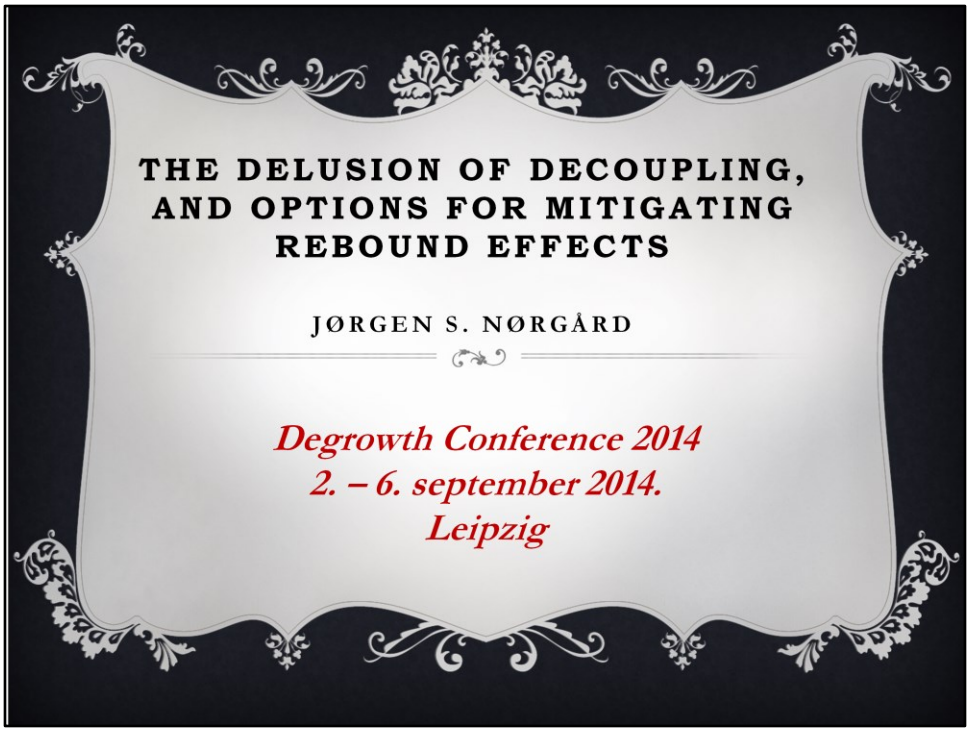


I will here consider three aspects of rebound and degrowth, which I have found are important, but often ignored, namely 1) the importance of the population development, 2) the postulated option for decoupling environmental impacts from the human activities expressed by GDP, and 3) the ignored potentials for increasing the lifetimes of our durable goods.

The following slides with notes are complementing (and overlapping) the long abstract: *The delusion of decoupling, and policy options for mitigating the rebound effects and the environmental impact,* by the same author for the same conference.

First a little about a very simple model behind the environmental damage.

BASIC STATIC EQUATION

$$I = P \cdot A \cdot T$$

or:

Env. **Impact** = **Popul.** · **Affluence** · **Techn.** Eco-intensity.

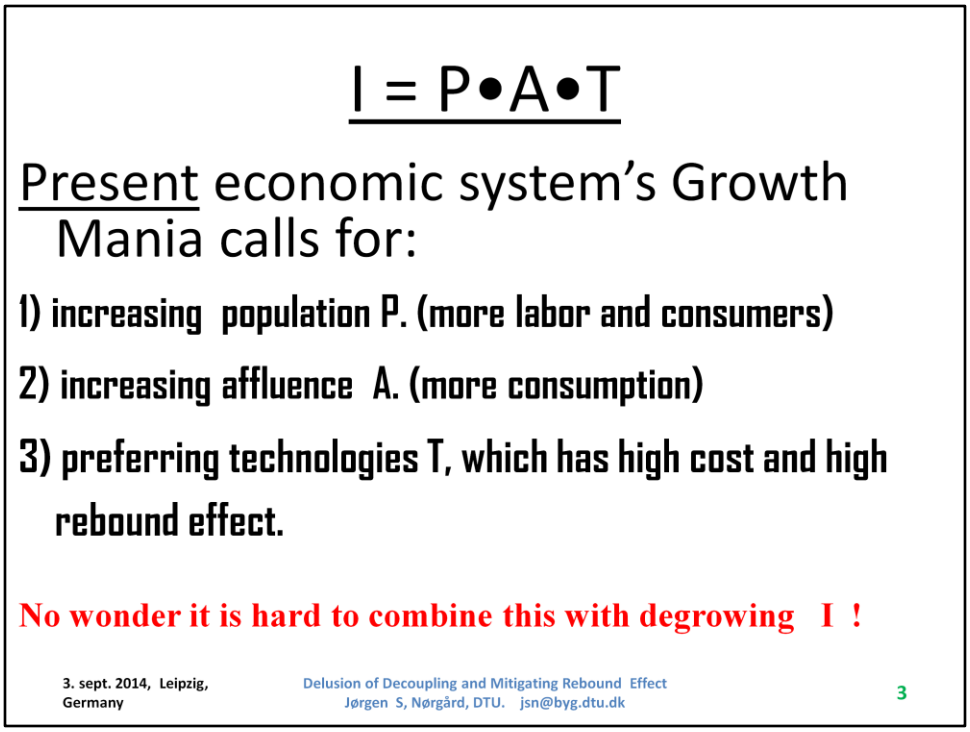
or:

$$I = f(P, A, T)$$

In environmental studies, I like to hold on to the simple I=PAT equation as a memo to keep in mind the basic causes of the environmental impacts, we are trying to mitigate. The four factors can for instant be expressed as indices, relative to a certain basisc situation. This simple version where the three decisive factors are just multiplied, applies to a **static** situation, with no interaction between them.

However, the rebound effect demonstrates for instance that with a reduction in 'T', = the environmental impact intensity of the technology, (i.e. more energy efficient energy using technology) , 'A' tends to grow. Also, 'P' seems to depend on 'A'. This all means that the three factors are not independent of each others, and for a more dynamic and realistic situation, the equation should express 'I' as a function of the three parameters.

