

Renewable Energy Online

Laura Henn, Mitavachan Hiremath, Herena Torio, Christiane Stroth,
Michael Golba

Renewable Energy and Sustainability

Lehrbrief



**PUBLIKATION DER BILDUNGSALLIANZ MINT.ONLINE:
UNIVERSITÄT OLDENBURG, UNIVERSITÄT KASSEL, UNIVERSITÄT STUTTGART, FERNUNIVERSITÄT IN
HAGEN, FRAUNHOFER-GESELLSCHAFT, DLR-INSTITUT FÜR VERNETZTE ENERGIESYSTEME (EHEMALS
NEXT ENERGY)**



GEFÖRDERT VOM



Bundesministerium
für Bildung
und Forschung

Das diesem Bericht zugrundeliegende Vorhaben wurde mit Mitteln des Bundesministeriums für Bildung, und Forschung unter dem Förderkennzeichen 16OH12044 gefördert. Die Verantwortung für den Inhalt dieser Veröffentlichung liegt beim Autor/bei der Autorin.

Renewable Energy Online



Renewable Energy and Sustainability

edited by

Christiane Stroth

(C) CARL VON OSSIETZKY UNIVERSITY OF OLDENBURG (2017)

This document has been typeset using the L^AT_EX2e bundle on T_EX.

compilation date: September 29, 2017

Imprint:

Author:	Laura Henn, Mitavachan Hiremath, Herena Torio, Christiane Stroth, Michael Golba
Publisher:	Carl von Ossietzky University of Oldenburg
Edition:	First edition (2017)
Editor:	Christiane Stroth
Layout:	Robin Knecht
Copyright:	© 2017 Carl von Ossietzky University of Oldenburg. Any unauthorized reprint or use of this material is prohibited. No part of this book may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or by any information storage and retrieval system without express written permission from the author/publisher.

Oldenburg, September 2017

Contents

1	Strategies and Concepts	1
1.1	Our Common Future	2
1.2	History of Growth	5
1.3	Exponential Growth	10
1.4	Efficiency and Rebound Effects	13
1.5	Sufficiency - Changing Values and Lifestyles	21
1.6	Decoupling	32
2	Environmental Dimension	1
2.1	Ecological boundaries and climate change	2
2.2	Energy Return on Investment (EROI)	12
2.3	Life Cycle Assessment (LCA)	15
2.4	Water-Energy Nexus	18
2.5	Exergy	21

3	Social Dimension	1
3.1	Prosperity	2
3.2	Well-being, Needs and Energy Consumption	10
3.3	Psychological effects of economic growth	13
3.4	Energy and Capitalism: is also a "solar-imperialism" possible?	20
3.5	Energy as "Common"	23
4	Economic Dimension	1
4.1	Energy and Wealth	2
4.2	Biophysical Economics	4
4.3	Steady-State Economics	7
4.4	Degrowth	9

1 — Strategies and Concepts

"Nature is part of our life. We grew out of the seed, the earth, and we are part of all that. But we are rapidly losing the sense that we are animals like the others... If you hurt nature you are hurting yourself."

- J Krishnamurti, Letters to the Schools vol II, p 71

1.1 Our Common Future

”How long can we go on and safely pretend that the environment is not the economy, is not health, is not the prerequisite to development, is not recreation? Is it realistic to see ourselves as managers of an entity out there called the environment, extraneous to us, an alternative to the economy, too expensive a value to protect in difficult economic times? When we organize ourselves starting from this premise, we do so with dangerous consequences to our economy, health, and industrial growth. We are now just beginning to realize that we must find an alternative to our ingrained behaviour of burdening future generations resulting from our misplaced belief that there is a choice between economy and the environment. That choice, in the long term, turns out to be an illusion with awesome consequences for humanity.”

- Charles Caccia, Member of Parliament, House of Commons. WCED Public Hearing Ottawa, 26-27 May 1986

Learning objectives

- The flawed past and present developmental trends, and the conflict between developmental agendas and environmental sustainability
- The way 'sustainable development' and 'sustainability' defined in the literature
- Complexities and problems involved in defining/predicting them.
- The basic understanding of the interconnectedness and mutual dependencies of development and environmental sustainability, and how these are in-turn connected with social and political factors.
- The root causes for unsustainable pathways.

Guidance for discussion

ABSTRACT FOR DISCUSSION PAPER

The paper discusses the basic definitions and arguments related to sustainability and sustainable development from multiple viewpoints. It first highlights the past and present developmental trends that threaten the sustenance of human societies and the root causes for these unsustainable pathways. Then the paper sheds light on the complexity and challenge involved in shifting towards the sustainable pathways by highlighting the interconnectedness and intricate mutual dependencies of different dimensions of sustainability, in particular environment and economic dimensions. In nutshell, the paper presents a gist of what sustainability and sustainable development mean in the literary sense, and what the root causes of unsustainable pathways are, via relevant statistical data wherever applicable.

BIBLIOGRAPHY

Primary reading for this topic:

1. Our Common Future

G. H. Brundtland. *Report of the World Commission on environment and development: "our common future"*. United Nations, 1987.

Main sections to focus on:

- Report's Summary "From one earth to one world". To get a glimpse of major findings and recommendations of this report, and the approach the commission had adopted to reach these findings.
- Chapter 1. A Threatened Future
 - Get a basic understanding of the causes that threatens the future of human societies.
 - Understand the linkages between the: present developmental trends, environmental stresses and developmental disasters; poverty and environmental degradation; growth, consumption and environmental stresses; environmental and economic problems with many social and political factors.
 - How the environmental challenges of today are arising from the lack of development and also from the unintended aftermaths of economic growth?
 - Why is that we are forced today to account for not only the effects of development on the environment, but also the ways via which the on-going environmental degradation can dampen or overrule the present and future economic development?
 - The inter-relation between the environmental degradation and human survival; and also how the environmental stresses are intra-linked with one another, for example, deforestation and soil erosion (among many others).
 - What are the root causes that threaten the future of human societies? Is treating environment and development as two separate entities one among them?
 - In a nutshell, this chapter shall help to answer the question, "why sustainable development?"
- Chapter 2. Towards Sustainable Development
 - What is sustainable development? And what shall be its scope and key ingredients?
 - How do the economic injustice and social injustice within and amongst nations create hindrances in promoting the common interest in sustainable development?
 - What shall be the 'nature of growth' that can lead us on sustainable pathways?
 - What is the role of technology in sustainable development?
 - Finally, what are the main challenges for moving towards sustainable development in the present scenario?
- Chapter 3. The Role of the International Economy (optional).
- Chapter 7. Energy: Choices for Environment and Development (optional). To get a brief overview of the role of energy in the process of sustainable development.

2. Defining and Predicting Sustainability

R. Costanza and C. P. Bernard. "Defining and predicting sustainability." In: *Ecological economics* 15.3 (1995), pp. 193–196.

This is a simple and straight forward commentary discussing the different aspects of sustainability and the complexities involved in understand the same. The paper asks three fundamental questions about sustainability and tries to address these questions from different view-points: (1) what system or subsystems or characteristics of systems should be sustained? (2) For how long? (3) When do we assess whether the system or subsystem or characteristic has sustained? Finally, the paper takes a standpoint that sustainability is mainly a problem of prediction than definition.

Further Reading

A. Voinov. "Understanding and communicating sustainability: global versus regional perspectives." In: *Environment, Development and Sustainability* 10.4 (2008), pp. 487–501. URL: http://www.likbez.com/AV/PUBS/Sustainability_Springer.pdf.

U. Nations. *Prototype Global Sustainable Development Report - Executive Summary. Online edition*. New York: United Nations Department of Economic and Social Affairs, Division for Sustainable Development., 2014. URL: <http://sustainabledevelopment.un.org/globalsdreport/>.

An Action Agenda for Sustainable Development, Report for the UN Secretary-General, tech. rep. Leadership Council of the Sustainable Development Solutions Network. URL: <http://unsdsn.org/resources/publications/an-action-agenda-for-sustainable-development/>.

J. D. Sachs. "What is Sustainable Development?" In: *The Age of Sustainable Development, Chapter 1, Coursera* (). URL: <https://www.coursera.org/course/susdev>.

Also, feel free to explore more, i.e., no need to restrict yourselves just to these reading materials.

GUIDING QUESTIONS FOR DISCUSSION

- What was the necessity to define 'sustainable development' during 70s? What are the problems in coming to a common understanding on the definition of sustainable development / sustainability?
- Why the future is threatened by human activities / development? The root causes, not symptoms!
- How do you define sustainability and sustainable development personally? Agree with the Brundtland commission's definition and others? Justify your standpoints?
- What shall be the basic characteristics / key ingredients of sustainable pathways?
- Why is it a challenge for the present societies to walk on sustainable pathways?

1.2 History of Growth

Learning objectives

- Understand how humanity's use of and impact on the natural sphere have changed during the course of modern history,
- being able to relate the dimensions of more recent developments of resource exploitation, emissions, and altering of the natural environment to historical levels, according to the characteristics of exponential growth.

Growth - Rise of a New Paradigm

Something new under the sun - human-caused altering of the natural environment from 1800 AD until today.

Looking back on developments of humankind and its impacts on the natural environment the 20th century shows a pattern that is characterized by growth in almost all sectors.

McNeill (2003) gives detailed analyzes on the historical development of economic growth, population growth and the impact on the physical environment, e.g. soil, air quality, climate change, ozone, water, and the biosphere.

After centuries of very slow changes and a very moderate population growth rate the population started off to increase more rapidly from 1 billion in 1820 to 2.5 billion in 1950 and to 7 billion in 2012. While it took 130 years to come from 1 billion to 2 billion inhabitants the third billion took only 30 years (3 billion reached in 1960). Between 6 billion and 7 billion people there are only 14 years (UN World Population Prospects, 2012).



Figure 1.1: Extrapolated world population history 1804-2054 (Source: en.wikimedia.org, data from <http://www.geohive.com>)

The population growth rate reached its maximum in the post-WWII-period (2,2% in 1964). The maximum total increase per year was reached in 1989/90 (87,4 million) and is slightly decreasing since. However, linked to the population growth economic activity has increased by almost factor 4 per capita and total energy use increased 16-fold in the 20th century (McNeill, 2003, p.31).

A major driver of the increase in the world population are new technologies to use energy resources that were not available before when people had to rely on their muscle energy. At best, a person is able to generate power of 100 Watt (McNeill, 2003, p.27). By using fossil fuels, the amount of power could be increased several hundredfold. Consequently, the per capita energy use increased alongside. In the 1990s, a person used as much energy in average as 20 people could (theoretically) produce if they worked one year 24 hours a day. This energy exploitation would not have been possible if humankind would have to rely on muscle work. Steam machines enabled the transformation of energy from coal into mechanical work and not only into heat as in the centuries before. Machines took over the hard physical work and were developed to become more productive and efficient. The discovery of huge oil reserves and the refining technique led to a strong increase of fossil fuel use during the 19th century. In the 20th century oil was the most important energy resource because of its high energy content and the technologies developed for it.

Coupled with a great inventiveness of humans the possibilities of this energy affluence led to a strong increase in production, technological development, and not least to a great change in labor work.

It took quite a while until the impacts of intensified production processes, traffic and land use were recognized. McNeill (2003) describes how cities suffered from air pollution through coal-based heating and industry (like London and Pittsburgh). Policies were changed to aiming at a reduction of air pollution only after severe damage had been done and thousands of people had died from respiratory difficulties like in London during the winter 1952. Another air pollution problem is smog, caused by a chemical reaction of sun radiation in exhaust gases producing ozone. The smog problems arose with upcoming mass traffic in cities during the development of the private transport sector and the impressive increase of cars in cities. A large number of large or industry-intensive cities is almost permanently struggling with smog problems today, such as Beijing, Ahwaz, Ulan Bator, Mexico City, New Delhi, Dhaka and many more. Depending on weather conditions almost all big cities have faced smog problems at least temporarily and often during summer. Another dimension of air pollution relates to the atmosphere in which even slight changes of trace gas concentration can have dramatic impacts on living conditions on earth. The most important ones that have been threatening the atmospheric balance in modern age are carbon dioxide, ozone and sulfur dioxide. Anthropogenic influence on the changes in concentration of greenhouse gases since 1900 are estimated to be about 100% in carbon dioxide, stemming from fossil fuel burning and deforestation; about 60% in methane, stemming mostly from rice cultivation, cattle-breeding, landfill of waste, use of fossil fuels, and mining; and 100% of the changes in CFCs (chlorofluorocarbon) can be attributed to human activity. While the ozone-destroying CFCs have been quite successfully curtailed by stricter regulations on their use, attempts to restrict carbon dioxide emissions are only slowly progressing, most prominently reflected in the numerous international climate negotiations since the first Rio conference in 1992.

Despite the impressive increase in living standards for at least some parts of the world's popu-



Figure 1.2: CO₂ emissions by humans and atmospheric CO₂ levels over the last millennium. (Source: berc.bekeley.edu)

lation the intensification of energy extraction was on immense costs. The benefits were mostly for the today industrialized countries, the costs lay often in less privileged regions of the world, even today, and in the environment. The burning of fossil fuels and biomass causes severe environmental damage which further increases with further intensified production and consumption. Inequalities between regions of the world have increased since technologies and related social and political structures for fossil energy use were primarily found and developed in Europe and North-America while many other parts of the world relied on biomass for heating and physical mechanical work until the 1950s - some poor countries do so still today.

The end of the fossil fuel reserves has been predicted several times already but is pushed into the future as new sources are being detected and extraction methods are further developed (e.g. the extraction of unconventional oil and gas). Scarcities will not force humanity to abandon fossil fuels as energy source but the social and environmental damage is already high and challenges the trade-off between cheap energy and an outlook on an inhabitable planet beyond the age of fossil fuels.

Is this the Anthropocene?

