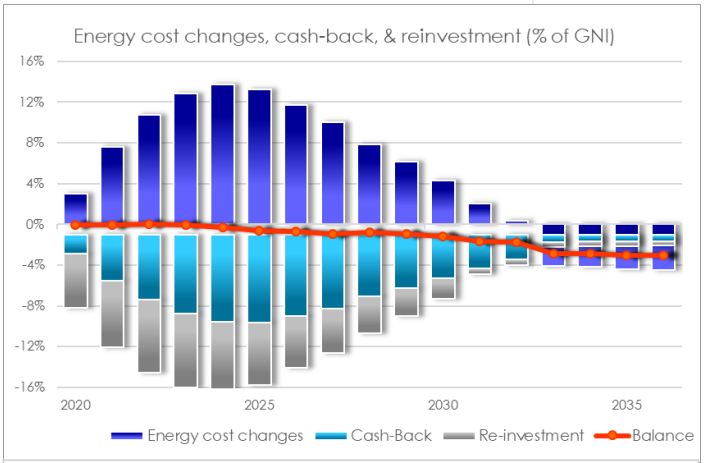
Soft scenario cost changes and balance: overall cost impact will be negative by 2035



Medium scenario cost changes and balance: overall cost impact will be negative by 2034



Hard scenario cost changes and balance: overall cost impact will be negative by 2032



Emergency scenario cost changes and balance: overall cost impact will be negative by 203. However, cost increase short-term is up to 15% of global GNI.

Nevertheless, the high increase could lead to an unplanned increased inflation, as well as difficulty in controlling prices. It therefore might be considered more prudent and more realistic to opt for a less drastic scenario.

5.5 Agricultural GHG emissions: how to replace meat & milk?

Agriculture is responsible for between 25% of global GHG emissions – and roughly 85% of that is caused by human breeding of animals (cow, pigs, chickens). We all love cows, but each cow produces more than 2 tCO_2e per year, mainly through the CH_4 (methane gas) released from the cow's digestion process. Cattle breeding is responsible for roughly 60% of agricultural emissions, with breeding of pigs and chicken is adding another 10% each. The significant proportion of overall global emissions of the agricultural sector makes it clear that these emissions have to be cut significantly. However – replacing meat, and maybe even more so, milk, might be challenging.

The theory is simple, with two possible solutions:

- we have to reduce meat and milk consumption, or
- alternatively, replace meat and milk with less GHG aggressive substitutes, e.g. soy-milk, plant-based meat substitutes, or lab-grown meat.

Diet change solution

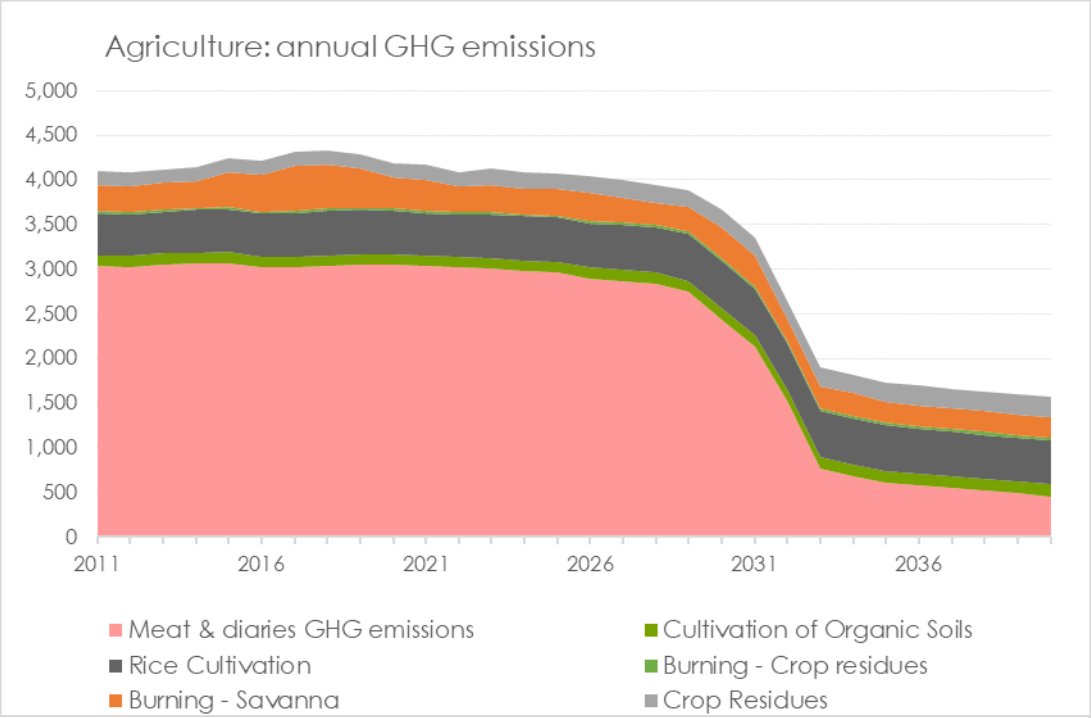
In order to simply reduce meat & milk consumption, large parts of humanity in the more developed world would have to change their diet, e.g. according to the "planetary health diet by the EAT Lancet commission. No doubt that such a diet – focused on a diverse healthy diet including more vegetable, fruits and nuts – would have significant positive side effects on the health of large proportions of society, in particular the more developed countries. However, it is neither feasible nor desirable nor possible to prescribe people what they should it. It is not expected that a majority of the global population is going to change their diet at the scale required to have a sufficient global impact on the agricultural sector's environmental footprint. A technical solution therefore seems more feasible.