Still, however, the simple static version is useful, for instance for remembering the often ignored population 'P'.

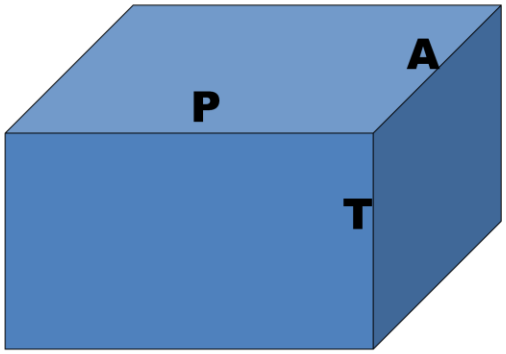


Almost all affluent countries, such as the European nations, as well as Japan, have quite low birth rates, often below replacement, which of course on our dense populated planet is a positive trend. Nevertheless, in these regions, politicians are usually expressing concerns over the transition problems of a declining population. The aging population will have fewer people in the *working age group*, and more in the groups dependent on supplies of output of goods and services from this shrinking group. The dilemma can, however also be interpreted as politicians being scared of having too few workers to produce goods, and too few consumers to buy the goods. Hence they have a more or less hidden agenda of increasing the birth rate.

With a few exceptions, politicians in these affluent countries want also the per capita consumption 'A' to grow further in the future. They simply want both 'A' and 'P' , and thereby their product, Gross Domestic Product, GDP , - to grow so far without setting any goals or limits for the size .
If such politicians also want to appear 'green' by lowering the environmental impact 'I', they only have the third factor 'T' to rely on, i.e. letting eco-efficient technology to do the task. But even here there seems be a preference for technologies which in their very production create GDP and jobs, and hence eat up a substantial portion of the environmental gains obtained through the technological efficiency, among other ways through the *rebound effect*.
Consequently, it is very hard to achieve the necessary reduction in 'I'.

MOST IMPORTANT FACTOR ?

Env. Impact = "VOLUME" = **I = P•A•T**



Which of the three dimension of the box is the most important for the volume?

3. sept. 2014, Leipzig, Germany

Delusion of Decoupling and Mitigating Rebound Effect
Jørgen S, Nørgård, DTU. jsn@byg.dtu.dk

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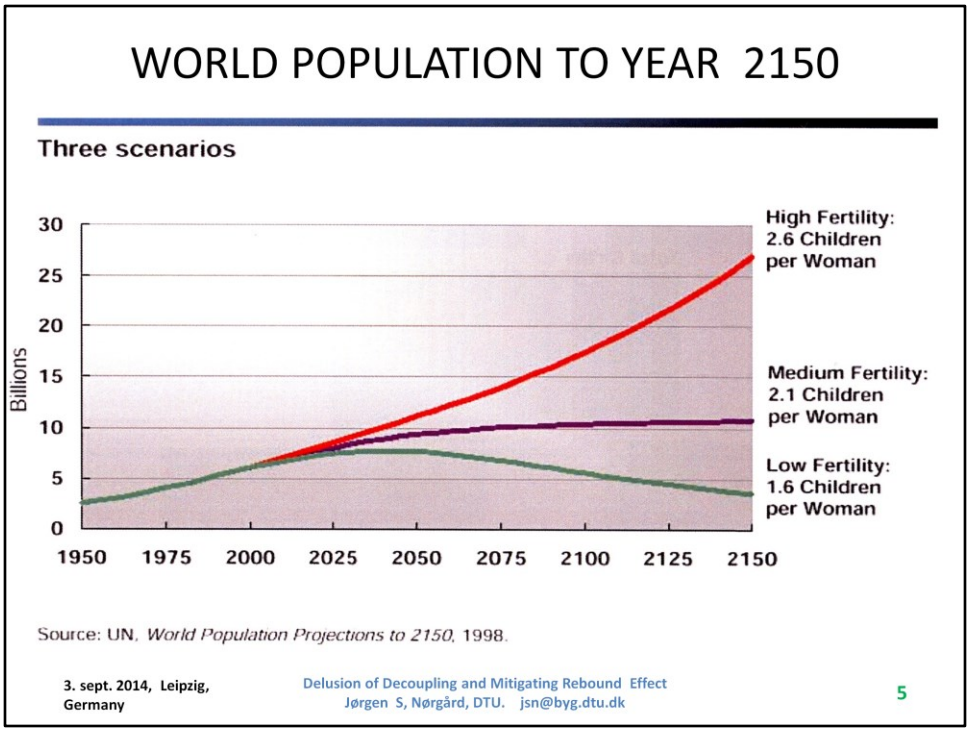
The three factors, 'P', 'A', and 'T', causing the environmental impact, can graphically be illustrated by the three dimensions of a box, the volume of which then represents the total impact, 'I'. The dispute in the environmental debates is basically often about which of the three factors is most responsible for the environmental impact, which we are trying to mitigate. Some claim that the affluent consumption patterns, 'A', in the Western economies is the main the cause of the problems. Many think it is an insufficient technology, 'T', we apply to provide the affluence. Finally some, but actually rather few, refers to the number of people on Earth, 'P' as responsible for this **man** made environmental misery.

The answer is that it is all three of them. It seems, however, to be hard for humans to imagine that there can be more than one cause of a problem. Now, imagine the environmental impact is represented by the volume of the squared box shown, and has to be reduced to say one tenth. Which dimension is responsible – or most responsible – for the volume? The question does not make sense. If one of them was zero, the volume would be zero. If one of them shrinks to half, the volume would be halved. If one is reduced to half and another one is doubled, the situation, the volume, would remain the same. We need to have all three factors in mind when aiming for sustainability. Improving the technology is typically through the **rebound effect** more or less eaten up by growth in affluence and/or population, and we are still bad off.