The great influence that mankind has on the geophysical environment has led to a discussion about regarding this period as a distinct geological epoch, the anthropocene. Officially, this term has not been accepted yet but is widely used by scholars and examined by several independent working groups whether the anthropocene will be formally accepted to the geological time scale. While some scientists argue for dating the beginning of the anthropocene back to the rise of agriculture and the Neolithic revolution (12.000 to 15.000 years before present), atmospheric evidence suggests a beginning in the 18th century with the Industrial Revolution (Zalasiewicz et al., 2008). The Holocene, the epoch that began around 11.700 years ago, is characterized by increasing human activities. The quality of activities and their impact has, however, changed with the Industrial Revolution where the altering of the physical environment has reached levels that impact the lithosphere, the climate and has brought up phenomena of global scale (cf. Zalasiewicz, 2008).

Steffen et al. (2011) outline the changes in ecosystem services that are caused by humans. They differentiate three types of ecosystem services: Provisioning goods and services (also referred to as 'natural services') are those resources that are directly used by humans, e.g. food, fibre, freshwater, fossil fuels, metals and all other kinds of geological material extracted for use. Supporting services (also referred to as 'environmental services') are processes like nutrient cycling, soil formation, primary production, ocean circulation and glacial actions providing large freshwater depots or ensuring fertile soils in the long run. Regulating services are not directly contributing to provisioning goods and services but help maintain an inhabitable environment by regulating for instance diseases or the climate system as carbon is stored, ozone is built by chemical reactions or temperature is regulated by polar ice sheets (Steffen et al., 2011). The pressure on all three kinds of services caused by humankind has led to globally significant changes as Steffen et al. (2011) line out in the following. However, provisioning services are the ones that most directly serve humans. Thus, "benefits associated with food production [...] currently outweigh the costs of declines in other services at the global scale." (p. 750).

The consequences of human activity for the Earth System are so grave and global in scale that Steffen et al. (2011) speak of humanity as a geophysical force and the human enterprise is a "fully coupled, interacting component of the Earth System itself" (p. 740). This, some argue, is a distinct feature of the modern age and is different to the Holocene in which human activity developed but didn't have major influence on the condition of the planet. Thus, terming it the Anthropocene can be an appropriate way of addressing the Earth historical meaning of the changes in people nature relations.

Please also read:

W. Steffen et al. *The Anthropocene: From Global Change to Planetary Stewardship*. *AMBIO*, 40. p. 739-761. Please read pages 739-746 ("The Anthropocene: From Hunter-Gatherers to a global geophysical force"). 2011.

Literature

J. McNeill. *Blue Planet: Die Geschichte der Umwelt im 20. Jahrhundert (Something New under the Sun [engl.])*. Frankfurt: Campus Verlag GmbH, 2003.

1.3 Exponential Growth

"Many people ... are concluding on the basis of mounting and reasonably objective evidence that the length of life of the biosphere as an inhabitable region for organisms is to be measured in decades rather than in hundreds of millions of years. This is entirely the fault of our own species."

- G. Evelyn Hutchinson, "The Biosphere," Scientific American, September 1970, p. 53.

Learning objectives

- The concept of 'Exponential Growth' and its significance in living systems
- The simple arithmetic behind the exponential growth
- The application of the exponential growth concept to human society and developmental processes (e.g., earth's finite resources, fossil fuel consumption, inflation, population growth, land usage)

Guidance for discussion

ABSTRACT FOR DISCUSSION PAPER

The paper discusses the basic concept of 'exponential growth' and its significance in the growth of living systems. It first introduces the concept and then highlights the simple arithmetic that characterizes the exponential growth, with relevant examples wherever necessary. The paper also sheds light on the necessity, complexity and challenge involved in understanding the exponential growth in real world systems, especially when the processes are interconnected in an intricate lacework fashion. The paper also discusses and provides rule-of-thumb figures for a couple of common growth examples of human societies, e.g., oil consumption patterns, population growth, land usage and potential of renewable energy sources. Lastly, the misleading nature of most of the past and present forecast estimates for resources consumptions (calculated via 'static reserve index' method) will be discussed. In a nutshell, the paper highlights the problems of ever increasing growth models and makes it self-evident why the concept of 'ever increasing growth' itself is unsustainable.

BIBLIOGRAPHY

Primary reading for this topic:

1. Limits to Growth

D. H. Meadows, D. L. Meadows, J. Randers, and W. W. Behrens. *The Limits to growth: A report for the Club of Rome's Project on the Predicament of Mankind*. New York: Universe books, 1972.

Main sections to focus on:

- Introduction. What is this report about and what are its conclusions (generic)?
- Chapter 1. The Nature of Exponential Growth
 - A quantity exhibits exponential growth when it increases by a constant percentage of the whole in a constant time period.
 - Examples of exponential growth (chess board and a grain of rice, pond and water lily)
 - Simple mathematical relationship between the interest rate, or rate of growth, and the time it will take a quantity to double in size.
 - Application of exponential growth to world population and world economic growths.
- Chapter 2. The Limits to Exponential growth
 - Figure 10 and its core messages;
 - Why does the report says "precise" numerical assumptions about the limits of the earth are un-important?
 - What is law of increasing costs?
 - What are 'static reserve index' and 'exponential reserve index'? Why the report does consider static reserve index as a misleading measure of resource availability?
 - Can you cross-compare some of the conclusions of the report with the present trends or recent version of the same (remember the report was published in 1970s)?

2. Arithmetic, Population and Energy: Lecture by Prof. Al Bartlett [Watch video]

A. Bartlett. *Arithmetic, Population and Energy (Lecture)*. URL: <http://topdocum%5C%5Centaryfilms.com/arithmetric-population-and-energy-lecture/>.

Key points to focus on:

- The simple arithmetic of exponential growth.
- Example of bacterial growth in a bottle.
- How it can be applied to growth in human populations and material consumptions.
- The cases of oil and coal reservoirs and production capacities over time.
- Can you develop similar graphs for your home countries (see assignments section)?

Further Reading

M. K. Hubbert. "On the Nature of Growth. Testimony to Hearing on the National Energy Conservation Policy Act of (1974)". In: (1974). URL: http://www.technocracyinco%5C%5Crporated.org/uploads/3/0/7/0/30701439/m._king_hubbert_on_the_nature_of_growth_-_marion_king_hubbert_-_1974.pdf.

A. A. Bartlett. "Forgotten fundamentals of the energy crisis." In: *American Journal of Physics* 46.9 (1978), pp. 876–88. URL: http://www.albartlett.org/articles/art_forgotten_fundamentals_overview.html.

ASSIGNMENTS

1. Classify some of your main activities and your national policies in the space-time graph shown in 'Limits to Growth' (Figure 1). In which categories do these falls?
2. After watching the video by Prof. Al Bartlett, try estimating and customizing the sample cases shown in the video for your own home cities / countries.
3. Calculate the time required to reach the limit of fossil fuel potential (e.g. oil), and the same for RE potential using 'static reserve index' and 'exponential reserve index' described in 'Limits to Growth' for two cases; case 1: global averages; and case 2: your home countries / states. Make necessary assumptions as and when required. [You can use the links provided in additional information section to get raw data for your assignments]

GUIDING QUESTIONS FOR DISCUSSION

- Can exponential growth be considered as a natural signature of all living systems?
- Discuss the results obtained from your assignment questions!
- Given that the exponential growth is a default natural trend, how can the human societies learn from this and adapt their lifestyles and consumption patterns for sustainable development? What role can individuals, policy makers, engineers and politicians play in this regard?

ADDITIONAL INFORMATION

You can use the following links to get raw data on renewable energy potential, consumption patterns of countries and many more for your assignments (please feel free to explore the web for more data sources):

Rewable energy potential. URL: http://www.irena.org/potential_studies/.

World Bank website for development related data. URL: <http://datacatalog.worldbank.org>.

World's power plants data. URL: http://enipedia.tudelft.nl/wiki/Portal:Power_Plants.

1.4 Efficiency and Rebound Effects

A politically and economically popular answer to the sustainability challenge is efficiency and green technology or green innovation. As we have seen in the first chapter already (History of growth) efficiency has played a crucial role in the course of modernity. Many innovations aim at facilitating processes that previously have been time- or effort-intensive: washing machines have substituted washing by hand, in factories there are machines that do the work in a fraction of the time that was formerly needed to do it manually. Cars are way faster than horses used to be, the time needed to find information on the internet is unbelievably shorter than it was earlier to do research in libraries or by contacting specialists on a certain topic, and many examples more. As a first attempt, innovations usually aim at being more time-efficient. Since this demands more energy while energy sources are becoming scarce and their depletion has destructive effects, the development is then directed at becoming more energy-efficient. This is popular because it provides a 'win-win' situation for almost all participating actors: There are new jobs in research and development, new products or new product features to be promoted, marketed and sold by businesses, it is supposed to be environmentally friendly, it contributes to less carbon dioxide emissions, and the best is: consumers don't have any drawbacks or sacrifices to make â they even save money when their devices consume less energy. Efficiency policies are therefore easy to implement and politicians usually don't face opposition since there is profit for all.

Efficiency has been the important feature of basically all innovations during the last centuries and it is now even considered as the promising path to sustainability. But despite the impressive efficiency gains energy and resource use are still increasing â there is hardly a number that indicates a decrease in total consumption and carbon emissions are ever increasing as well. One important factor for this failure of efficiency gains has been termed the 'rebound effect', first described and systematically investigated by Khazzoum in 1980. The classic microeconomic rebound effect occurs when as a consequence of increased efficiency the demand for a product or service increases. The rebound effect has been identified already in 1865 by William Stanley Jevons who described that more efficient coal use would result in greater technological progress and thus in more coal use instead of a saving of coal. Despite this early insight into the side effects of efficiency increases the discussion about the phenomenon has not been taken up again in economics until the 1980's. In economics it is sometimes referred to as the Jevons' paradox. Related to sustainability the term 'rebound effect' is more common.

Three kinds of rebound effects

In general, three forms of rebound effects can be distinguished. Direct rebound effects occur on the consumer side when the same product or service is used to a larger extent (either more often or more intensive). If for example a car is more fuel-efficient and needs only three liters instead of six liters per 100 kilometers, using the car becomes cheaper per distance unit and therefore the car is used more often (Santarius, 2012). To put another example for a direct rebound effect we can imagine how the substitution of old light bulbs by new efficient energy-saving lamps results in people leaving the lights on more often because they use so little energy anyway. A similar effect can be assumed for firms â reduced energy prices enable higher production rates (Greening, Green Defiglio, 2000).

Indirect rebound effects occur, when efficiency gains in one area lead to more consumption in

another, for example as a consequence of a more fuel-efficient car more heating or travelling by plane can be afforded. On the production side this can mean that investments in other areas become possible, like new products, renewal of processes, machines or buildings, etc. Indirect Rebound effects are second-order effects of the increased income or free assets [of money].

Third, there are macroeconomic or structural consequences of efficiency increases that result from the changes in prices and demands. They are also referred to as general equilibrium effects. Increased efficiency and thus lower costs on the production and on the operation side often lead to innovations and a different demand potential. Fridges that are energy-efficient tend to become bigger because the purchase and maintenance can be afforded by the same people that used to have a medium-sized fridge of the old type that is consuming more energy. The increased efficiency technology in cars enables producers to build and market bigger cars or even cars for other demands like city car, sports car or family car. Consumers might rather have two fuel-efficient cars for different purposes instead of formerly one car only. The efficiency changes in single product classes can thus have far-ranging effects on a macroeconomic level.

Quantification of rebound effects

There is a lot of argument about the quantitative extent of real rebound effects. The size of a rebound effect is determined as the percentage of the possible efficiency gains that is consumed more as a consequence of the decrease in energy demand. If a fridge becomes more efficient in the way that it consumes only half the energy compared to the old model (possible efficiency gain 50%) but due to the larger size uses 80% of the energy that the old fridge needed, we calculate a rebound effect of 30%. If the rebound effect is more than 100% â this means even more energy is used after the efficiency measure than before â this is called a backfire phenomenon.



Figure 1.3: Schematic representation of the rebound effect.

Different studies come to very different estimates of the extent of rebound effects. This is highly dependent on the products and on the methodology used. It is very different, for example, if travel behavior is investigated where possibilities of travelling more are large, or if TV purchase is under study where the maximum number of TVs per household is probably something close to the number of rooms (and rebound effects will rather play a role when it comes to size and other features of the TV). The effect can also vary by country since it depends on various context

1.4 Efficiency and Rebound Effects

factors. A study in the USA found a direct rebound effect of 87% for car using behavior of household as a result of fuel-efficiency technology (West, 2004). In Germany, the direct rebound effect in car use has been found to be about 60%. This means that from the possible fuel-use reduction only 40% are realized. A meta-analysis comes to a range of 0-50% of rebound effect sizes on the consumer side for different end uses like space heating, space cooling, water heating, lighting, and automotive transport (Greening, Greene Defiglio, 2000). On the production side for firms there are only few studies indicating rebound effects between 0 and 20%. Explanatory power is low for these effects and the long-run aggregate impacts of energy-efficiency potential for firms have to be found in their outputs (ibid.). This is difficult to systematize since the output changes can hardly be traced back to energy savings. Here it becomes obvious that a firm or company that is growth-oriented has no other interest in saving energy and costs than to increase their economic success. Even though the extent of rebound effects might be hard to trace, a look at the overall energy consumption (see figure 2) discloses that the overall rebound effect is hardly smaller than 100% (Otto, Kaiser Arnold, 2014). The graph clearly shows no decline in energy consumption but at best a halt of the upward trend for the USA, Europe and Germany (and, notably, a sudden decrease following the crisis of 2008 for the USA).



Figure 1.4: .Per-capita energy consumption in metric tons of oil equivalent (from Otto et al., 2014, data source: The World Bank).

Reasons for and mechanisms behind rebound effects

We have now described different forms of rebound effects. But they are the outcome of processes we have not addressed yet.

Santarius (2012) provides a useful overview of the mechanisms that can be at work to lead to a rebound effect. He proposes 13 rebound effects and clusters them into four categories: financial, material, cross-factor and psychological rebound effects.