Replacement solution

Technically speaking, the solution to increasing meat consumption is lab-cultivated meat. Lab-cultivated meat is, basically, growing muscles in a laboratory. The technology is already available, but needs to be refined and improved. When taking into account a GHG tax on meat, lab-grown meat will be cheaper than animal meat by around 2025. After that point, most meat from cattle - but also pork and chicken - could be gradually replaced with lab-grown meat. Apart from the obvious benefits – no need to breed & feed animals – lab-grown meat also has better hygiene characteristics and contains no additives that are feed life animals, directly (e.g. antibiotics and growth hormones) or indirectly (pesticides and other pollutants used in the cultivation of animal feed). Questions remain over the acceptance of lab-grown meat, but it is probably safe to assume that the price factor will convince most consumers.

Given human nature, the impracticality of ordering a certain diet on individuals, and the cost factor – cultivated lab-meat is expected to be cheaper than animal meat by 2025 - the replacement solution seems to represent a more feasible as well as more realistic way to curb agricultural emissions.

The following graph is based on the assumption that meat and, to a smaller extent, milk products can be replaced after 2025:



Agricultural GHG emissions under the assumption that livestock-meat consumption can be subsidised by lab grown meat after 2025, and, to a lesser extent, also animal milk. GHG emissions from rice paddies will remain.

For the purpose of this scenario, it is assumed that 90% of current meat consumption and 75% of milk consumption can gradually be replaced after 2025 with alternatives (lab-cultivated meat, soy and other replacements for milk), reducing agricultural emissions by 54%.

The main remaining source of agricultural GHG emissions after the transition will come from rice cultivation (rotting plants and other organic matter in the water of rice paddies that release methane). Considering that rice is the main and basic food staple in many countries, it seems not possible and not feasible to eliminate emissions form rice cultivation.

Positive side-effects of reducing livestock-based meat consumption

The agriculture sector, and in particular livestock breeding, has significant adverse impacts on the environment:

- Twenty-six percent of the Planet's ice-free land is used for livestock grazing
- 33 percent of croplands are used for livestock feed production.
- Billions of hectares of forest area are lost due to land conversion for agricultural purposes, as pastures or cropland, for both food and livestock feed crop