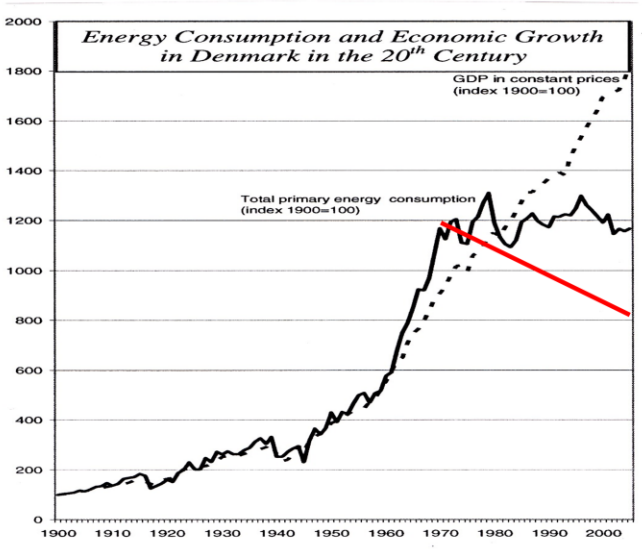


The graph shows the marked long term effect of birth rates on population development. Often the population issue is termed the population *growth* problem. But the very *size* or density of population should be the issue, something realized in the policy of a few pioneering countries like China, the aim of which is to **reduce** population over time as a way to offer a better life condition for future generations. As seen, relatively small changes in the number of children born per woman, from average 2.6 to 1.6, makes a difference in the year 2150 from around 27 billions to only 3.5 billions. The latter is about half of the present world population and would make it significantly easier to cope with environmental problems than will the former. Is a future birth rate of only 1.6 on average not totally unrealistic? Not really, it is around the present average in Europe and China !

Following the success of China, birth rates in other parts of Asia are dropping significantly. In some parts of Africa birth rates are still high, but there are indications, that women would prefer to have few children if only the contraceptives and information were made more easily available.

Unfortunately, often short term and narrow economic growth consideration make politicians to not only ignore the population problem, but *even to encourage higher birth rates in Europe, Japan and other countries which are on the right environmental track with low birth rates.*

MYTH OF DE-COUPLING



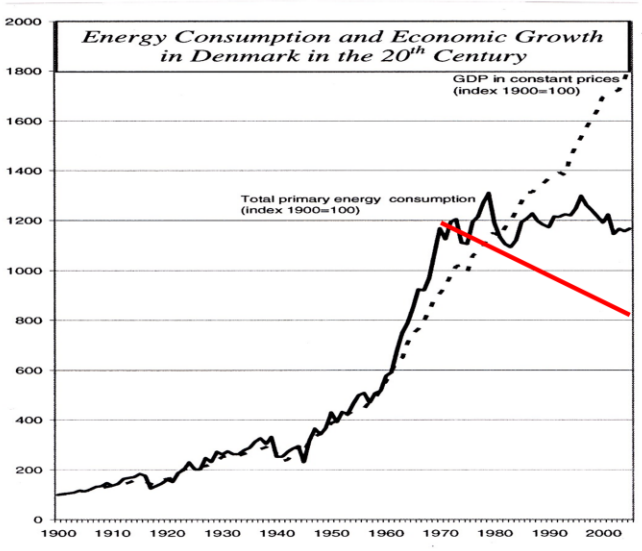
Denmark's energy intensity, 'T', has since1970 dropped by about 30%.

Q: Why has this not given a similar drop in energy consumption, 'I' , **red line** ??

Source: Updated from Hansen(2002) (http://dspace.ruc.dk/handle/1800/1124/) with new data from Danmarks Statistik, Statistikbanken

Now, a few words about the **postulated options for decoupling** the environmental impact from human activities. The solid black line illustrates, how Denmark within its borders has managed around 1970 to stop the growth in consumption of primary energy, and ever since stabilizing it for about 40 years. Since the economy, expressed by GDP, continued its growth, as shown by the black dotted line, this has often been used as an example of such a decoupling between economy and environmental impact, which, however, is a misunderstanding.
The red line indicates how the energy efficiency improvement – to a large extent by converting thermal power plants to combined heat and power plant – would have reduced the 1970 energy consumption by about 30 %.

MYTH OF DE-COUPLING



Denmark's energy intensity, 'T', has since1970 dropped by about 30%.
Q: Why has this not given a similar drop in energy consumption, 'I' , **red line** ??

A : It's Coupling to GDP !

Jørgen Nørgård

3. sept. 2014, Leipzig, Germany

Delusion of Decoupling and Mitigating Rebound Effect
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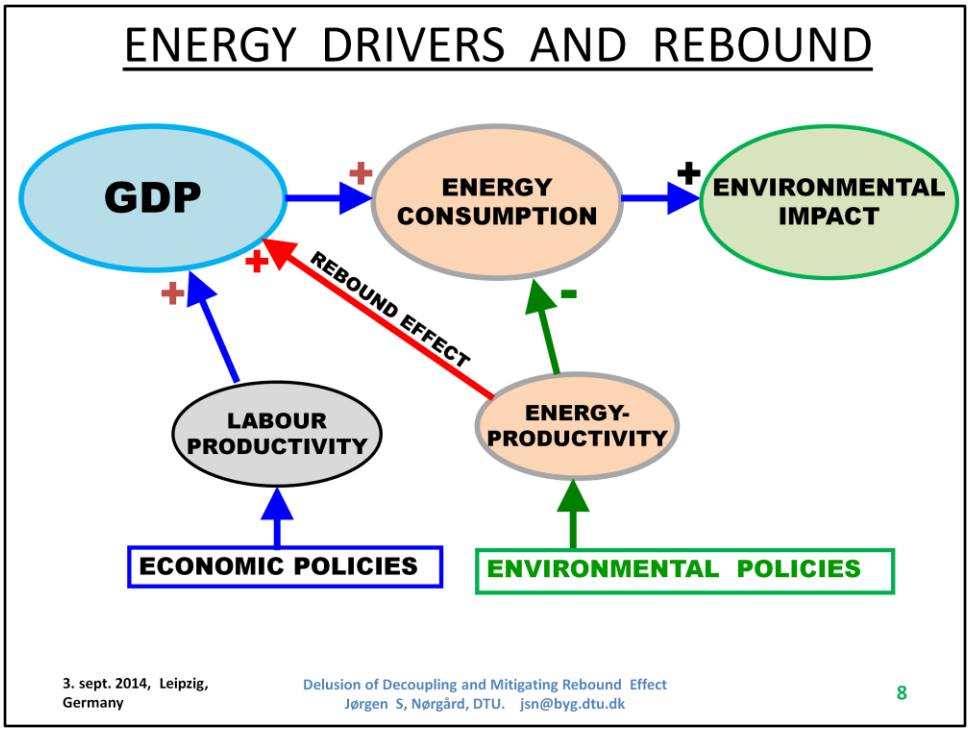
The reason why this reduction did not materialize was the obvious **coupling** between energy consumption and a growing GDP.