The financial rebound effects result from the cost savings from efficiency gains. On the individual consumer level this is an income effect â the consumer has more money freed up to invest directly into the same product (e.g. driving more with a fuel-efficient car; a direct rebound effect). Or he can invest the money in other products or services that themselves use energy and resources, like an additional holiday trip by plane (an indirect rebound effect). On the producers' side almost

the same happens as a reinvestment effect. Producers can either expand production of the same good if they gain the financial capability by efficiency increases. Or they expand their range of products, invest in other areas of the business or increase the wages of their employees which again can produce an income effect on their individual level (Santarius, 2012). The reinvestment effect can anticipate the income effect on the consumers' side and equip the more energy-efficient products with more features, different design and increased comfort. A prominent example is the VW Beetle, a car that used to use 7.5 liters of petrol for 100 km in the 1955 edition. Since it is an all-time classic it has been produced ever since with changes, of course, including modern engine technology that has become more fuel-efficient. The 2005 model of the Beetle is, however, yet not more fuel-saving. It still uses 7.1 liters per 100 kilometers because other features of the car have changed and 'used up' the efficiency gains. Table 1 compares the 1955 model and the 2005 model of the Beetle in some features that led to an almost constant fuel use over time.

	VW Beetle 1955	VW Beetle 2005
weight	730 kg	1.200 kg
engine power	30 hp	75 hp
top speed	110 km/h	160 km/h
liters of petrol per 100 km	7.5	7.1

Table 1.1: Rebound effect in product development exemplified by the VW Beetle.

Material rebound effects refer to the material and energy that are needed to produce products that are more efficient. If, for example, a house gets insulation to become more efficient in heating, energy and material are used to produce the insulation. This 'grey energy' is embodied in the product or the efficiency measure. The increase in energy or material use resulting from grey energy is called the embodied energy effect.

Since efficiency technology is needed, whole new markets have developed for it. Research has to be done, products have to be developed, tested and marketed. Therefore, we can see a new markets effect. A very obvious example for this is the solar energy industry. A new technology has been developed that can help to provide energy in a less polluting way, becoming more efficient in environmental harm per energy unit. This creates a new industry where research and development, series production, marketing, safety and maintenance, support services, component suppliers, consultants and many more tasks provide potential for business activities. This has implications at large on a societal level and can contribute to economic growth. As we have discussed in an earlier chapter economic growth is strongly associated with energy demand and material use (see chapters 3 and 4). So even though it is necessary to invest energy and material into efficiency measures it is at least as important to consider the larger consequences for material and energy use beyond the single product focus.

A third material rebound effect occurs when old products are not really replaced by new more efficient ones, but the new ones are just supplemented. A consumption accumulation effect can be observed when the new fridge in the kitchen is supplemented by the old one in the cellar for special occasions. Often the replaced old products are given to others for use (e.g. the child gets the old car when parents buy a new one; Santarius, 2012). From a life cycle perspective on the products this is desirable but on a societal level it means an accumulation of material since new products add on older ones that are still running.

Cross-factor rebound effects

1.4 Efficiency and Rebound Effects

There are other factors that can impact the energy demand when their productivity is increased. Labour productivity has increased about 10-fold during the 20th century (Santarius, 2012). This has not only led to people working less but also to more work being done. Despite the reduction of working hours from 60 to 40 hours, more vacation time and other changes in working conditions, the productivity of work has increased at a much higher rate. Instead of using the freed up time that is won by increased labour productivity for something else, people use the time to work for more output. Historically, free time has seldom been used for doing nothing, as Madlener and Alcott (2011) point out. This means rebound effects on the material and on the energy side by increased production. And it means higher income on the side of workers that can again spend their money on energy- and material- intensive goods and services.

Furthermore, on the consumer side, time plays another important role. Time savings by efficiency increases are usually not used for idling but are taken as a chance to work more (as mentioned above), to experience, to communicate, to travel – in short the freed time is filled with alternative actions. They not only lead to stress, overburden, and increased consumption (as we have discussed in the previous chapter), they also contribute to rebound effects in energy and material. Since cost saving is not the only reason for rebound effects, Girod and de Haan (2009) subsume the other reasons as time saving and the reduction of socio-psychological costs of ownership. To understand why people don't curb their labor work time and are not reacting in the same way to an energy-efficient option as to the conventional option it is useful to have a detailed look at the psychological processes that lead to rebound effects.

Psychological rebound effects are the back coupling of efficiency measures on people's evaluation and decision making processes. In economic theory, wrongly, there is often the presumption *ceteris paribus* – 'all other things being equal'. We have discussed quite some examples so far that imply that this assumption is not useful in reality because it is not true that all other things stay equal when one factor is changed. All things that happen in societies, economics and private spheres are related to human cognition. The changes in prices, in time demand, in environmental impact and in many more facets change mental processes that lead humans to make behavioral decisions.

First of all, consumption often has an important symbolic function (Steg, Vlek Slotegraaf, 2000). The symbolic meaning of products and services changes when the products change and can suddenly be labeled 'environmentally friendly'. Green consumption has become an important part of status competition. To consume 'green' products signalizes that a person is altruistic because she is willing and capable to spend more money for environmental benefit (Griskevicius, Tybur van den Bergh, 2010). If a certain behavior is considered to be more environmentally friendly it will be shown more often by people who do want to consume environmentally friendly – and that may lead them to demand even more than they did before. So we might find a higher demand because of the efficiency gains that make it more environmentally friendly.

Behavioral action is preceded by several psychological processes (Peters, Sonnberger Deuschle, 2012). People hold certain attitudes¹ towards a behavior itself and attitudes towards the outcome of the behavior. There are personal norms and values that a person holds and social norms of what people around expect from her; norms lead behavior as well. A person has certain assumptions about what the consequences of a certain behavior are and of her own capability to control the behavior in a certain way (Peters et al., 2012).

Many environmentally friendly behaviors are based on knowledge about negative impacts that a

¹Attitudes are the evaluation of something as (rather) positive or negative.

certain behavior can have (e.g. that driving pollutes the air, uses finite fossil fuels and contributes to climate change) and on the will to reduce these harmful behaviors and find environmentally friendly alternatives where possible. If efficiency measures lead to the behavior being not perceived as 'so bad' anymore those mechanisms are impeded where the harmfulness of a behavior is an important driver of environmentally friendly action. When an energy-saving lamp does not use a lot of energy, switching off that lamp is not regarded as contributing a lot to energy-saving anymore. So a person does not regard the consequence of the behavior (turning off the lights when leaving the room) as an effective way for reducing energy consumption.

The attitude towards a behavior like driving a car might be rather negative in an environmentally friendly person. When the conventional car is replaced by a hybrid or an electric car the attitude towards driving may change and become more positive. The positive attitude will now increase the probability that the person decides to drive by car, resulting in more kilometers than with the conventional car. A study in Japan investigated changes in the driving behavior of people who bought a Toyota Prius, a hybrid car that is considered to be environmentally friendly because it combines combustion engine and electric engine as to produce less emissions. After one year, on average, the Toyota Prius drivers had increased the distance travelled by car by 1.6 times (Ohta Fujii, 2011).

An increased income resulting from lower energy costs can increase the so-called behavioral control of a person. Behavioral control means the belief that one is capable of performing a certain action that it is within the person's own control whether to do something or not. Behavioral options that were limited by financial means before (e.g. car use limited by high fuel prices) become available when costs are sinking (e.g. if fuel prices fall or the car is more fuel-efficient). Thus, increased behavioral control for behaviors that are harmful for the environment can lead to a direct rebound effect (Peters et al., 2012).

The role of norms that are guiding pro-environmental behavior can be affected by measures that improve the environmental impact of a certain behavior. The personal commitment to not taking the car for short distances will decline when driving is regarded as not so harmful because the norm to act pro-environmentally does not apply for waiving the car to the same extent as before with a conventional car (Peters et al., 2012).

Sometimes the term 'moral licensing' is used to explain the changes in people's behavior when people 'license' a harmful behavior with their pro-environmentalism in another area. Their conscience is relieved by buying ethical products for example (fair-trade coffee, organic food, etc.), so they feel it is alright to make unethical purchases in other areas (e.g. buying cheap non-fair clothes).

Girod and De Haan (2009) present an interesting concept to approach human reactions to increases in efficiency. Similar to book-keeping in a company where certain budgets are allocated to different areas, there is a similar concept in people's mental accounting with their money. Experiments have shown repeatedly that there are different 'accounts' that people allocate their money to (e.g. food, travelling, culture, housing, etc.). When they bought a 10\$ ticket for the cinema and lose it by mistake, they subtract 10\$ from their account for cultural activities and won't spend those 10\$ to buy a new ticket. Meanwhile, the loss does not affect expenditures in other categories to the same extent (Thaler, 1999). Girod and de Haan assume that such mental accounts not only exist for money but also for an environmental budget. When people 'save' environmental impact in one place (by driving a very fuel-efficient car), they allow themselves more environmental impact in another situation (e.g. leaving the lights on). The calculation is rather fuzzy and far from exact, but it matters, as Girod and de Haan could show experimentally.

Therefore, a reduction of environmental impact does not occur effectively as long as the mental account of 'allowed environmental impact' is not decreased.

Conclusions

Rebound effects are rooted in the reactions of other parts of the system when one part is changed. When energy demand for a good or service decreases this does have an impact on the market, on the production and on the user or consumer. The decreased need for energy provides financial possibilities to produce more or to consume more. It also impacts the reduction of the energy price which again leads to more demand for energy. The free time that is won by more efficient processes (e.g. faster production, faster transport, faster communication) is used for more activities (expanding the range of products) or more intensity of the same activity (further distances travelled, more heating). When energy efficiency leads to people regarding certain behaviors as a way of acting environmentally friendly or as an act of 'green consumption' psychological mechanisms that guide pro-environmental behavior become weaker. When the consequences are not regarded as harmful anymore the commitment to not behave in that way does not make sense anymore in an environmental way. Status seeking can even lead to an increased consumption of now environmentally friendly innovations. Furthermore, there is an idea of people having a mental account of environmental impact. This can help explain how people justify environmentally damaging behavior when they have reduced their impact in another area.

Besides a history of modernization that is driven by efficiency gains and productivity increases there is also empirical evidence for distinct rebound effects in several fields of consumption (Greene et al., 2000). Depending on the specific field of study, on the definition of rebound effect and on methodological questions they can reach from 0 to more than 60%. Note, however, that specific rebounds usually miss the more complex processes. That considered, rebound effects can easily be 100% or higher, in total. This can be taken as a clear indicator that technological change alone will not lead to a desired outcome of true sustainability as long as no countermeasures against the reinvestment of freed assets into more consumption are taken into consideration.

Literature

- P. Girod, Bastien; De Haan. "Mental rebound rebound research report 3". In: (2009). URL: <https://doi.org/10.3929/ethz-a-006224327>.
- L. A. Greening, D. L. Greene, and C. Difiglio. "Energy efficiency and consumption - the rebound effect - a survey". In: *Energy Policy* 28.6 (2000), pp. 389–401. ISSN: 0301-4215. DOI: [http://dx.doi.org/10.1016/S0301-4215\(00\)00021-5](http://dx.doi.org/10.1016/S0301-4215(00)00021-5). URL: <http://www.sciencedirect.com/science/article/pii/S0301421500000215>.
- V. Griskevicius, J. M. Tybur, and B. V. D. Bergh. "Going Green to Be Seen: Status, Reputation, and Conspicuous Conservation". In: 98.3 (2010), pp. 392–404. DOI: 10.1037/a0017346.
- J. D. Khazzoom. "Economic Implications of Mandated Efficiency in Standards for Household Appliances". In: (1980). URL: <http://www.iaee.org/en/publications/ejarticle.aspx?id=1472>.

- K.-M. Griese, C. Kumbruck, and A. Schlichting. "Promotion of sufficient living to reduce CO2 emissions: the example of the tourism industry: an interdisciplinary analysis". In: *uwf UmweltWirtschaftsForum* 23.1 (June 2015), pp. 23–31. ISSN: 1432-2293. DOI: 10.1007/s00550-015-0347-6. URL: <https://doi.org/10.1007/s00550-015-0347-6>.
- S. Ohta, H.; Fujii. "Does Purchasing an "Eco-car" Promote Increase in Car-driving Distance?" Tokyo, 2011. URL: https://link.springer.com/chapter/10.1007/978-1-4471-5532-4%7B%5C_%7D2/fulltext.html.
- S. Otto, F. G. Kaiser, and O. Arnold. "The Critical Challenge of Climate Change for Psychology". In: *European Psychologist* 19.2 (2014), pp. 96–106. DOI: 10.1027/1016-9040/a000182. eprint: <https://doi.org/10.1027/1016-9040/a000182>. URL: <https://doi.org/10.1027/1016-9040/a000182>.
- J. D. Anja Peters, Marco Sonnberger. "Rebound-Effekte aus sozialwissenschaftlicher Perspektive: Ergebnisse aus Fokusgruppen im Rahmen des REBOUND-Projektes". In: January 2012 (2017).
- Santarius. *Der Rebound-Effekt. Über die unerwünschten Folgen der erwünschten Energieeffizienz*. 2012. ISBN: 66666666666666.
- L. Steg, C. Vlek, and G. Slotegraaf. "Instrumental-reasoned and symbolic-affective motives for using a motor car". In: *Transportation Research Part F: Traffic Psychology and Behaviour* 4.3 (2001), pp. 151–169. ISSN: 1369-8478. DOI: [http://dx.doi.org/10.1016/S1369-8478\(01\)00020-1](http://dx.doi.org/10.1016/S1369-8478(01)00020-1). URL: <http://www.sciencedirect.com/science/article/pii/S1369847801000201>.
- R. H. Thaler. "Mental Accounting Matters". In: 206.September 1998 (1999). DOI: 10.1002/(SICI)1099-0771(199909)12:3<183::AID-BDM318>3.0.CO;2-F.
- S. E. West. "Distributional effects of alternative vehicle pollution control policies". In: April 2014 (2004). DOI: 10.1016/S0047-2727(02)00186-X.