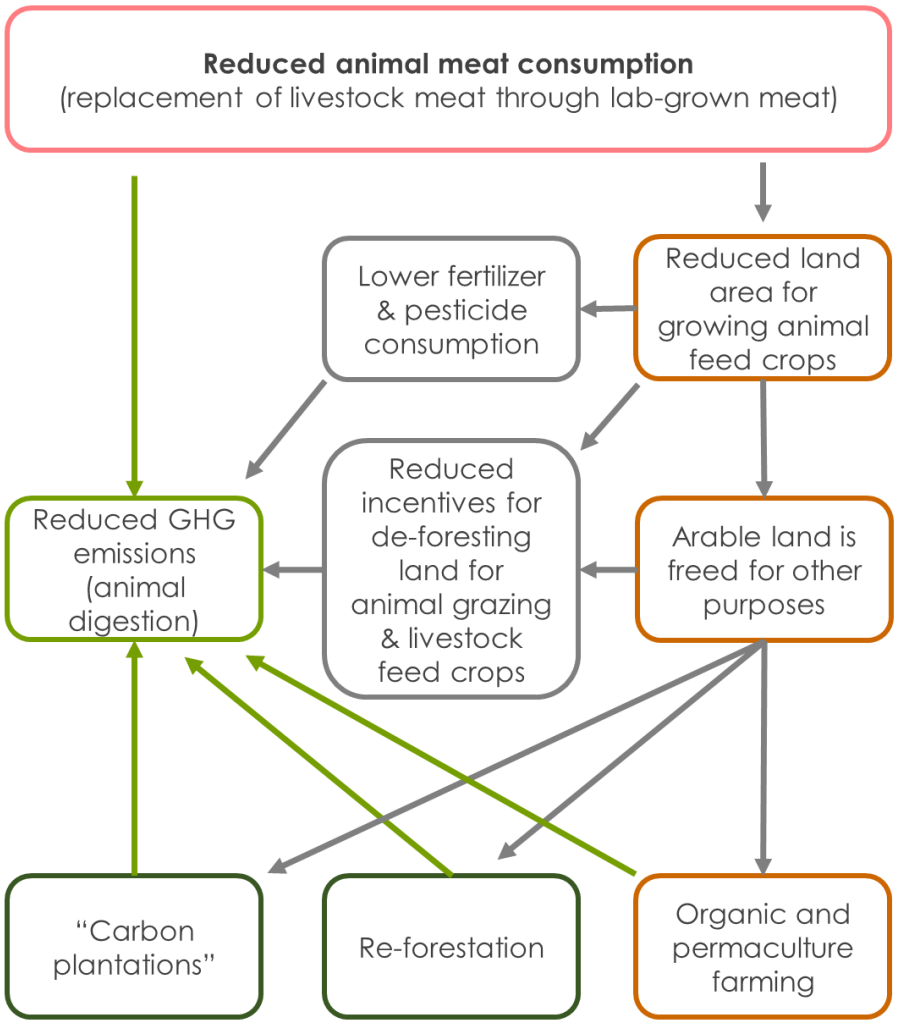
production. This has detrimental effects on regional water availability, soil fertility, biodiversity and climate change.

- More than 20 percent of the world grasslands are degraded and in danger of becoming infertile; a trend that is increasing, mainly due to intensified animal density per area.

A potential shift from animal-meat as we now know it to lab-grown meat would free significant positive side effects:

- Up to 30% of arable land currently used for livestock feed crop production could be freed for other purposes
- The reduced need for pasture land and livestock feed reduces the need to gain new pasture land, protecting existing forest areas from de-forestation

The freed agricultural land could be used to grow the basis of plant-based milk subsidies such as soy, nuts, almond, and other crops, for re-forestation to capture carbon and reduce atmospheric CO_2 concentration, and "potentially "carbon plantations"



Positive side-effects of reducing livestock meat consumption

Politics doesn't have a clue.

The climate youth movement means business.

6 Implementation

6.1 Be Realistic. Demand the Impossible

Every observer of the political landscape – both of individual countries and on global conferences related to the environment and climate change – would consider the introduction of a global climate tax as political impossible, and the demand for such a tax as completely naive.

However – the science is clear. We have only a very short time left to change course before irreversible climate change is kicking in with yet unknown consequences. However, even the best-case scenarios make it clear that the way of our life, if not humanity itself, is the what is at stake.

Demanding a complete halt to GHG emissions is therefore not impossible, and for sure not naive: ***Ending all GHG emissions is the only realistic way forward.***

So what does it need to implement a global climate tax?

- A majority of countries implementing the tax, forcing the other to follow suit because of import tariffs.
- The decision to implement a climate tax has to be made politically. The politicians have to make the decision. The tax therefore needs political acceptance and support.
- Unfortunately, politicians today are somewhat unlikely to come together and act.

And what does it need to make politicians act?