A decoupling should imply no coupling at all between the two, which physically is ridiculous to assume, recognizing that all environmental impacts are rooted in some economic activities, just as the other way around, all economic activities cause environmental impacts, more or less.

The problem in using the term 'decoupling' about this statistical delusion, is that it gives the public and the politicians the impression that GDP can go on growing infinitely without any increase in energy consumption or other environmental impacts.



A little system thinking.
As long as we have an economic policy, the most prominent goal of which is to limitlessly turn all productivity gains into more GDP, then we have a problem.
More efficient use of energy and other resources, constitutes *productivity* gains, just like increase in labor productivity does. These productivity gains will therefore through what is called the **Rebound Effect,** push upwards the GDP and hence energy consumption. In some macroeconomic cases higher energy efficiency can in this way stimulate the economy to an extend that it eats up more than the technological gains and leads to a higher total energy consumption, if no actions are taken to counteract this effect.

Also, it is obviously **nonsense** to talk about a **decoupling** (meaning no coupling) between GDP and energy consumption (and environmental impact). There has always – and there will always be -- a coupling between the two, even if they grow at different rates. This coupling can to some extend be counteracted by the gains in energy efficiency, but the coupling still exist.

Ref.: Nørgård, J.S. 2009: Avoiding Rebound through a Steady-State Economy. Chapter 10 in : *Energy Efficiency and Sustainable Consumption: The Rebound Effect,* Palgrave Macmillan, UK. www.palgrave.com

INDIRECT RESSOURCE SAVINGS

PEOPLE'S AFFLUENCE CONSISTS OF TWO TYPES:

1) **FLOWS** OF **NON-DURABLE GOODS** (FOOD, BEVERAGES, ENERGY, ETC.), VALUED BY BEING CONSUMED.
2) **STOCKS** OF **DURABLE GOODS** (HOUSES, BIKES, CLOTHES, COMPUTERS, ETC.) VALUED BY PROVIDING SERVICES TO PEOPLE.

1) GETS MOST ATTENTION IN ECO-DEGROWTH POLITICS,

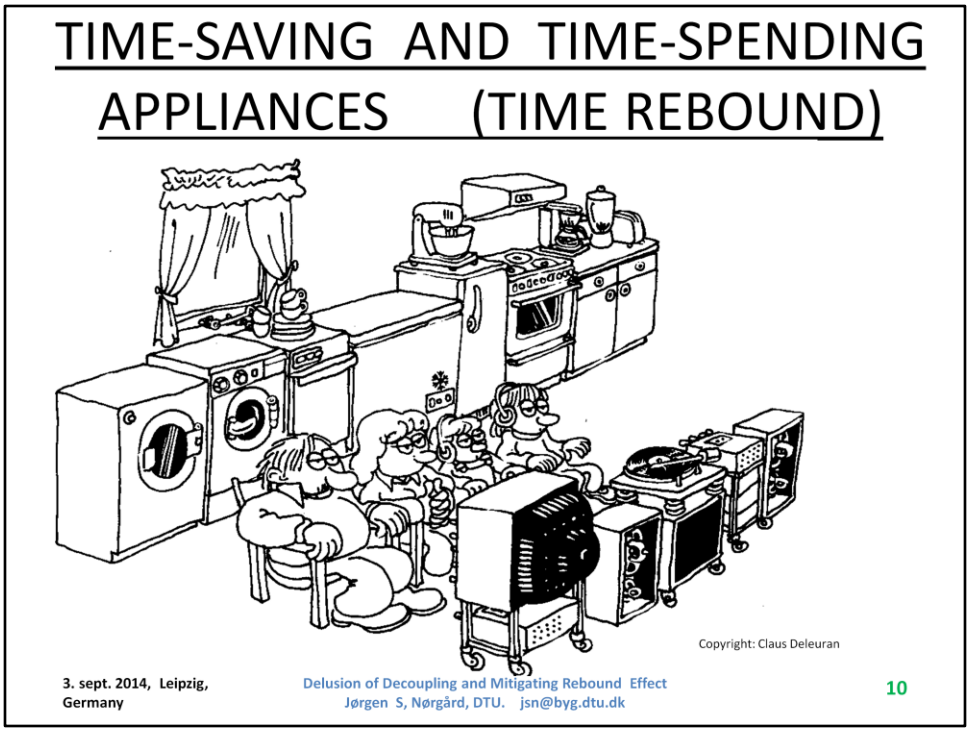
BUT:

2) PRODUCING, MAINTAINING AND SCRAPPING 2) , THE STOCKS ALSO INVOLVE FLOWS , AND HIDES HUGE **INDIRECT DEGROWTH OPTIONS.**

In the debate, energy savings or environmental improvements are usually referring to the **direct** energy consumption, like when heating the house, driving a car, or running a refrigerator. Another category of energy use is the **indirect** consumption, for instance used in producing the house, the car, the refrigerator, as well as producing furniture and many other durable goods, which consume no energy in use.