1.5 Sufficiency - Changing Values and Lifestyles

Growing economic activity, the pressure exerted towards planetary boundaries, the increasing stress that modern, increasingly complex life evokes in humans have led to discussions about the nature and needs of the human species and about the role that they play in Earth's present history. Are they naturally made for growing, wanting more, being egoistic? Did they choose to live the way that is encouraged today by politics and the economic system? Are they just following, adapting to their environment and structures that are built around them? This would imply a passive, deterministic view of humans. Or do they decide actively, are things going the way that is best for humans? Are they even capable of steering the course of humanity? If so, are they steering towards a common goal for the common good?

As of now, it seems that the 'better' of a dominant rich minority is achieved through the 'worse' of a less powerful majority of people and at the cost of nature. The massive overuse of natural and social capital underlines the responsibility especially of that part of humanity that is dominating the aggressive economic and extraction activity. Humans are causer of and sufferer from this development and they are regarded as the problem solvers at the same time.

On the one hand, the 'human factor' is important when we are talking about resource protection. Humans are a relevant force for the planet's condition. Also, technological progress alone will not successfully lead to sustainability when the consideration of human reactions, behaviors and needs is left out. On the other hand, from a human well-being perspective there is a justified critique on the acceleration of life and growing overconsumption. We have discussed this topic in a previous chapter (Psychological effects of growth). Therefore, a successful path towards sustainability includes a reduction of consumption. Without a limited demand for goods and services that use energy and material a protection of natural resources and the environment is not possible. And a reduction of consumption provides a great potential for human well-being although this seems to be counterintuitive at first sight. We will have a closer look at these potentials in this chapter.

Sufficiency, Efficiency and Consistency

The reduction of consumption is referred to as sufficiency. Sufficiency can be seen as one of three strategies for sustainability: efficiency, consistency and sufficiency. Efficiency aims at reducing the amount of input (energy) per outcome unit whereas it is not defined whether less input is used for the same output or the same input increases the output. Efficiency is a relative measure for the input-output ratio.

Consistency aims at integrating material and production cycles into each other and into natural processes. This means to destroy and impact nature as little as possible. Recycling of material and waste products is an important part of consistency but by far not the only. The cradle-to-cradle (C2C) principle is a practical application of the consistency strategy. A consequent consistency strategy is complex and challenging but can dramatically improve negative impact on nature. Yet, it is not developed and implemented to a large extent. So far, only 30% of the mass that is moved by human activity today (e.g., by mining, building, etc.) is recycled. In most cases, recycling implies that the material loses in quality and amount (so-called downcycling; Schmidt-Bleek, 2007). It is highly unlikely that material and waste cycles can be fully 'closed' and be 100% ecologically compatible (Huber, 2000; Linz, 2006).

Sufficiency is the third strategy that allows for the reduction of consumption in total the goal

that the other two strategies facilitate but cannot fulfill alone (cf. rebound effect, for example)². It means to find a level of consumption that is 'enough'; a strive for the optimum instead of the maximum. Sufficiency aims at the free choice of people to live on a moderate consumption level that allows for a good life and environmental soundness. This does not mean to refrain from pleasant things and suffer deficiency, as the German degrowth economist Niko Paech (2012) argues. It can mean to free oneself from the unnecessary that congests life with clutter, decisions or financial requirements. Most of all, consumptions requires time â time to choose, to take care of and to use a product (Paech, 2012). Time is the utmost limited resource we have. Acknowledging that each consumption activity requires time which on the other hand is ultimately limited, implies that there is a limit to the amount of consumption an individual can bear.

Politically, the sufficiency strategy is usually seen as difficult to implement. It does not contribute to market development towards economic growth as, for example, efficiency can do. It is economic growth, however, that is still used to indicate success of a society (as we have discussed in chapter 4). Despite that, there are policy measures that can support sufficiency. They are addressed later in this chapter.

Four principles of sufficiency

Wolfgang Sachs (1993) was the first to term the 'sufficiency strategy' in Germany. He introduced four principles that can guide sufficiency and help to understand what sufficiency means. The first principle is de-celeration, as opposed to the acceleration of modern times. Machines and technology have rendered possible seemingly unnatural level of pace that becomes most evident in travelling more, faster and further. Sachs describes it as a strong tendency to reach places ever faster where we stay ever shorter. As things go faster, the experience of the present actually becomes poorer. Sociologist Hartmut Rosa (2003) calls this 'contraction of the present'. Acceleration impacts the private sphere and the individual lives with consequences for mental, physical and social health. More activities are carried out and longer distances are covered as the very processes become faster and the resulting free time must be filled. De-celeration means to allow things the time they need and to slow down life to a pace that is agreeable. People are still complaining about a lack of time. Since promises of a much happier future have not redeemed, there is no hurry to reach this future. Acceleration has not brought about the felicity that was hoped for. Hence, we could allow ourselves more placidity and profit from intentional de-celeration by a more intensive and joyful experience of the present (Sachs, 1993). This reduces consumption by extending the time between consumption activities and during each consumption activity, at the same time intensifying the positive experience of the act. It is well known in psychology that joy and pleasure increase when full attention is paid (Hunecke, 2013). Mindfulness training comprises explicit concentration on what is going on right now and what it evokes in one's body and mind. Mindfulness helps to have a fuller experience of the states of body and mind. So, there are reasons to believe that more attention to fewer activities is more satisfying than to carry out a large number of activities but with only superficial experience.

Unbundling is the second principle that Sachs (1993) suggests to implement sufficiency. The production and distribution systems of economic goods are highly optimized within the present economic system. The main goal behind this principle is to increase profits and market share.

²Since a full decoupling of production from natural resources (perfect consistency) is not possible and efficiency does lead to rebound effects which means freed resources are used anyway, another strategy is necessary to limit the demand (i.e. sufficiency).

1.5 Sufficiency - Changing Values and Lifestyles

A high level of specialization, efficiency, and the increasing variety of products has led to high economic dependencies which are to safeguard political stability. However, Sachs summarizes that 'lean production' leads to 'fast transportation'. The geographical distance between the extracted resources, the production sites (that can be various for one product) and the consumer has outreached any level of commensurability. Products can easily be transported around the world before they are sold. The pervasion of the landscape for transport's sake does neither internalize the loss of natural soundness nor social costs of noise and pollution. Since ecological and social damage is not financially incorporated in transport costs, simple products accumulate thousands of kilometers during their production. Unbundling means to counter these problems by decreasing the distance: Distributing products and services on shorter ways to reduce the amount of transport, producing and selling local and regional when possible, and thus compacting regional economies. Another reason for unbundling is to increase transparency. When products have been produced in highly differentiated processes it is difficult for consumers to understand where they come from and how they were produced. Unbundling increases transparency and returns power from multinationals back to smaller regional enterprises. Increased transparency empowers people to make conscious decisions and detect social and ecological problems in the production. De-commercialisation points towards the fact that the economic value of a contribution to society does not reflect the true value. Special attention has been put on 'reproduction work' (D'Alisa Cattaneo, 2013). Reproduction refers to the activities necessary to maintain one's life and create the predispositions to contribute to production. This encompasses child rearing, recreation, hygiene, food (supply and intake), maintaining relationships, running a household, caring for others and other activities that contribute to a functioning human life. Volunteer and reproduction work, interaction among friends and family, and the use of common goods that all members of a society share is an important foundation of a society. Sufficiency requires a reasonable balance between commercial activities and reproduction activities. Consequently, that impairs economic growth. Therefore, sufficiency is very closely related to the idea of a non-growing economy, i.e. degrowth but also other models of a non-growing economic system are discussed (and will be taken up in the next chapters of this course).

Since consumption leads to a large amount of possessions and 'things', people can feel overloaded and unfree. Often, this becomes evident when people relocate and find themselves packing and carrying all kinds of clutter they actually have not used in a long time. De-cluttering is a principle that facilitates a lighter lifestyle and is associated with sufficiency in a very direct sense: how much is enough? How much do I really need? Many possessions pose a responsibility on the owner - e.g. a house or a flat that has to be taken care of, a car that needs to have an insurance and regular repairing or expensive devices like electronics, art or jewelry (just to name a few) that are not to be broken or stolen. They require attention, maintenance, expenses, worry, space and time. Moreover, the above mentioned hyperchoice and a consumerist culture full of advertisement tell us almost constantly what we ought to buy to be happier and have a richer life. Poorer people, who cannot easily afford these things, have a hard time participating in such a society and often try to spend their money on such goods nevertheless. By de-cluttering it is possible to free oneself from stuff and related responsibilities and gain time to enjoy the aesthetics of the own life and prevent a 'fragmentation of [attention and] the mind' (Sachs, 1993, p. 72). Sachs suggests that it is actually satisfying to not take consumption options and just ignore them to a large degree. Just as Henry David Thoreau put it in the 19th century, 'a man is rich in proportion to the number of things he can afford to let alone'.

Sachs' essay is published under the keyword 'value change'. This already indicates the fundamental changes in society that come along with a sufficiency orientation. So far, sufficiency is an idea or a strategy that is talked about and niche communities as well as individuals are practicing it (and always have done so) but no systematic implementation of a sufficiency strategy into society has happened. Fears of scarcity and constraints to freedom are expressed by opponents. Proponents stress the voluntariness and gains in self-autonomy that they associate with sufficiency. While a dictate how to consume is not tolerable in democratic systems we discuss sufficiency with respect to its potentials for self-determination, quality of life and social sustainability.

Wealth in time as a critical feature of sufficiency

One important feature of sufficiency is an increase of the amount of time that one can self-determine. In contrast to material wealth and financial wealth 'wealth in time' is seen as important to realize goals of personal development. Time is a necessary prerequisite to many aspects of sufficiency. The negative consequences of stress due to little time have been addressed in the previous chapters (social and psychological effects of growth and rebound effects). Therefore, it is conducive to quality of life to increase the time people can spend for their own sake. During our chapter on 'consumption and prosperity' it might have become clear that it is necessary for social welfare that community work is done, that time is spent for and with other people and that labor work is not sufficiently contributing to a successful communal life (Linz, 2006).

In the sufficiency debate much attention is paid to the meaning and consequences of wealth of time. There are two approaches to justifying the claim for more time beyond labor work. One is of physical concern: too many resources are used because people produce and consume too much. A promising way of cutting down consumption is to have people earn less money to spend on consumption goods, e.g. by reducing time for labor work. This seems harsh at first sight because it implies that people cannot afford all the things anymore that they have needed so far to live their lives. For most people, it is hard to imagine a life with considerably less money as long as the present lifestyle is the measure and not up for negotiation. It requires a substantial effort, openness, trust and fantasy to figure a different 'norm life' where some parts of labor work and commercial consumption is substituted by unpaid reproduction work and activities, exchange of services, and non-material need satisfaction. From a resource-concerned point of view, less purchase power is, quite straightforward, an easy and safe way to reduce consumption. This results in less production and means less resource extraction from nature.

The other approach leads to the same strategy of reducing people's labor work. But it starts with concern for people's well-being and questions the imbalance of labor work and the other parts of a good life. Here, scholars claim that a reduction of work has multiple advantages for the individual well-being. People, who are suffering less from stress and who have a feeling of being self-determined are healthier. Self-determination increases with more time that can be used for personal purposes. Personal development 'in a Maslovian sense becoming 'what one can be' needs free time and free thought. Less labor work empowers people to cultivate their social self, to define themselves according to their social relationships, e.g. their role in the family, neighborhood, among friends, in the church community, the sport club etc. Then, work is not the main identification mark. Moreover, it can become more usual to contribute to community life in what way so ever. Since the discussion about prosperity indices and critique on the GDP as a measure has brought up the notion that volunteer (or unpaid) work is necessary for a functioning society,

1.5 Sufficiency - Changing Values and Lifestyles

a reduction of labor work time provides the opportunity for far more people to get engaged in volunteering and non-commercial activity. People have the time to make things themselves, to repair things they might replace by a new purchase if they figured there was no time they could invest in fixing the old one. The present logic is to work a lot to buy all the things one cannot take care of oneself because one has to work. In sufficiency logic, this would be turned over by working less for money and more for oneself. This is easy to imagine with the example of food: cooking with basic ingredients or even growing one's own fruits and vegetables in the garden requires a lot more time than buying ready-made food. But it can be cheaper, so expenses for food go down and self-determination is higher because one knows every ingredient, can decide on the amount of fat and sugar in it and so on. Finally, democracy could be strengthened and shortcomings of many present democratic systems that lack transparency and representativeness can be overcome. Less labor time can set free time that people can use individually to participate politically, be it as a private person or in an NGO or political party. The time can be invested to follow political discussions and decisions and to actually use democratic rights that all citizens in a democracy have (but can hardly make use of with a full-time job; Haug, 2014).

Similar principles in practice â South American âBuen Vivirâ and Bhutan's âGross Happiness Productâ

Sufficiency has been brought up for discussion in the early industrialized countries as a reaction to the problems caused by the unlimited hunger for resources of their lifestyles. The core idea, however, is not new. On the contrary, almost every religion has some principles of modesty and humility. Important ancient Greek philosophers suggested that happiness is not increased by possession (like Diogenes in a barrel who requested only the sunlight when he was asked for his wish by Alexander the Great), and in other cultures, there are principles that are quite similar to what we call sufficiency here.

This fact is especially of interest since a major point of the criticism with sufficiency is the privileged position from which people in the global North discuss the need for reduction. Sufficiency is associated with wealth and very high living standards. It promises a relief that follows the refraining from consumption options and increasing well-being by a higher self-determination â but this implies that the options to consume are there.

Sufficiency, however, can be understood as an 'enough', indicating that this does not only mean less but â very intuitively â more for those who are lacking necessities, for example food, shelter, safe water access, electricity, access to education, health services, and information and communication technology. As a term, sufficiency can be inclusive for both norm deviances: too much and too little. As a concept, it stems from a European and North American debate and is related to sustainability and overconsumption.

In other parts of the world, similar ideas can be found but they root in a different history and a different context and, consequently, they are named differently. The need for keeping consumption within limits that respects ecological and human boundaries can thus be seen as a global goal that is of interest regardless of the context.

Buen Vivir is an old Andean tradition. It has recently found its way into the constitutions of Ecuador and Bolivia and also plays a role in Brazil and Venezuela. In its modern form, it comes along as an emancipatory statement that marks off from the Western belief in endless technological progress (Fatheuer, 2011). It surely is an effect of the new 'era' of left-wing governments in Latin America. As such, those countries provide examples of fundamental changes in politics

and economies that lead to positive developments in natural conservation and relative economic independence and even to political success: most of the left-wing governments have been re-elected.