- Broad acceptance and support throughout all levels.
- Broad acceptance and support from the public
- Broad acceptance by and support for by businesses.
- Broad acceptance and support for by economists
- Broad acceptance and support by institutions – both public and private
- Broad but neutral media coverage

While there is significant acceptance for market-driven solutions amongst businesses and economists, that support is more in spirit, and not bundled into a singular set of concrete demands, therefore not very effective.

So what could channel those support into concrete demands?

- Pressure from the streets
- Incessantly lobbying of influencers (businesses of all sectors, institutions, non-governmental organisations. ….)
- Incessantly lobbying of the decision makers (petitioning, calling, mailing, …)

6.2 The Barriers

There are technical barriers, and there are human barriers to the implementation of a global climate tax. The human barriers are probably more difficult to overcome.

6.2.1 Technical barriers

- **Energy storage**: Today's batteries are not advanced enough to store electricity at the scale required. However, there are alternatives available until batteries can store sufficient electricity
- **Replacement of air-transport fuels:** we are currently still 25+ years away from an electric powered commercial airliner
- **Plastic replacement**: all plastics are made from crude oil and produce GHG emissions after their mostly short lives.
- **Lack of industrial capacity**: insufficient current capacity to build electric cars and renewable energy components

Energy storage

solar panels and wind mills don't produce when the sun isn't shining and there is no wind. That is a fact. We therefore need technologies to temporarily store electricity to be available for use when people actually need energy. The most obvious candidate are batteries. However, batteries are not yet advanced enough to store the amounts of energy required if we are to replace all fossil energy.

Energy density of batteries have been improving at an annual rate of 5-8%. At this rate, we are still 25 years away from sending a electric commercial airliner into the air. The climate tax will provide significant funds for R&D, which is expected to increase the annual density improvement rate.

In the meantime, there are alternatives available: converting electricity to other forms of energy, i.e. heat energy, kinetic energy, or gas-based energy carriers (H_2, CH_4) and then convert it back to electricity when demand requires. During the transition period, there will need to be investments made in a variety of energy storage infrastructure (power to gas to power, kinetic systems). All scenarios described in this report make amendments for investments in electricity storage.

Air transport

We are still 25+ years away from a real replacement for fossil-powered jet engines. While it is expected that the economic pressure and significant funding for R&D made available by the climate tax will reduce this time span, it is unlikely that commercial electric air-transport will be available before 2040. The climate tax will increase the cost of airlines by a maximum of between 20-40% (depending on scenario), which will reduce some, but most likely insignificant demand for air travel and transport services. A technical alternative might be represented by lab-cultivated bio-fuels based on algae, but cost developments of this technologies over the past 20 years do not look very promising. Based on this outlook, all 4 scenarios described in this report make provision for continued use of oil-based jet fuel for a period until well after 2040.

Plastics

Plastic is, basically, oil in another form. Thanks to its material specification, ease of forming, and low cost, plastic is used in all sorts of objects and appliances; not only in the form of plastic bags. At the end of the lifetime of the good, the plastic will be burnt or left

to rot in landfills, contributing to GHG emissions. While there are some alternatives available, it remains a significant challenge to subsidise all plastic in all its form. Further technological break-throughs are required before plastic can be replaced.

Industrial capacity

A global climate tax implementation requires a significant shift in industrial manufacturing: the production of renewable energy elements (wind mills, solar panels, etc.), but also the manufacturing capacity to produce alternative appliances, in particular vehicles. However, the manufacturing industry is highly flexible. Given the progressive increase of the climate tax would allow more than sufficient time for the global industry to adjust.

6.2.2 Human barriers

- **The political stalemate**: inability or unwillingness to facing challenges
- **Wrong perceptions:** "reducing emissions & renewable energy is expensive & will crash the economy"
- **Ideologies:** Ideologies always have negatively affected the judgment of humanity. The free market ideology is doing that too
- **Particular interests:** the influence of capital in the hands of the few, and the influence of those who make profits in the current protected market
- **Extractive industries:** the owners and CEOs of extractive companies are set to lose their business-as-usual guaranteed profits
- **Directly affected industries (real or perceived):** energy-intensive industries will be directly affected by increasing fuel costs and therefore be opposed to changes that threaten their business-as-usual profits, e.g. airline industries with the associated value chain (airlines, airplane producers, airport owners), or cement and metal producers.
- **OPEC/the oil-dependent countries:** a number of countries in the Middle East have generated free money for the last 60 years with the sale of abundant and easily accessible fossil resources. The near-elimination of the fossil energy market would completely dry up their income streams in the absence of the development of an economic alternative. They will not be happy.