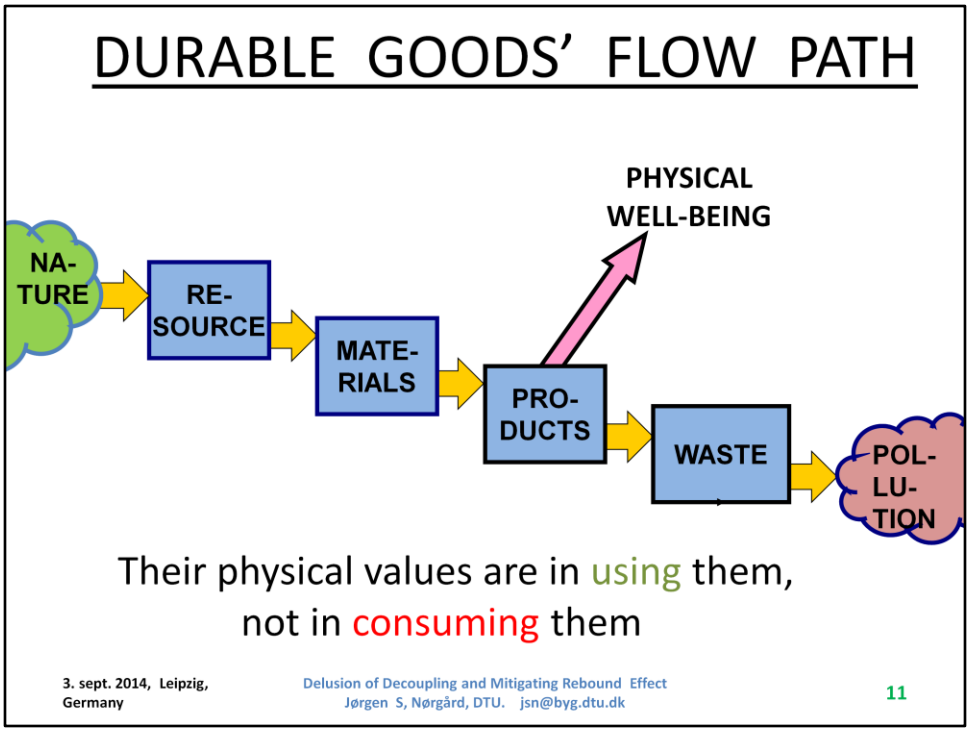
Very roughly, on average, out of a nation's energy consumption, half is spend on direct energy and half on indirect energy. But this ratio varies a lot between nations, since some produces many industrial as well as agricultural goods, which are exported and used in other countries.

As shown, a nation's wealth consists of non-durable and durable goods, and, as will be illustrated by a few examples, there are huge potentials for reducing the indirect energy consumption while still maintaining the service from the durable goods.



Interestingly, statisticians distinguish between two types of household appliances, namely time-saving (behind the family) and time-spending appliances. This reflects a marked development in the economy, when GDP was spurred by women increasingly entered the paid work force, which was accounted for in the GDP, as opposed to unpaid household work.
The cartoon is from a book 1982, which explains the designs og the IT goods!

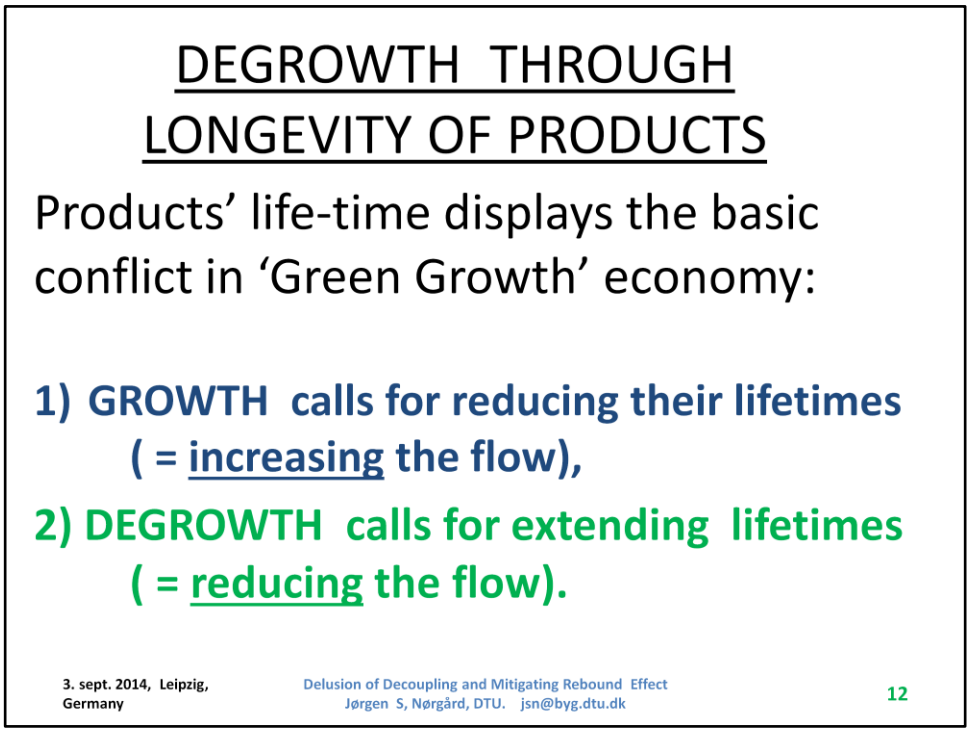
Nørgård, J.S. and Christensen, B.L. (1982): *Energihusholdning, husholdning, holdning.* FDB publisher, Tåstrup, Denmark (Also available in Japanese and Chinese).



The physical value or well-being derived from so-called **durable goods** like cars, bikes, furniture, clothes, appliances, etc. lays usually in having them at hand to provide some **services** like comfortable indoor climate, warm meals, transport, and other contributors to well-being, as shown. This is contrary to **non-durable** goods like food, water and gasoline, where the value lies in consuming them.