Ecuador's constitution encompasses one section that solely specifies the good life and designates the right for food, health, education, and water. Furthermore, it states the necessity that people are in possession of their rights and exert their responsibilities in respect of their interculturality (as part of a plurinational state) and in harmony with nature (Fatheuer, 2011). In contrast to the Western notion of prosperity, *Buen vivir* does not aim at accumulating more but at finding and reproducing an equilibrium — sometimes referred to as *Sumak Kawsay*, the term in the native language Quechua. As a constitutional concept, *Buen vivir* puts the relation to nature into the focus of development. This is something new.

The inclusion — or even more: the constitutional goal — of traditional concepts of conviviality into a modern constitution is not surprising at first sight, since many constitutions comprise certain value statements. It is more than a value statement but rather a far-reaching 'political roadmap' of change it is remarkable in its consequences and does not halt before considerable consequences for economic activity in the country which, of course, also affects international corporations. *Buen vivir* explicitly addresses the good life of people in their environment. And it acknowledges nature as a legal subject. To ensure control over this condition, external economic dependencies of the country are held low. In a capitalist sense, this is not optimal because it excludes capital and investment — or at least it does not allow for the full potential of external investment. This low dependency has evidently contributed to a relatively high economic stability of the progressive Latin American countries (Fatheuer, 2011).

Bhutan is a country with Buddhism as state religion and a constitutional monarchy. It is famous for introducing the term Gross National Happiness since its King declared the happiness of his people as the goal of the country's politics. In Bhutan, economic interests are put behind environmental protection and the constitution states the right for happiness for every citizen.

It is important to note that those principles and values connected to sufficiency exist in similar forms in different parts of the world. Sufficiency is not only —rich-world frugality— (Alcott, 2008) but has culturally embedded equivalents in different parts of the world.

Policies to support sufficiency

While in some cultures principles of simplicity, modesty or a strong connection to nature are inherent, niche groups can be found all over the world that adhere to such principles. In many European countries ecovillages and eco-communities can be found as well as the strong transition town movement all over the world. In the USA, there has been a social movement for decades that practices a —Lifestyle of Voluntary Simplicity— (Huneke, 2005). Voluntary Simplicity in its practice is very much the same as sufficiency and can be found in other early-developed countries (Australia, UK, Western Europe, New Zealand, Japan, for example; Alexander, 2012). An investigation of motivations and obstacles for Voluntary Simplifiers to practice their way of life provides interesting information about how the context of people facilitates or hinders simplified lifestyles (Alexander, 2012). The most important specific motivations for Voluntary Simplifiers were environmental concern, the wish to be healthier, self-reliance/self-sufficiency, de-cluttering life, to save money, to live more spiritually or mindfully and having more time for oneself and one's family. The greatest obstacles for living a lifestyle of voluntary simplicity were a suitable employment and suitable transport, followed by suitable housing and resisting consumer

1.5 Sufficiency - Changing Values and Lifestyles

temptations. It is, therefore, structural aspects that can play a crucial role whether individuals effectively contribute to sustainability. Motivation for sufficiency is a feature of the person whereas its translation into action is dependent on context factors and the existence of alternatives. Even though sufficiency seems to be rooted in the individual sphere, it is not the individual alone that can be held responsible for a truly sustainable lifestyle of sufficiency. There are policies that can facilitate individual sufficiency attempts. Policies, of course, are highly dependent on the very circumstances in a country and are therefore not directly transferrable. Nevertheless, some quite possibly effective policies have been proposed for the specific case of Germany (e.g. Linz, 2015; Schneidewind Zahrnt, 2013).

- Cities should be designed in a way that enables people to reach schools, workplaces, culture and sport sites, shops etc. easily by bike or walking – that is: more compact. When people live in a green environment that encourages encounter with others, they will act differently than in an anonymous environment where people live close but no space for encounter is designated.
- Cities should provide space and opportunities for recreation instead of leaving people with the decision whether to drive out into the countryside or go shopping on weekends. A limitation of advertisement in public space helps to reduce consumer temptation and does not distract from other opportunities that a city provides.
- Free transport on a communal level facilitates waiving the car. At the same time, with increasing passenger numbers service in transport systems can be extended and thus being made more convenient.
- Policies can support facilitating part-time employment so that this form of employment becomes more accessible, less disadvantaging and more usual. This would possibly lead to more people in labor and at the same time give more people the freedom to additionally work for themselves and engage in community work.
- Taxes and a reformation of subsidies (e.g. in EU agriculture) can help to adapt prices so that they account for negative environmental and social impact. This could apply, for example, to unsustainable clothes production, to non-ecological agriculture, and to meat products. Ideally, choosing the more sustainable alternative out of two would then not be tied to paying a premium but would be the easier (cheaper) alternative.
- Approaches to enable civic participation in political decision making, for example on a communal level, can also help to redefine the role of citizens from a consumer role to the role of responsible and relevant stakeholders. This possibly increases acceptance of the outcomes and can change the attitude of people – from considering oneself as a passive subject that has an untouchable private life, a not self-determined working life and a reactive consumer role to an active member of society that is given responsibility and the possibility of actual participation.

The proposed policies are structural interventions that support individual sufficiency. Some of them are simply implemented by changing the default option. This sort of interventions is often referred to as nudging – gently pushing people towards a behavioral option by making certain options more visible or more easily accessible. The important message of the policy examples is that, on the one hand, there are possibilities to facilitate behavior in the private sphere and that, on the other hand, the design of policies, of political participation and of the living environment does affect the image of the individual's role within the system. This can be reflected upon and integrated into planning processes of interventions, technologies, city development and legisla-

tion.

As Librova (2008) states, it is complicated to live simply. But, as we have learned in this chapter, there are a lot of measures on very different levels that can be taken to make it easier.

Literature

- S. Alexander and S. Ussher. “The Voluntary Simplicity Movement : A multi-national survey analysis in theoretical context”. In: 163 (2012). DOI: 10.1177/1469540512444019.
- C. Alisa, Giacomo D; Cattaneo. “Household work and energy consumption : A degrowth perspective. Catalonia ’ s case study”. In: January (2013). DOI: 10.1016/j.jclepro.2011.11.058.
- F. Haug. *Frigga Haug: Zeit, Wohlstand und Arbeit neu definieren - YouTube*. (Accessed on 09/11/2017). 2014. URL: %5Curl%7Bhttps://www.youtube.com/watch?v=fqOTf3Ry0AA%7D.
- J. Huber. “Towards industrial ecology: sustainable development as a concept of ecological modernization”. In: *Journal of Environmental Policy and Planning* 2.4 (2000), pp. 269–285. ISSN: 1522-7200. DOI: 10.1002/1522-7200(200010/12)2:4<269::AID-JEPP58>3.0.CO;2-U. URL: http://dx.doi.org/10.1002/1522-7200(200010/12)2:4%3C269::AID-JEPP58%3E3.0.CO;2-U.
- P. D. M. Hunecke. “Psychological resources for sustainable lifestyles”. In: June (2013). DOI: https://doi.org/10.1016/j.jclepro.2015.10.061.
- M. E. Huneke. “The face of the un-consumer: An empirical examination of the practice of voluntary simplicity in the United States”. In: *Psychology and Marketing* 22.7 (2005), pp. 527–550. ISSN: 1520-6793. DOI: 10.1002/mar.20072. URL: http://dx.doi.org/10.1002/mar.20072.
- H. Librova. “The Environmentally Friendly Lifestyle: Simple or Complicated?” In: (2008).
- M. Linz. “Weder Mangel noch Übermaß”. In: 145 (2004).
- M. Linz. “Suffizienz als politische Praxis Ein Katalog”. In: (2015). URL: https://wupper%5C%5Cinst.org/.
- N. Paech. “Liberation from Excess”. In: (2012), pp. 12–23.
- H. Rosa. “Social Acceleration: Ethical and Political Consequences of a Desynchronized High-Speed Society”. In: *Constellations* 10.1 (2003), pp. 3–33. ISSN: 1467-8675. DOI: 10.1111/1467-8675.00309. URL: http://dx.doi.org/10.1111/1467-8675.00309.
- W. Sachs. “Die vier Es”. In: 11.33 (1993).
- F. Schmidt-Bleek. *The Earth: NATURAL RESOURCES AND HUMAN INTERVENTION*. Frankfurt, Germany, 2007. ISBN: 9781906598099.
- A. Schneidewind, U. & Zahrnt. *Damit gutes Leben einfach wird. Perspektiven einer Suffizienzpolitik*. Munchen, Germany, 2013.

Additional reading suggestions:

E. Fromm. *Die seelischen und geistigen Probleme der Überflussgesellschaft-YouTube*. <https://www.youtube.com/watch?v=b8RkAB4SBxk>. (Accessed on 09/11/2017).

From Efficiency to Consistency, from Consistency to Sufficiency | *The Sceptical Economist*. (Accessed on 09/11/2017). URL: <https://zielonygrzyb.wordpress.com/2012/05/08/from-efficiency-to-consistency-to-sufficiency/>

A. Muller. "Sufficiency-does energy consumption become a moral issue?" In: (2009). DOI: 10.1088/1755-1307/6/6/262003.

Guidance for discussion**ABSTRACT FOR DISCUSSION PAPER**

The paper discusses the role of the so-called sufficiency strategy for promoting sustainability. After a sound discussion on different definitions of this strategy available in the literature and a distinction from efficiency and consistency, the main focus and concepts that are part of the sufficiency strategy are extracted. Then the implications of this strategy for countries in different economic development (or energy consumption) stages are discussed and the different arguments for the existence of a 'sufficiency-rebound' effect are presented and critically reflected. On the light of the above given definitions and implications, the role of political schemes promoting the sufficiency strategy is discussed. Finally, critical statements and sound conclusions on the role that this strategy should play for achieving a 100% renewable energy supply in North-South contexts are given.

BIBLIOGRAPHY

Primary reading for this topic:

B. Alcott. "The sufficiency strategy: Would rich-world frugality lower environmental impact?" In: *Ecological Economics* 64.4 (2008), pp. 770–786. ISSN: 0921-8009. DOI: <http://dx.doi.org/10.1016/j.ecolecon.2007.04.015>. URL: <http://www.sciencedirect.com/science/article/pii/S0921800907002728>.

Main points to focus on:

- What are the different definitions of the sufficiency strategy? What are main principles characterizing it? What are the main goals of the strategy and by which means does it intend to reduce environmental impact (I=PAT)?
- The "efficiency-rebound effect"?: definitions and examples from literature; own examples? (→ stating clearly which is your own and which is from literature)
- The "sufficiency-rebound"?: strengths and weaknesses in the argumentation stating its existence. Try to state the paper's argumentation and opinion and then present your own conclusions and own argumentation (stating clearly that it is your own one - or critical questions on the paper's argumentation)
- What are the different implications and implementations of sufficiency required for North/South countries?

D. Heyen et al. *When less is more - Sufficiency - Need and options for policy action*. en. 2013. URL: <https://www.oeko.de/oekodoc/1880/2013-008-en.pdf>.

Key points to focus on:

- Conflict between political and personal definitions of the strategy

-
- Necessity of political instruments and examples of system innovation schemes
 - Examples of political schemes

GUIDING QUESTIONS FOR DISCUSSION

- What definitions of the sufficiency strategy are available?
 - Personal vs. political level of this strategy
 - Principles and goals of this strategy
 - Distinction from the efficiency strategy and the consistency strategy; definitions of these strategies
- What are the implications of the sufficiency strategy for different countries (depending on their "economic" development level)?
- What is the role of political schemes promoting this strategy? What are suitable schemes for this aim?

1.6 Decoupling

Learning objectives

- Achieve a sound understanding of the concepts of relative and absolute decoupling and reflect on the role of renewable energies for promoting the two of them
- Get familiar with the Ehrlich equation and the relationship between the variables involved in it
- Critically assess the present state of decoupling in the energy sector on the light of a particular application field

Guidance for discussion

ABSTRACT FOR DISCUSSION PAPER

This paper presents a sound introduction and critical understanding of the decoupling concept. After a sound definition of the concept, its main goals and principles are introduced in relation to the strategies for sustainability which they tackle. Then, the concepts of absolute and relative decoupling are presented and differentiated from one another: their different scope, aims and the different possibilities they address for achieving or sustaining a "green growth". To ease and clarify the differences among them, their goals are presented on the light of the different variables they address from the Ehrlich equation. Furthermore, their achievements and fundamental differences are shown by means of graphs showing the current global trends of relevant variables (e.g. carbon intensities, resource extraction,...). Finally graphs and values analyzing the achievement of real decoupling in the energy sector from either a chosen country or global trends will be presented, analyzed and discussed as a particular in-depth case study.

BIBLIOGRAPHY

Primary reading for this topic:

Prosperity Without Growth: Chapter 5, The Myth of Decoupling. (Accessed on 09/12/2017).

URL: %5Curl%7Bhttp://indigodev.com/ProsperityWithoutGrowth.html#myth%7D.

Main points to focus on:

- define the general concept of decoupling as well as the ideas of relative and absolute decoupling: which are the differences and common ideas? Which principles and strategies do they focus on?
- draw qualitatively graphs for relevant magnitudes showing real, absolute and relative decoupling. Compare them to real global trends of the chosen magnitudes.
- explore critically the Ehrlich equation: which terms are addressed for relative and absolute decoupling? What is the role of economic growth in achieving decoupling? Which

relation do the economic costs of decoupling have with current growth rates (see comments on Stern report conclusions and assumptions!)

- on the basis of a literature review and relevant data analysis analyze decoupling in the energy sector either for a single country (of your choice) or globally: which is the role of technology development and resource efficiency in both decoupling concepts?