Politics

Politics (and/or politicians) today seem to be unable to accept science - science they otherwise use in their everyday life. The functioning of a mobile smart phone is based on science, as is the working of a car. so is climate science.

Politicians The also seem to be unwilling to face up the challenges: what has been achieved so far – both in domestic country politics and in international agreements – is dismissal in face of the challenges.

Politics is heavily influenced by capital. In democracies, parties and politicians need funds to finance their campaigns to make themselves heard. In autocratic states, the co-operation between the political rulers and the wealthy is a constant that runs through all of human history (the politicians make the wealthy wealthier, in exchange the wealthy support the politicians to stay in power.

Wrong perceptions

How many times have you heard politicians say "We love nature, and we want to protect the environment, but economic development comes first." Or, "We love the environment, but alternatives to fossil fuels are too expensive".

We all know they are wrong. Tackling climate change is a big business opportunity, lowering the global energy bill by 2% of GNI.

Ideologies

There are advocates – economists, politicians, in the media – that advocate a totally free market, where all the decisions are left to the market. There is no such thing as a free market, as we can observe. In a free market, the more powerful players make the market and its rules, and/or buy potential competitors, leading to less competition, less innovation, worse products/services, and all that at higher prices.

Markets can be directed whatever way the regulators choose. If regulators are making wise rules, everybody – including the environment – profits. Some people and/or corporations maybe will make a bit les profits, if they cannot adapt to changing market environments.

Particular interests

Everybody – both private individuals and the economy – needs energy. The main energy sources are oil and gas, and coal (all fossil energy). Oil, gas and coal exploration and selling is therefore an immense business.

Some – mostly very small groups – profit from the status quo, and through the accumulation of power and capital, have been able to influence regulations and policies supporting their aim, and therefore objected to changes to a business model that guarantees them endless profits. Through their extraordinary power and masses capital strength, these groups exercise influence far beyond their actual importance – in the media, in politics, on the markets.

Extractive industries

The climate tax is more or less eliminating the need (and therefor the business case) of the extractive industries. However, the changing environment does not necessarily equal less business; it only means less business for companies unwilling or unable to adapt to the new circumstances. For example, if a company identifies itself as an energy company, there are immense new business opportunities, facilitated by the large sums generated by the climate tax and reinvested in renewable energy infrastructure. However, if a company identifies itself as a "coal" or "oil" company, then the business outlook is less rosy.

Directly affected industries: energy intensive industries

Some industries are directly affected by increasing fuel costs, including the fossil and airline industries, as well as utilities that failed to read the signs of time, focussing investments on fossil electricity generation. The airline industry is particularly affected, because alternative technology (electric powered commercial airliners) are not yet available. Increasing fuel cost therefore might lead to less frequent flying; weekend city hoping by air, for example, is likely to decrease under a progressive climate tax.

We have to expect significant opposition to a global climate tax by the fossil and airline lobbying industry.

OPEC

OPEC countries will lose their main (and sometimes single) income sources, yes. They most likely will be opposed to the global introduction of a tax that is designed to end fossil consumption. In addition, the predominant male conservatism is inherently opposed to change, and maybe incapable of seizing the opportunities in the challenge. However, the graduated introduction of the tax should allow for sufficient time to adjust and develop new income sources – for example in solar energy production.

6.3 The Requirement for Success: Multi-strategy dissemination and engagement approach

Politician's in democracies have been elected to serve the people – making rules that allow individuals to fulfil their potential in a healthy, violence-free environment. The same applies in autocratic states. We all would love if politicians would take active and strong measurements to tackle climate change. Unfortunately, that is unlikely to happen. Not on a national level, and even less so on the global level. Tackling climate change therefore requires a different approach that forces the hand of rulers/politicians.