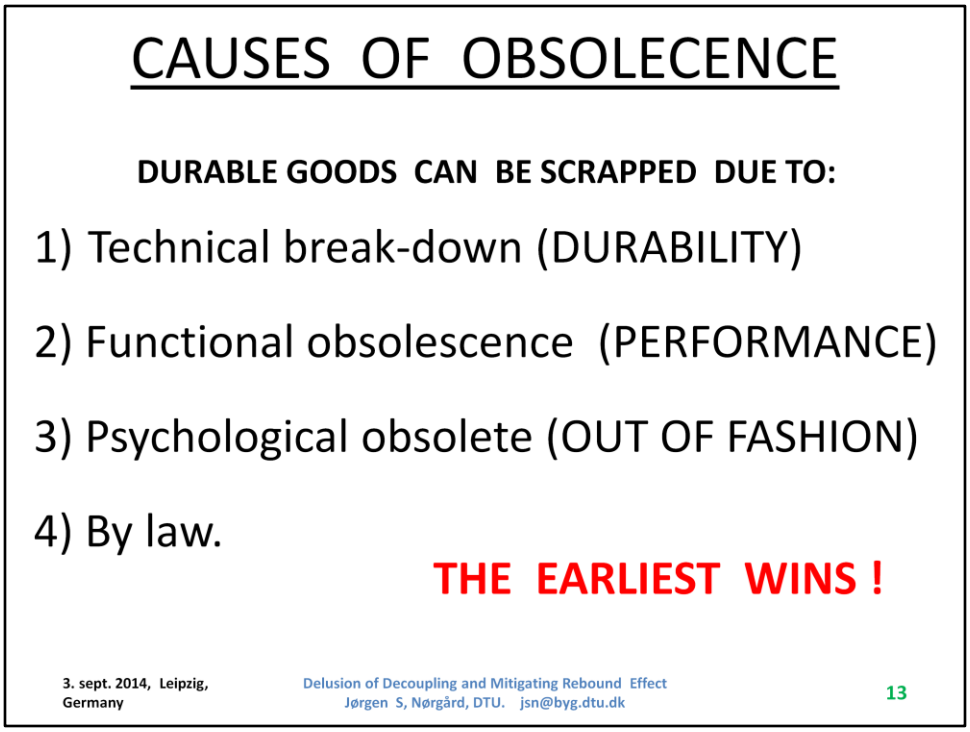
A durable good is part of a long flow of materials from the extraction, growing, etc. in nature to its ending up as waste and pollution in nature.

All along the flow, energy is needed. This implies that one important way to reduce the environmental impact of durable goods is to slow down this flow path. Use the products for longer, instead of discarding and replacing them with new ones, is one way. Repairing and sharing them with others is another. Also recycling the materials from 'waste' to 'resources' when scrapping the goods, saves energy and materials.



Attempts to combine sustainability with a green image in a 'green growth' policy display the dilemma between a *growth guided* economy and a *degrowth guided* economy. A growth policy will allow, and even support a 'buy and throw away' economy through shorter lifetimes for consumer goods, which has no role to play in a degrowth aiming society.

The obsession with growth in GDP, accentuated after the depression in 1930s made it tempting to deliberately make the products obsolete prematurely, i.e. well before the were otherwise obsolete. This **'planned obsolescence'** has since been applied to all the kinds of causes shown on the following slide. It included obviously fashion changes in the design of cars, clothes, furniture, etc., as well as technological obsolescence making the product break down after a certain number of uses.



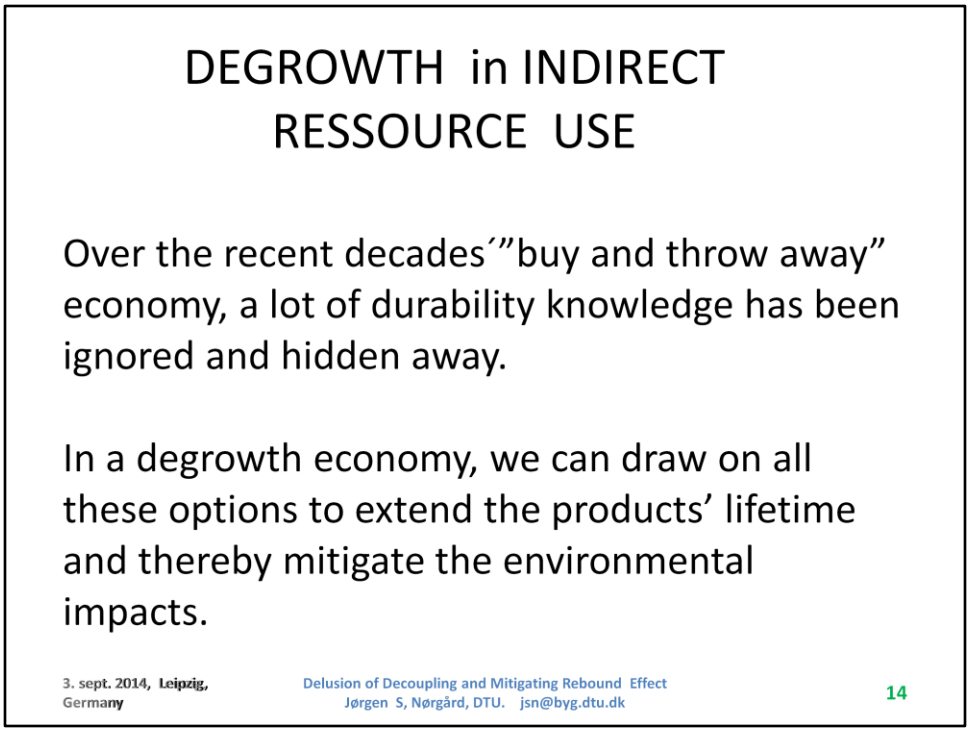
The list shows different reasons for scrapping a product, which is often in our minds associated with its durability. When it breaks down or wear out, it is necessary to scrap a coat, a car, a chair etc. This is how **durability** was the decisive factor in the early industrialization, but today few products are scrapped on the ground that they are worn out.

Nowadays scrapping is more often justified by new products with a better **performance** entering the market. Today this cause is most obvious in the electronic equipment businesses with new gadgets offered every month or year. Better performance obsolescence of *resource consuming* products, say a car or refrigerator, can be environmentally reasonable, if new models' annual energy saving is compatible with the energy used to produce it, for example measured by its energy payback time.

Ranging from cars to clothes businesses, introduction of **new fashion** has up through the 20th century increasingly been used as way to get people to consider their durable goods obsolete, well before the durability and performance dictates that. Fashion changes do not satisfy material needs, but rather short term psychological and social preferences.