GUIDING QUESTIONS FOR DISCUSSION

- Would an absolute decoupling be fostered by the global implementation of renewable energies? Or maybe the opposite would be more likely the case? Justify your answer!
- Are there strong differences in the role of different RE technologies for promoting an absolute decoupling? Are there RE technologies more likely to reinforce the trend of achieving merely

3 — Social Dimension

*“When all the trees have been cut down,
when all the animals have been hunted,
when all the waters are polluted,
when all the air is unsafe to breathe,
only then will you discover you cannot eat money.”*

- Cree Prophecy

3.1 Prosperity

In this chapter we want to address the question of prosperity. The term seeks to indicate how well people are living in a country. When talking about prosperity, the association of economic wealth is quite strong and in general it is assumed that people are living well in a country where the economy is strong. We take a look at this connection between economic prosperity and the well-being of people and discuss alternative indicators of prosperity that might be more proper indicators of the prosperity of a society.

GDP as a prosperity index

The prosperity of nations is usually inferred from the economic wealth within a country, expressed through the Gross Domestic Product (GDP) per capita. It is assumed that the average amount of money a person has defines the standard of living in a country. There is a lot of critique on using the GDP as a main indicator of a nation's prosperity. Even its 'inventor' Simon Kuznets warned in 1934 to not use the GDP as an indicator of welfare. However, it is a measure of the total national economic activity. One assumption is that living standards increase with increasing economic activity. Another one is that a nation's economic success would 'trickle down' to all citizens of the country. This effect is questioned though by many scholars such as economists and Nobel Prize winners Paul Krugman and Joseph Stiglitz. The GDP encompasses economic value that has been produced in terms of final goods and services. The GDP, however, does not account for 'bads' that result from economic activities as well as for 'goods' that are done beyond economic value. Let's go more into detail on those two crucial points.

'Bads' that result from economic activity besides goods

The production of goods and services relies on natural resources and services. There are multiple examples of negative by-products in environment, work and living conditions that are brought about by economic growth (Diefenbacher Zieschank, 2010). Agrarian production and intensification has for example caused pollution in ground-water, soils and aquatic systems that are not reflected in the produced value. Dangerous working conditions in mines, nuclear power plants, factories with low safety standards as for example in some parts of the textile industry are by-products of economic activity that is likewise not reflected in the resulting value of the products. Hard working conditions, performance pressure and social disintegration can cause depression, alcohol and drug abuse, and other negative consequences for individuals. Thus, besides the produced 'goods' that are expressed in economic value, there are also 'bads' - undesirable outcomes of the very same activity that leads to an expression in GDP indicating prosperity.

Unpaid work ensures a successful society

On the other hand, the welfare of a nation is not sufficiently determined by economically quantified goods and services and the resulting monetary value. Work that is done at home like raising children, running a household, cultivating friendships and voluntary service in the community, church or sport clubs, engagement in political groups etc. constitutes an essential part of welfare and the general functioning of a society. Especially when it comes to care for the elderly, it becomes obvious that a lot of work is covered within the informal private sector. It is very often family members that care for them and sometimes even step back from their labor work for that.

3.1 Prosperity

To integrate the care for the elderly fully into the economic system by providing full institutional care would in fact hardly be bearable for the current societies. The GDP does only measure value that has been monetized. Therefore, these private and unpaid contributions to the well-being of other people and for the community do not have any impact on the GDP. An indicator for welfare that does not include the important 'informal' contributions to welfare and neither accounts for the harm done by producing its wealth can be regarded as insufficient.

Different kinds of human needs

Prosperity is ultimately a measure of how well people live in a country. Individuals strive for need satisfaction and societies have the goal to facilitate need fulfilment for its members, that is to foster their well-being. Abraham Maslow proposed a theory on the nature of human needs about half a century ago. Maslow (1964; 1987) assumes that needs come up in a hierarchical order. The basic needs that have to be fulfilled first are physical and safety needs: food, sleep, health, shelter, and removal from danger. Before a need is not fulfilled to a satisfying level, higher-order needs will not play an important role in people's actions. When basic needs are fulfilled to a satisfactory degree, needs of belonging become dominant such as the need for love, affection, and being part of groups. Next higher needs are esteem needs, meaning self-esteem as well as esteem from others. This is the need to feel respected and valued by others and people seek it often in their jobs or hobbies and find its manifestation in status and reputation, for example. However, even more important is the often subsequent goal of self-respect, which means to accept who one is, experiencing inner strength, self-confidence, competence, independence and freedom (Maslow, 1943). The highest need is according to Maslow the need for self-actualization. What he means by that is subsumed in the statement "What a man can be, he must be". It is the rest of restlessness that remains even if all other needs are fulfilled unless the full potential in a person is tapped. The structure of the hierarchy of needs is visualized in Figure 3.1.



Figure 3.1: The hierarchy of needs according to Maslow (1943).

While it cannot be assumed that the order of needs is strictly unvariable in every person and the needs do not necessarily have to be fulfilled before higher needs come up, it is a helpful approach

to understand different qualities of needs, their interrelationship and the direction humans are striving to.

Consumption as a means for need satisfaction

To fulfill these needs in hierarchy money could theoretically become less important for the higher needs since they are not necessarily tied to material consumption. However, as we can easily see when looking at advertisements, there are masses of products that promise to fulfill higher needs (shampoo not simply helps you wash your hair but expresses your personality makes you a highly attractive and adorable person for others).

Smart (2011) states that in early developed countries basic needs are satiated so that an increase in consumption does not lead to further fulfilment of those. Since consumption can hardly contribute to the highly individual pursuit of self-actualization, industries do â as already mentioned â focus on needs that are related to esteem by self and others because these are the needs where further fulfillment is possible and more consumption can be stimulated â which is so necessary to provide economic growth (Smart, 2011). He explains the growth strategies as perverse because while aiming at need satisfaction they inhibit a satiation of needs at the same time, creating more needs to stimulate more consumption.

There is consumption that facilitates belonging to a group, at least in the first place. To have a true feeling of belonging and of being esteemed, money and possessions are not ultimately leading to the goal. For esteem needs it is easy to comprehend consumption-based strategies as an endeavor to gain esteem, be it status symbols like cars, houses, electronics, or "green" consumption to be esteemed in certain groups that value expenses in this field or even immaterial consumption such as travelling to exciting or interesting places, engaging in costly activities like paragliding or climbing famous mountains. But still, consumption is not the need itself, it is a means for reaching something different that is not necessarily consumption-related â and this is social affiliation and to be respected.

For self-actualization, the highest need, there is hardly a way consumption can satisfy this need. So for higher goals the potential to satisfy them by monetary means is limited and their effectiveness can be doubted (see the later seminar unit on psychological effects on growth). A certain prosperity is necessary to have the means and to have other needs satisfied; nevertheless at least equally important it is to have the freedom, stable social embedment and self-confidence as well as the time asset to address self-actualization. There are necessary preconditions that have to be met so that people have a stable basis for developing themselves to what they can be and want to be.

Well-being as the capability to...

The idea of necessary preconditions to develop oneself is the logic that underlies an alternative approach to determining the welfare of nations, that regards the actual well-being of people: the capabilities approach. It was developed by Amartya Sen, an Indian economist and philosopher who was awarded with the Nobel Prize for Economics in 1998 for his work that integrated welfare economics, theories of economic development and living standard. Central in the capabilities approach is the idea that neither the monetary possibilities (as expressed in the GDP) nor a pure concentration on human rights and living standards are sufficient to properly express the level of people's well-being. To be capable of living a good and succeeding life it is nec-

3.1 Prosperity

essary to have choices and to experience agency (Robeyns, 2005). Therefore, material goods and resources as well as money are important means, but not ends. On the other hand, it is not adequate to define what people have to gain or to know. This can be highly dependent on their environment, culture, and free choice. There is no need for example to define a certain health status or a minimum living space that is considered necessary for a high standard of living if people decide by themselves to live on an unhealthy diet or if it is considered as adequate and pleasurable to live with a large family in a small space, this is not a valid indicator for living standard. People must have the opportunity and the choice to live a good life, whatever that means to them. Important is what they are able to do and to be (Robeyns, 2005). Central ends according to Sen's argumentation are increased well-being, justice and development. Economic prosperity, technical progress and social modernization are still regarded to be important but always in the light of enriching people's lives. The mere possession of goods is no guarantee that it provides the necessary functioning. Achievements have to be supportive of a valuable life and actual choices.

Alternative indicators of prosperity - HDI

Sen's capabilities approach lay the foundation for developing the Human Development Index (HDI) as an indicator for estimating prosperity of different countries. The HDI combines indices for life expectancy, education, and GDP per capita of a country. The rationale behind this is that health, education, and money are necessary to take part in society and to lead a valuable life, just as the capabilities approach suggests.

Since 1990, the United Nations (UN) publish the state of human development in the world's countries in annual reports. While the HDI provides the advantage of including education and life expectancy besides GDP, it neglects other important factors. There is no measure of social equity included, meaning that it does not reveal the range between high and low incomes. This, however, is an important precondition for peace and health levels (Wilkinson Pickett, 2010). Furthermore, the HDI does not reflect ecological conditions such as damage or pollution. It is better suited for comparing countries that are less developed whereas it does not show the development potential for countries that are high in HDI. Some critics say that it was actually a measure for how "Scandinavian" a country is (Caplan, 2009) where there is no more development intended. This refers to the question indeed, whether the Scandinavian standard and way of living are the ideal to strive for.

From a different perspective, the point that also in terms of Scandinavian standards there should be more potential to develop, as Caplan puts it, leads us back to the question what development means (referring back to Seminar Unit 2). While on the one hand a society as prosperous as Scandinavian countries (that are leading the HDI rankings) can, of course, go on and develop more innovations, comfort-enhancing features of everyday life and further optimize human bodies in terms of disease treatment and longevity of lives, there are on the other hand questions of happiness and life satisfaction that are hardly related to that. Here again, it becomes obvious that HDI is still an 'objective' measure that does not reflect subjective well-being or happiness, but assumes that with economic power, education and high life expectancy well-being is ensured.

Integrating the subjective perspective â Happy Planet Index

A different indicator that is less important in policy terms but has gained a lot of attention as well is the Happy Planet Index. It relates expected happy years ("Happy Life Expectancy") to the resources needed to realize them. Happy Life Expectancy is calculated by the average reported happiness in a country (derived from the World Database of Happiness) multiplied with the life expectancy at birth in that country. By relating the Happy Life Expectancy to the resource demand for leading that life, reflected in the average ecological footprint, the Happy Planet Index thus takes sustainability into account and many 'happy years' are not valued by a high score unless they are achieved in a resource-saving way.

Alternative Indicators respect non-economical factors of well-being

By accounting for non-economical aspects of life satisfaction the HDI, the Happy Planet Index and some other approaches of measuring prosperity provide different advantages of either respecting social issues like health or education, or ecological well-being of the immediate surrounding in (and from) which people live. Just as need satisfaction is not only a matter of material goods and economic power, a nation's welfare potential and prosperity is determined by a multitude of factors directly influencing people's subjective well-being as well as their capabilities of realizing a good life for themselves â just as the highest needs related to self-actualization require highly individual decisional freedom.

The resource demand of human well-being

Concerning sustainability, there is of course a crucial question asking: how is resource consumption related to human welfare? There is no need to argue about the obvious requirement of energy, land, and other resources for the realization of a good, safe and valuable life. However, there are several studies leading to the assumption that there is a saturation occurring in the gains by increased economic power, energy consumption and others. Jackson (2009) reports that an increase in GDP per capita leads to no relevant increase in quality of life over a threshold of about 15.000 \$ p.a.



Figure 3.2: Happiness and average annual income (Jackson, 2009)

3.1 Prosperity

With increasing prosperity a decoupling of per capita energy (that means: carbon emissions) from quality of life (that is a higher level of needs satisfaction) becomes evident (Steinberger Roberts, 2010). While in lower levels of human need satisfaction (reflected in HDI) an increase in primary energy consumption and alike in carbon emissions leads to significant improvement of living standards this does not hold true for higher HDI levels. The curve in Figure 1 rises steeply in the beginning – an increase in per capita energy consumption leads to a quite strong increase in quality of life. But the curve satiates at a certain level, meaning that an increase in energy consumption does not lead to substantial increases in quality of life anymore. Steinberger and Roberts (2010) suggest thresholds of energy consumption where human needs are met to a reasonable extent and the influence of increased energy consumption becomes weaker. Already some decades ago there have been authors proposing that a satisfying level of living standards can be reached by 2000 Watt per capita which corresponds to about 1 t of CO₂ emissions per year (Spreng, 2005; Chakravarty et al., 2009). Moreover, the amount of energy required to reach a certain level of HDI seems to be lower in later data as compared to some decades ago, as was found in comparisons between the 1960's and 1990's (Suarez, 1995). The thresholds for 'high human development' as proposed by the United Nations Development Programme (UNDP) are a life expectancy of 70 years at birth, a GDP of 10.000 USD, a literacy rate of 80% and an HDI of 0.8. This can be achieved by a constantly decreasing input of energy indicating that a decoupling of human development from energy is happening. This concept is often referred to as environmentally efficient well-being (Dietz, Rosa York, 2008).

Steinberger and Roberts (2010) confirm that energy input into society becomes more tightly linked to the GDP. This means a growth in GDP is increasingly dependent on higher energy input. At the same time, indicators of human well-being like the HDI and its separate components life expectancy and literacy level become less associated with energy consumption – meaning that at a certain level they are either fulfilled or their further fulfillment needs something that is not tied to energy consumption and GDP growth.



Figure 3.3: The relation of basic physical need fulfillment and income. Data points are scores for nations. N = 101 nations. Basic needs include food calories, clean water, sanitation, longevity, and low infant mortality. (taken from Diener Diener, 1995)

At least politically, GDP still is the number one indicator of the development and success of a

nation. But there has been some impact of alternative measures and of the notion that the gross economic activity does not display the well-being of individuals in a country. There are some countries that consequently direct their policies towards different goals.

Bhutan is famous for its politics that aim at enhancing the gross national happiness instead of gross domestic product. Policies and governments thus have to be evaluated by their effects on the happiness of people in Bhutan.