In short –

- Politicians have been elected and took an oath for serving their country and the people. It therefore would seem natural that politicians would act for the benefit of all. For some strange reasons, in practice they don't.
- The US is the only country that, thanks to its size and importance of the economy, could single-handed force a global agreement on a global climate tax. Just tax everyone that does not participate in a global scheme 30%. In practice, there is not even Mickey Mouse. The fact that some of the candidates for the next presidential election are running on a fight against climate change platform is an encouraging sign, but not at all a guarantee for real changes.
- The markets: ending financial support for fossil projects of all kinds could accelerate the transition to a renewable infrastructure. While there have been some divestments made by large public owned funds, and all banks these days claim to integrate ESG factors in their investment risk/opportunity analysis, banks and the overwhelming majority of capital owners/asset managers go about their business business-as-usual. The financial markets will not be the decisive player – unless forced into this role through regulation.
- On-line actions such as petitions have not proven to be very successful in the past
- The new, independent, not politically affiliated, and fast developing movement of school pupils and students (climate strike, Fridays for the future) have significantly altered the landscape, the awareness, and the discussion around climate change. While there is an incredible energy and mobilisation in this movement, it is not clear whether their pressure will be sufficient to force real changes, quick.

Barriers

Can potentially be overcome	Most likely cannot be overcome
Wrong perceptions The general perception of the cost of a renewable transition are completely wrong. Information can overcome these perceptions, adding to the mobilisation of the climate movement	Views/opinions influenced by ideology
Political stalemate Street action paired with constant lobbying and information campaigns, potentially paired with mass acts of civil disobedience, change the perception and urgency in politics	Opposition of company-owners and executives in the extractive industries (particular interests) that are set to lose guaranteed income streams
The financial industry Targeted and creative acts of street and inside pressure on financial institutions might reduce the investment in fossil projects and assets	Opposition of the rulers of oil-dependent countries (OPEC countries)

In the absence of a US president supported by a like-minded congress that is taking real and fast action, the youth movement seems to be the most promising force. There is a chance that the youth on the streets and multiple pressure can force the hand of politicians and the financial markets.

A scenario with a somewhat not completely unrealistic potential for success therefore has to be multi-faceted and concentrated on the barriers that can be overcome:

Politics' assignment is to serve the people and guarantee an environment where individuals can fulfil their potential. It is not natural that politics cannot be changed. Politics can change. However, it seems the hand of politicians need to be forced to act. The hands of politicians can be forced through

- Information, information, information
- Continued mobilisation of people in the streets to show that business is meant. However, the masses need to be even bigger than today
- Constant lobbying of the key players and institutions in politics and industries, through on-line actions, letters, calls, and personal mobilisation
- Creative, peaceful acts of civil disobedience could increase pressure on both politicians and industries, if conducted regularly and at points that "hurt". For example through short, but regular blocking of key transport infrastructure (e.g. fossil industry infrastructure and facilities, highways, airports, banks, …)

In addition, there are two key requirements for the climate movement to be successful

- Political independence. The movement has to be kept free of any affiliation to any political parties and/or political figures
- The climate movement has to remain peaceful and free of violence at all times

Scenario calculation and data sources

Key assumptions made for all scenarios:

- World population, GNI and energy usage (end-user demand) grows at the average of the last 10 years
- Each additional energy unit of renewable produced energy replaces a fossil unit
- Historical energy data is derived from IEA, IMF, and BP Energy Statistics
- The spot price for oil is assumed to grow with global inflation (before climate tax), but expected to slight fall after 2025 due to sinking demand
- Renewable cost projections are based on historical trends, projections made by IRENA, and own calculations
- Provision for the losses of the increased need for storage of renewable electricity have been included
- Not all emissions can initially be taxed, but the rate is increasing over time
- Assumptions have been verified through interviews with experts

Data sources

- World Bank
- IMF commodity database
- IEA energy data
- BP energy statistics
- IRENA

About this Report

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The contents of this report have been researched, calculated and compiled by SolAbility. SolAbility is a Swiss-Korean competitiveness think-tank with a successful history in management consulting.

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About Global Climate Tax

Global Climate Tax Now is a non-profit association.

We are slightly concerned about what science is telling us.

We believe that action needs to be taken.

Now.

Luckily, tackling climate change will also save our economy.

Further information: www.globalcarbontax.org
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Change Climate Change

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