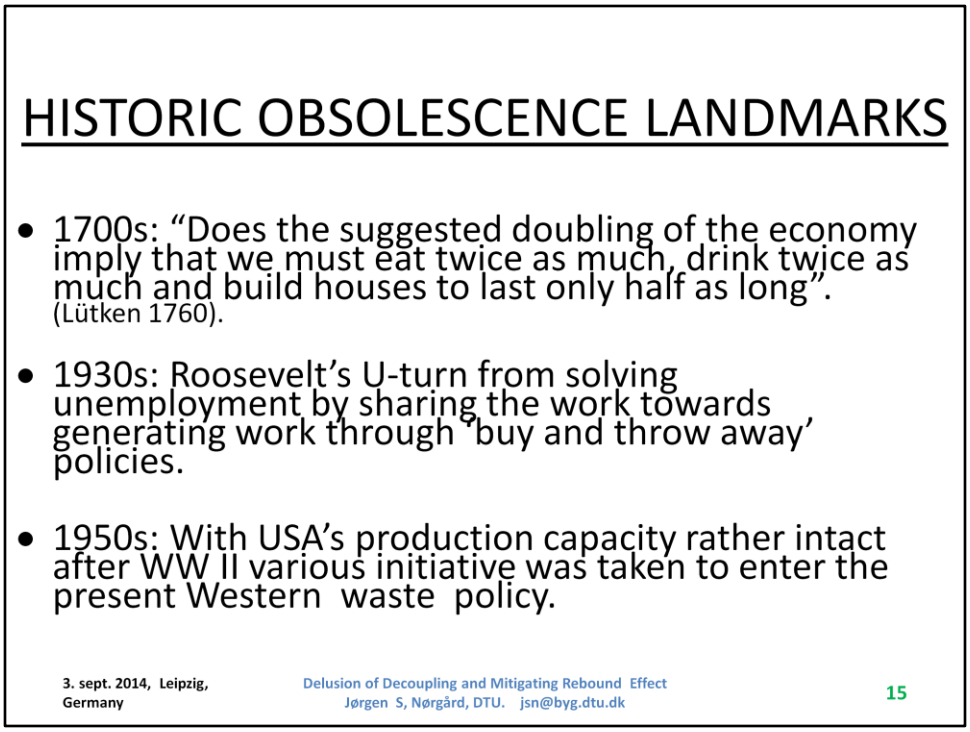
Finally, some products can be required replaced by **law** , for instance due to safety or environmental precautions.

The first occurring of the four causes for scrapping will obviously 'wins'. Consequently, there is no reason to make a product very durable, if it is doomed to be functional obsolete long before it is worn down.



Whether we define degrowth as a decline in GDP or in environmental impact, it is worth having a closer look at the huge indirect resource use related to lifetime of durable goods. The *physical* service output can obviously remain the same or even increase, while slowing down the replacement rate in our 'buy and throw away' society.

The technological durability can, as we will see by examples, often be extended almost 'ad libitum'. Over the past decades of expanding the throw away culture, many *durability options have been shelved or bypassed*, because it was meaningless to make goods more durable when they were discarded for other reasons.



History shows how thoughtful people over time have wondered about the trends to consider *growth* in production and consumption as a *goal*, instead of seeing it as what it is, a *process towards a goal*. Again and again, over the passed couple of centuries, the options for ending the growth in consumption has been turned down, often with the argument that with increasing labor productivity this would leave many people out of job.

In the early 1930s, USA was very close to introducing 30 hours work week instead of 40. The bill had past the Senate, when President F.D. Roosevelt, who had supported it, suddenly in 1933 under influence from industry, changed strategy towards aiming for *generating more work* rather than *sharing the work.* This step can be considered the birth of the 'buy and throw away' culture. (Nørgård 2013, Hunnicutt 1988).

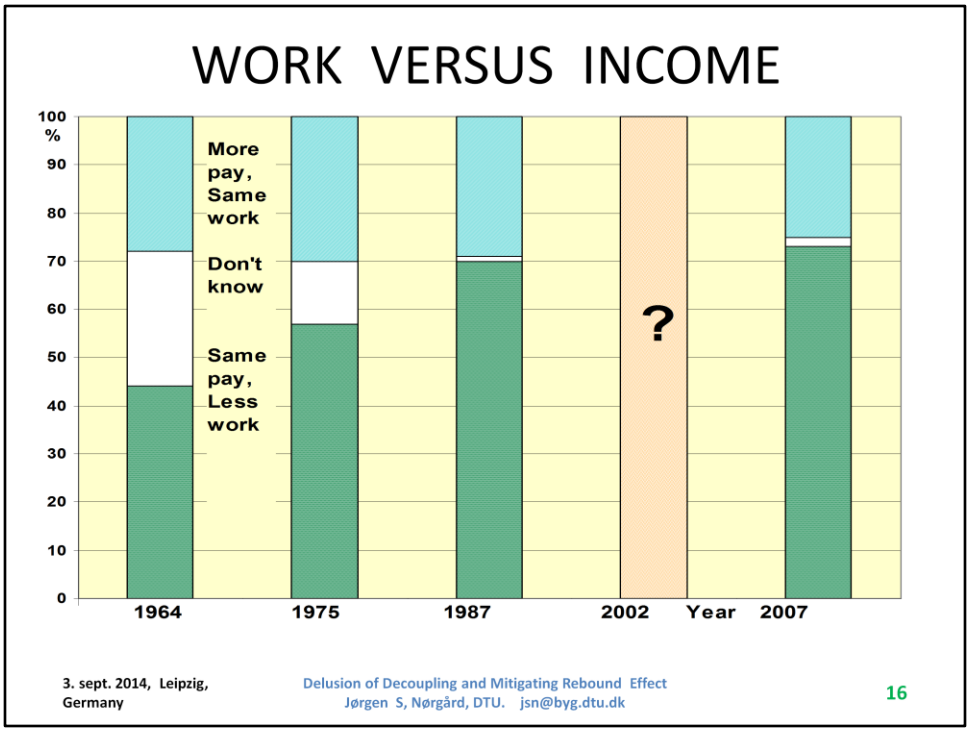
One obvious alternative is of course to share the work and incomes more equally by reducing work hours. Another option would be to reduce productivity in return for more healthy and satisfactory working conditions. Refusal to even debate people's preferences for such solution reveals a serious inconsistency in the Western world's democracies, as will be indicated by the next slide.