Bolivia and Ecuador have the concept of 'buen vivir' enshrined in their constitution, an old principle of the andine cultures aiming at the 'good life'. While politics also in Bolivia and Ecuador are still lacking a consequent implementation of this principle, these examples are reminders that there are ways of committing politics to human well-being in a more direct and explicit way than the focus on GDP growth does.

Homework

- Please elaborate on the difference between functionings and capabilities in Sen's approach and give examples for both. What is in your opinion the limitation of policies aiming at functionings only?
- Read Amartya Sen's "Human Development and ecological sustainability"
- Buen Vivir, Gross National Happiness – how do the countries who are committed to a different welfare indicator realize this endeavor in politics, society or institutions? Find one or two examples and describe them.

Literature

Chakravarty et al., 2009

Spreng, 2005

Suarez, 1995

B. Caplan. *Against the Human Development Index*. (Accessed on 09/13/2017). URL: %5Curl%7Bhttp://econlog.econlib.org/archives/2009/05/against_the_hum.html%7D.

R. Z. Hans Diefenbacher. "Measuring Welfare in Germany". In: (2010). URL: http://www.umweltbundesamt.de/uba-info-medien-e/mysql%7B%5C_%7Dmedien.php?anfrage=Kennummer%7B%5C&%7DSuchwort=3903.

E. Diener and C. Diener. "The wealth of nations revisited: Income and quality of life". In: *Social Indicators Research* 36.3 (Nov. 1995), pp. 275–286. ISSN: 1573-0921. DOI: 10.1007/BF01078817. URL: <https://doi.org/10.1007/BF01078817>.

T. Dietz, E. A. Rosa, and R. York. "Environmentally efficient well-being : Is there a Kuznets curve ?" In: *Applied Geography* 32.1 (2012), pp. 21–28. ISSN: 0143-6228. DOI: 10.1016/j.apgeog.2010.10.011. URL: <http://dx.doi.org/10.1016/j.apgeog.2010.10.011>.

P. T. Jackson. "Prosperity without growth? The transition to a sustainable economy. Report for the Sustainable Development Commission." In: (2009).

A. H. Maslow. *A Theory of Human Motivation*. (Accessed on 09/13/2017). 1943. URL: %5Curl%7Bhttp://psychclassics.yorku.ca/Maslow/motivation.htm%7D.

-
- A. H. Maslow. *Peak experience* - *Wikipedia*. (Accessed on 09/13/2017). 1964. URL: %5Curl%7Bhttps://en.wikipedia.org/wiki/Peak_experience%7D.
- A. H. Maslow. *Motivation and personality (Book, 1987) [WorldCat.org]*. <http://www.worldcat.org/title/motivation-and-personality/oclc/14586023>. (Accessed on 09/13/2017). 1987.
- I. Robeyns. “The Capability Approach: a theoretical survey”. In: *Journal of Human Development* 6.1 (2005), pp. 93–117. DOI: 10.1080/146498805200034266. eprint: <http://dx.doi.org/10.1080/146498805200034266>. URL: <http://dx.doi.org/10.1080/146498805200034266>.
- M. Smart. “Anatomy of Growth in the Developed World”. In: *Economic Papers: A journal of applied economics and policy* 30.3 (2011), pp. 356–367. ISSN: 1759-3441. DOI: 10.1111/j.1759-3441.2011.00131.x. URL: <http://dx.doi.org/10.1111/j.1759-3441.2011.00131.x>.
- J. K. Steinberger and J. T. Roberts. “From constraint to sufficiency: The decoupling of energy and carbon from human needs, 1975â2005”. In: *Ecological Economics* 70.2 (2010). Special Section: Ecological Distribution Conflicts, pp. 425–433. ISSN: 0921-8009. DOI: <http://dx.doi.org/10.1016/j.ecolecon.2010.09.014>. URL: <http://www.sciencedirect.com/science/article/pii/S0921800910003733>.
- C. DEEMING. “R. Wilkinson and K. Pickett (2010), *The Spirit Level: Why Equality is Better for Everyone*. London: Penguin. Â£9.99, pp. 347, pbk”. In: *Journal of Social Policy* 42.4 (2013), 840â842. DOI: 10.1017/S0047279413000366.

3.2 Well-being, Needs and Energy Consumption

Learning objectives

- Get familiar with some indicators addressing the level of prosperity or development of a country, in particular with the HDI.
- Explore the relation between development indicators and the energy consumption (and related environmental pollution in terms of CO₂-emissions) and identify relevant threshold values for the second.
- Explore the relation between per capita energy consumption and GDP for on the hand of two country examples.
- Critically address the role of renewable energies and energy consumption for promoting development and prosperity in a society.
- Reflect on the importance on questioning (and critically understanding) discussions based on parameters addressing development levels, as well as discourses based on ever-increasing energy consumption levels.

Guidance for discussion ABSTRACT

In this paper the relation between the per capita energy consumption and several development goals (i.e. life-expectancy, literacy, GDP per capita and HDI) is discussed and analyzed based on data for two different countries (one early-developed country and a developing one). The Human Development Index (HDI) based on Amartya's Sen capabilities approach, is the main indicator chosen for assessing the level of prosperity of a country. The saturation behavior between the energy consumption and CO₂-emissions levels and the development indicators analyzed is thoroughly discussed and contrasted with the relation between energy consumption and national GDP. Comparing the different behavior of the variables allows to withdraw some critical conclusions on the role of increased energy consumption beyond certain levels and its related benefits to the society. From that argumentation the model 2000-Watt society as proposed by D. Spreng is motivated. The consequences of implementing the 2000-Watt society in a developed and developing country is analyzed then, based on the impact of the prosperity parameters chosen.

BIBLIOGRAPHY

Primary reading for this topic:

J. K. Steinberger and J. T. Roberts. "From constraint to sufficiency: The decoupling of energy and carbon from human needs, 1975â2005". In: *Ecological Economics* 70.2 (2010). Special Section: Ecological Distribution Conflicts, pp. 425-433. ISSN: 0921-8009. DOI: <http://dx.doi.org/10.1016/j.ecolecon.2010.09.014>. URL: <http://www.sciencedirect.com/science/article/pii/S0921800910003733>.

3.2 Well-being, Needs and Energy Consumption

Conceptual understanding of the topic:

Get familiar with the saturation behavior of the development parameters investigated by the authors as dependent variables as a function of the explanatory variables chosen.

- Understand the global and country-specific trends for the thresholds of energy and carbon emissions for achieving particular development goals (Fig. 2): what are the main factors influencing this trend?
 - Having in mind the different rate of decrease in the (energy and carbon) thresholds for life-expectancy, HDI and literacy and the rate of increase in energy consumption globally: can we say something about the behavior or future trends of absolute energy consumption?

Tasks for your paper:

For two countries of your choice (1 early developed and one developing one) develop for the time frame since 1980 (available data from UNO) graphs showing the behavior of: GDP vs. primary energy consumption; HDI, life expectancy and literacy vs. primary energy consumption. Relate them to the global regression lines (in Fig. 1 or 4) of the article, i.e. show your results together with those from the global regression plots in the paper.

- Show the "1000Watt" and "2000Watt-societies" proposed (p. 3 and p.8) proposed in the literature as a guideline for a more equal distribution of energy resources and consumption in the graph and relate it to the current data from the countries you are analyzing.
- Compare the different trends or relationship between energy consumption and the development indicators proposed on one hand, and between energy consumption and GDP on the other side : what are your main conclusions from this comparison? What is the main impact of increasing energy consumption?

D. Spreng. "Distribution of energy consumption and the 2000 W/capita target". In: February 2005 (2017). DOI: 10.1016/j.enpol.2004.03.023.

Conceptual understanding of the topic:

What is the motivation for the 2000-Watt society?

- What would be the role of Renewable Energies for pursuing this goal? How would the proposed threshold might be influenced by a wider implementation of REs?
 - Assuming that the average energy consumption proposed is to be achieved by fulfilling minimum requirements in intragenerational justice (i.e. drastic energy demand reductions in the developed countries are implemented to promote higher consumption levels in less developed countries): what would be its impact on the well-being in both developed and developing economies? (to answer this question relate to the limit proposed to the threshold graphs from the 1st article)

Tasks for your paper:

Compare the actual level of total primary consumption of the two countries you chose to the proposed 2000W limit: how far are they from there? If you can get data for the primary energy demand of these countries by sector try to include them in your

argumentation for the impact of converging with the 2000Watt-limit in each country case.

Additional reading:

S. Anand and A. Sen. “Human Development and Economic Sustainability”. In: 28.12 (2000). arXiv: S0305-750X(00)00071-1.

Data:

NOTE: The main focus of this paper should be on the indicators mentioned in the abstract. However, you might include a comparison with other indicators available such as the Happy Planet Index or the Energy Development Index. References for this additional indicators can be found below on the section named “Data”.

- <http://hdr.undp.org/en/data>
- <https://www.iea.org/publications/freepublications/publication/WEO2015SpecialReportonEnergyandClimateChange.pdf>
 - Happy Planet Index: <http://www.happyplanetindex.org> : here you can check the definition, advantages and drawbacks of the HPI as compared to e.g. the HDI. Data for different countries on this and related indicators are also available there, also historic data is not easily accessible (only values for two periods around 2007 and 2011).
 - Energy Development Index (EDI): <http://www.worldenergyoutlook.org/resources/energydevelopment/measuringenergyanddevelopment/> (Stand: 20.11.2015)

GUIDING QUESTIONS FOR DISCUSSION

How could you explain the rather proportional relation between the GDP and energy consumption per capita in a country? What do you think is the “link” relating the two variables?

- What are the main drawbacks and disadvantages of the HDI as an indicator for development? What are its main strengths and advantages as compared to other indicators?
- Do you think the HDI is a sound approach for assessing the development level of a country?
- Do you think the proposal of the 2000-Watt society is meaningful? Do you think it is feasible? Support your statements!

3.3 Psychological effects of economic growth

Three major questions shall be tapped in this chapter. Is it intrinsically in humans to strive for more? Does growth in consumption lead to higher individual well-being? What consequences can be drawn from the effects of growth on the individual?

In addition to the reading, please also watch this video by Barry Schwartz: "The paradox of choice" http://www.ted.com/talks/barry_schwartz_on_the_paradox_of_choice (20 min.)

Saturable needs and growth needs

There is unclarity about the nature of human need development. Maslow (1943) stated that a man is a perpetually wanting animal (p. 395), indicating that humans want more and more. This is true in so far as the organism has to be sustained. A person has to eat every day and being loved is not done after one occasion but is a constant need. However, there is the idea of sequentiality in Maslow's theory (as discussed previously in the earlier chapter on prosperity) where higher needs come up as soon as previous needs are sufficiently satisfied. Maslow distinguishes deficiency needs and growth needs. Deficiency needs need to be satisfied – if there is a lack humans will feel anxious and tense. These lower needs know a saturation level, on the other hand, because they are physical. There is an "enough" in food intake, for example. The basic needs are deficiency needs, like physiological and safety needs and need for love and belonging. Growth needs are those that grow with the level of satisfaction. They do not reach saturation because they are not physical – they are mental, abstract and first and foremost socially constituted. As a matter of culture and norms, the predominant notion is that 'development' is necessary to prosper individually. This means to go further, reach goals that have not been reached so far, to be innovative and discover new possibilities that can change one's own and others' lives. As soon as a certain level of need satisfaction is reached new goals emerge (related to that need) that exceed the currently reached level. This applies especially for the higher needs for esteem and self-actualization. But they can also be connected to lower needs. Eating a delicacy in a high-class restaurant with one's spouse is not basic need satisfaction in terms of food intake or mating success but serves social esteem needs. So when physical needs are satisfied they can still be used or redefined as a different kind of need satisfaction.

Satisfaction of needs can also be understood as relative in a sense that it is not merely based on an absolute level of need satisfaction (e.g. "I have a car, so I can drive anywhere I want") but it is sensitive for social comparison (e.g. "My neighbor has a bigger car, that is more costly and has a luxurious interior"). That means whatever level of need satisfaction is reached – be it by consumption or by immaterial status – it is not satisfying enough once too many others have reached the same level. Social comparison provides opportunity for an endless escalation.

Even though Maslow's theory is empirically controversial, the concept of new upcoming goals as soon as a previous one is reached is highly plausible. It helps to understand human behavior and consumption behavior through the stages of need satisfaction and also the logic behind the development and placement of new consumer products.

Saturation of needs

However, the concept of saturation is also inherent in the theory and easily observable in the lower needs: There is a need for warmth, but this does not mean that hotter temperatures are always better. There is an optimum level of warmth. The same holds true for food: there is obviously a sufficient level of food intake beyond which more food is not satisfying anymore but actually leads to a worse condition (aching stomach, feeling sick etc.). Smart (2011) argues that in the early developed countries basic need satisfaction has long been saturated for most of the people. This does not mean that this applies for humanity as a whole – there is abundant need for basic need satisfaction of food, shelter, and physical safety. Still, the observation is that at a certain level saturation sets in.

Also for non-basic but hedonistic goals there is a turning point. The pleasure of a stroll or a walk in fresh air is not more pleasurable the longer the walk is – at a certain point it is exhausting to walk, feet are hurting and the body becomes tired. So there is no indicator that more and more of a good is good. On the other hand there seems to be a striving for new goals as former goals have been satisfied. How does human well-being relate to the growing consumption in our society, where economic growth is the major societal goal, reached by increased individual consumption in many fields? We want to look at this question under the premise that increases in consumption do compromise a sustainable use of natural resources.

Well-being, environmental friendliness and consumption

In psychology, there has been quite some work recently investigating the relation between environmentally friendly behavior and well-being. While it is often assumed – and often communicated by media and politics – that acting environmentally responsible means sacrificing comfort, fun or quality of life, research suggests a somewhat different story. People engaging in more ecologically responsible behaviors, such as turning off the lights in unoccupied rooms or reusing paper and plastic bags, report a higher level of subjective well-being (Brown Kasser, 2005). This correlation can be explained by generosity and low materialism value orientation, meaning that people who report little interest in material values and who are generous are happier and live environmentally friendlier. What economic growth promotes and advertisement promises in obvious and subtle ways is that consumption leads to happiness, esteem, fulfillment of desires related to 'being someone' and to a high level of satisfaction. In fact, an orientation on materialistic values is associated with lower life satisfaction, less happiness, more health problems and drug abuse, more narcissism and other well-being related downsides. Brown and Kasser (2005) distinguish between extrinsic and intrinsic value orientation. Extrinsic value orientation means striving for external rewards by valuing money, possessions, status and image. Intrinsic values are striving for personal growth, intimacy, and contribution to the community, and they are assumed to be satisfying in themselves.