Lütken, O.D. (1760): *Undersøgninger angående Statens almindelige Oeconomie, som indeholde vigtige, vanskelige, og nu om stunder meest uomtvistelige Sætninger* (in Danish). Sorøe, Denmark.

Hunnicutt, B.K., (1988). *Work without End - Abandoning Shorter Hours for the Right to Work*. Temple University Press, Philadelphia, USA.

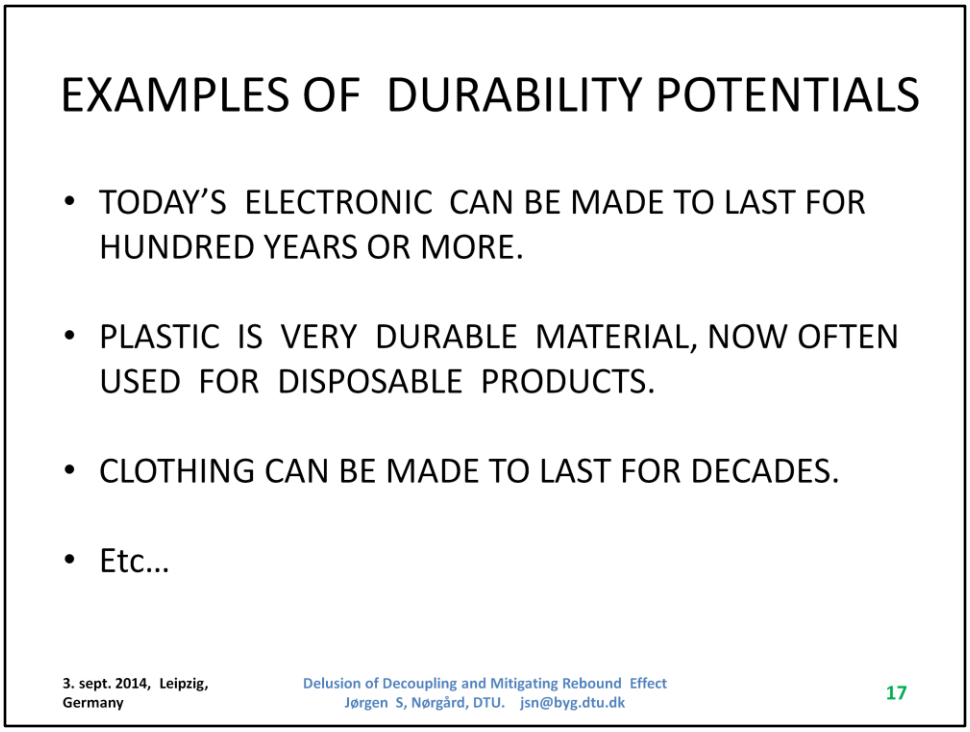
Nørgård, J.S., 2013. Happy degrowth trough more amateur economy. *Journal of Cleaner Production,*

38, 61-70.



The political barrier to extending lifetime of durable and hence reduce production, is that it will leave many people without a job. The obvious solution to this is to reduce working hours and thereby share the work to be done. (Alternatively, the work could be made more satisfactory by lowering labor productivity). The question is whether people are willing to turn the labor productivity growth into reduced working time, rather than into more income and consumption.

After extensive studies conducted by the *Danish National Sociological Institute* had shown a gradual steady increase in the fraction of people who expressed a wish for more leisure time, I was looking forward to their next study in 2002. But what a surprise ! Out of numerous questions in their big survey on how people spend their time and how they *would like to spend it*, just this question on preference for less work time versus more pay *was omitted.* Their explanation to me made no sense. But it is well known that not many politicians (left wing or right wing) seems to know how to handle this public preference quest for free time by work sharing, so they tend to ignore it.
However, another research institute took over, showing in 2007 the trend continued towards higher preference for less work over more income.



The slide shows a couple of randomly chosen examples of technologies and materials which can substantially increase the durability and hence potential physical lifetime of durable goods.

The development of solid state components in electronics was considered a big step forwards in many senses, including durability, as compared with earlier vacuum tubes. They were cheaper to produce, were very durable, consumed little energy, and hence also generate less heat, which contribute further to their long durability. Since the semiconductor was also cheaper to produce, it soon *rebounded* into an expanding business making the goods functionally and psychologically obsolete still faster.

Plastic materials are very durable, which could be a blessing. But ironically, this property also implies an environmental problem, because plastic is often used for disposable items, which then for decades can appear as waste in nature, posing a threat wildlife, etc.

Artificial fiber materials has made it possible to make clothing to last for decades, but with present fashions changing every year, the better durability is wasted. In a degrowth economy, however, these fibers can be a valid competitor to natural fibers.

CONCLUSIONS

- **Economic activity is always coupled to environmental impact**
- **'Buy and throw away' is incompatible with degrowth.**
- **Work Sharing is essential for a degrowth.**
- **Politicians and Financial institutions and greedy Businesses block the path towards degrowth, not 'common' people.**
- **Growth Mania is the Problem - not the Rebound Effect.**

NO BUILT-IN OBSOLESENCE !

Ford, model T, 1922 (Photo ≈ 1963)

Thank you for your attention !

In the early stage of industrialization some persons objected to the idea of building some obsolescence into the products. His name was Henry Ford, and he was first to mass produce automobiles. In 1908 he launched the Ford Model T, which was produced with basically the same design till 1926. The car shown was mine for about fifty years, bought (second hand) in 1960. With student friends, we used it for small weekend trips, as well as a longer vacation tour from Copenhagen to England. Also, we participation in rallies for veteran cars as shown here in 1963.

Ford's philosophy was expressed by his slogan: " We want the man who buys one of our cars never to have to buy another ..". The car was durable, simple, easily repairable, and low cost. For good and for bad, the mass produced cars have had an enormous environmental, economic and social impact in the world, involving many *rebounds effects* and other feed backs.

Thanks for your attention!