Hyperchoice and the freedom of choice

Market economy has led to a plethora of products and variations of buying options. A supermarket contains an average of around 25.000 articles. This is perceived (and marketed) as freedom for the consumer and especially in contrast to the harsh restrictions in communist societies of the

3.3 Psychological effects of economic growth

20th century this freedom of choice is considered an important progress. It leaves, however, the consumer with the burden of making this choice and considering a multitude of alternatives for nearly every item he/she shops.

While on the one hand it shall not be disregarded that freedom of choice and opportunities of choices are pleasurable and an important part of self-determination, it is worth to shed light on the downsides of an extensive scale of choices. Mick, Broniarczyk and Haidt (2004) summarize evidence for deleterious effects of what they call consumer hyperchoice. The ongoing increase in purchase options leads to an increase in buying. This needs more time and effort the more options there are. Several psychological processes are involved. Besides the pure time that it takes to make many choices, decision making is effortful and leads to exhaustion. This has been shown in many experiments where people were cognitively tired after making a lot of â though simple â decisions. In a following decision they were prone to let go good convictions and intentions and to use less energy on that decision. This usually led to a poorer quality of the decision. Multiple and sequential consumer choices demand an effort that negatively affects willpower and self-regulation (Baumeister Vohs, 2003) which again can lead to dissatisfaction when bad decisions are made under such conditions.

Time-stress on the other hand, as a result of hyperchoice, leads to less information being considered for each decision and leads to a reduction of complexity by ignoring alternatives, using rules of thumb instead of elaboration and valuing negative information higher. Thus, worse decisions are made (Mick et al., 2004).

When decisions are made in the light of a lot of alternatives, people are less satisfied with their final choice than if they had less options in the first place. This was shown in experiments where people in one group could choose either one of 6 chocolates and people in the other group could choose from 30 chocolates. Even though people in the latter group with an extensive selection enjoyed found the selection more appealing in the first place, those in the first group with fewer options were more content with their choice in the end (Iyengar Lepper, 2000). A possible explanation is that regret arises upon all the options that were not taken and doubts come up on whether it was really the best option. The mere presence of all possibilities raises expectations that are more easily disappointed than the expectations when choice options are only few.

In addition to goods consumption, the increase in choice options or decision necessities applies also for other parts of daily life, from choosing outfits and styles, obtaining information from an overwhelming range of media, being highly flexible on where and when to work, to communicate, to choose leisure time activities and travel destinations. More options in almost all fields demand quite a lot from individuals.

Less time for more activities

The downside of an affluent world with ever growing options and possibilities is thus that it means effort and stress to choose from these options, time-pressure, dissatisfaction as a consequence of very high expectations, and not least a greater responsibility for one's own destiny. Choice always means you have to choose (unless you let go the consumption process at all). If there is only one sort of rice in only one size by one brand in a shop, you take this one if you want to cook rice. If there are 8 different brands that offer each various sorts of rice (Basmati, whole grain, long grain, risotto rice, wild rice,âŠ) and you have to choose a proper size â maybe it is cheaper to buy a big pack but will you be able to use that up? â you are forced to put at least some energy into deciding which option to take. Also, the mere quantity of activities increases

(where 'activity' refers to all kinds of consumption acts, leisure and social activities, communication activities etc.). This means that less time is allocated to each activity and simultaneity comes into place. Simultaneity can refer to either being aware that simultaneously other things are going on that cannot be considered since one decision was made, as for example when one decides to have dinner with his colleagues at an Indian restaurant that means that he misses out the Barbecue buffet with live music in the other restaurant they considered and the self-made sushi at a friend's place that night. This can lead to regret or less enjoyment of the one option one ends up with. Simultaneity can also mean to do several things at the same time, for example you bought a new CD but while you are listening to it you eat your dinner meal, read the news about a recent policy decision that affects the energy market to be well prepared for a job interview the next days and via your smartphone you are messaging with friends about the weekend plans. This form of simultaneity lowers the intensity of experience for each of the activities. The increase in quantity of activities, the regretful waiving of parallel options, and the parallel attention to more than one activity at a time when possible necessarily lead to a lower intensity of experiences and thus to less pleasure. This happens because attention is split up and allocated to several processes instead of being focused on one.

Weariness and depression

This can make people unhappy. Alain Ehrenberg (1998) has written about the 'weariness of the self' (original title: *La Fatigue d'Être soi*) and how it relates to depression. The emphasis on self-determination and individual subjectivity that puts a person in charge of his or her own success and offers the possibilities to become whatever one wants, poses a constant pressure on people that is related to the high rates of depression. Today, about 15% of the population in high-income countries suffer from depression at least once in their life. In low- and middle-income countries the rate is somewhat lower with 11% (Bromet et al., 2011). Does higher material standard go with an increase in depressive disorders? A survey by Cohen and Janicki-Deverts (2012) examined psychological stress in different demographic groups of US Americans in the years 1983, 2006 and 2009. In almost all groups (by sex, age, income, education, race, and employment) there were increases in stress over the three points in time. Although the methodological quality does not allow for significance testing of these differences, it is interesting to note that even in a time span where possibilities in financial, societal, technical, and mobility aspects have massively increased especially the group of white, well-educated full-time employed men reports a significant rise in psychological stress although this is the group where (financial) resilience should be high. Due to the diverse circumstances, data, and influence factors worldwide, the relationship between human development and negative impact on mental well-being cannot be determined. The reported evidence shows though that there is no stable relationship between increased choices and wealth and subjective well-being.

Mindfulness as a way to have a fuller experience

To support coping with stressful conditions and as psychotherapeutic element, mindfulness training has gained a lot of attention during the last years (Hunecke, 2013). Mindfulness training aims at enhancing sensual perception by actively focusing on perceptions in the present situation. These are not necessarily positive. By accepting the reaction that certain stimuli evoke and mindfully experiencing the present, the 'here and now', more qualities and values are observed

3.3 Psychological effects of economic growth

and especially automatized negative interpretations are re-evaluated. The trend towards slowing down the pace of life by meditation, mindfulness training, down-shifting and using these techniques in helping people to deal with their depressive conditions, contrasts the acceleration of consumption, activities, and decisions, maybe as a consequence of their mere quantity.

Psychological Resources for sustainable lifestyles

Hunecke (2013) describes psychological resources that can help living contentedly in a society that does not rely on economic growth in which mindfulness plays an important role. Similar to the capabilities approach by Sen (1980) and Nussbaum (2004, see Robeyns, 2005), Hunecke assumes that certain psychological resources enable a person to lead a satisfying life that is not centered around consumption and materialism, thus providing high potential to be a sustainable lifestyle. Fostering these resources does not necessarily lead to a sustainable lifestyle but equips people with the capabilities to do so. The psychological resources are according to Hunecke (2013) self-acceptance, self-efficacy, capacity for pleasure as well as solidarity, mindfulness and construction of meaning. Self-acceptance is the fundamental acceptance of oneself with all positive and negative qualities one sees in it. To accept oneself with strengths and weaknesses raises the capacity to resist pressure for consumption, by groups, media, and advertisement. Self-efficacy means self-confidence – the belief in one's own capability to manage challenges and to have an impact. Capacity for pleasure aims at enhancing intensity of positive sensory experiences. These three resources are foundational resources since they aim at strengthening the personality but yet they are not directional concerning behavior. To bring a sustainable quality into place, there are three more resources that are more directional. Mindfulness has been mentioned already – it leads to a consideration of values beyond the self, since one of the core features is to be non-judgmental. This raises openness for different views, for empathy and enhances connectedness to the environment and other beings. Construction of meaning is the process of seeing one's life experiences in a meaningful relation to each other and not as a series of random events. This encourages a reflection on one's own life goals and values and thus facilitates to lead one's life consistent with them. Solidarity as the third directional resource points to the collective realm of behavior. Solidarity consists of the felt responsibility for others and common welfare and of the belief that collective action can enhance collective well-being.

Hunecke (2013) argues for this theory, that aligns striving for a good and meaningful life with the need for a sustainable society in which consumption is reduced compared to the current level and which does not rely on economic growth while the quality of life is not compromised. To integrate the fostering of these psychological resources into institutions, politics, and everyday life provides a good basis for people to lead a good life in a degrowth society. From another perspective, these resources help people dealing with the stress of a consumerist environment whose negative impacts on the individual were discussed above.

Perverse growth: new options to deal with too many options

These possibilities for individuals to deal with the burden of hyperchoice have brought about a great number of new businesses. Counseling becomes available for virtually all areas of life to deal with the complex offer of insurances, body care products, diets, university studies, job opportunities, personal development, recreational programs, volunteer services, travel options, life decisions, fashion, and so on. The vast plurality of choices is too much to handle for an

individual that feels the pressure to make the right choice (Binswanger, 2006). So the responsibility for good choices is outsourced to experts who capitalize on this overburden by asking for money and trust. Increased complexity is thus counteracted by increased offers of services. This mechanism is what Smart (2011) termed 'perverse growth' â a growth that promises satisfaction and creates more needs at the same time. Why is the hyperchoice not simply reduced instead of creating more choice by new services? There is no mechanism in liberal market economy that encourages and rewards such a development.

Homework

- Do you see any relation between Sen's capabilities approach and Hunecke's psychological resources? Compare the two and elaborate on their logic to lead to sustainable societies.
- How is the humanistic view of human nature related to the (hedonic) individual as discussed here [Spannungsfeld zwischen konsumistischem Austoben und happiness/quality of life....]

Literature

Ehrenberg, A. (1998). *La Fatigue d'Être soi - d'Expression et soci'et'.* Paris: Odile Jacob.

R. F. Baumeister, B. J. Schmeichel, and K. D. Vohs. "Self-regulation and the executive function: The Self as Controlling Agent". In: (2003), pp. 1–70.

M. Binswanger. "Why does income growth fail to make us happier? Searching for the treadmills behind the paradox of happiness." In: 35 (2006), pp. 366–381. DOI: 10.1016/j.socsc.2005.11.040.

E. Bromet et al. "Cross-national epidemiology of DSM-IV major depressive episode". In: *BMC Medicine* 9.1 (July 2011), p. 90. ISSN: 1741-7015. DOI: 10.1186/1741-7015-9-90. URL: <https://doi.org/10.1186/1741-7015-9-90>.

K. W. Brown and T. I. M. Kasser. "ARE PSYCHOLOGICAL AND ECOLOGICAL WELL-BEING COMPATIBLE? THE ROLE OF VALUES, MINDFULNESS, AND LIFESTYLE". In: (2005), pp. 349–368. DOI: 10.1007/s11205-004-8207-8.

D. Cohen, S. & Janicki-Deverts. "Who's Stressed? Distributions of Psychological Stress in the United States in Probability Samples from 1983, 2006, and 2009". In: (2012), pp. 1320–1334. DOI: 10.1111/j.1559-1816.2012.00900.x.

P. D. M. Hunecke. "Psychological resources for sustainable lifestyles". In: June (2013). DOI: <https://doi.org/10.1016/j.jclepro.2015.10.061>.

M. R. Iyengar, S. S. & Lepper. "When choice is demotivating: Can one desire too much of a good thing?" In: 79.6 (2000), pp. 995–1006. DOI: 10.1037//0022-3514.79.6.995.

A. H. Maslow. *A Theory of Human Motivation*. (Accessed on 09/13/2017). 1943. URL: %5Curl%7Bhttp://psychclassics.yorku.ca/Maslow/motivation.htm%7D.

-
- D. G. Mick, S. M. Broniarczyk, and J. Haidt. “Choose, Choose, Choose, Choose, Choose, Choose, Choose: Emerging and Prospective Research on the Deleterious Effects of Living in Consumer Hyperchoice”. In: *Journal of Business Ethics* 52.2 (June 2004), pp. 207–211. ISSN: 1573-0697. DOI: 10.1023/B:BUSI.0000035906.74034.d4. URL: <https://doi.org/10.1023/B:BUSI.0000035906.74034.d4>.
- I. Robeyns. “The Capability Approach: a theoretical survey”. In: *Journal of Human Development* 6.1 (2005), pp. 93–117. DOI: 10.1080/146498805200034266. eprint: <http://dx.doi.org/10.1080/146498805200034266>. URL: <http://dx.doi.org/10.1080/146498805200034266>.

3.4 Energy and Capitalism: is also a "solar-imperialism" possible?

Learning objectives

- Reflect on the main characteristics of Renewable Energies which make them different from fossil fuels for shaping our energy supply.
- Explore the relation between those characteristics of renewable energy systems and their subsequent impact on the economic and social system.
- Reflect on the advantages and disadvantages of internalizing external costs as an economic strategy for promoting the substitution of fossil fuels and different economic models.
- Critically address the role and potential of renewable energies for promoting different social or economic orders different from current neo-liberal capitalistic system.

Guidance for discussion ABSTRACT

This paper discusses the role attributed to energy and technology use in the capitalistic economy. Based on a comparison between the main attributes of renewable energies as compared to fossil fuels and their related consequences for the economic system, the possibility of attributing different social orders arising as a result of the use of renewable energies (i.e. the "solar society") is thoroughly discussed. For this aim, the main first (demand-side) and second (cost-side) contradictions existing in capitalist economies are introduced. Then the role of renewable energies for "solving" or leveling out these contradictions is explored as well as the potential of other strategies intended to promote sustainability such as internalizing external costs. Finally, a critical statement on the missing or existing interdependency between the implementation of renewable energies and the resulting economic and social order is presented.

BIBLIOGRAPHY

Primary reading for this topic:

E. Altvater. "The social formation of capitalism, fossil energy, and oil-imperialism". In: (2005), pp. 1–21.

Main questions to be answered:

- the main great question to be answered from this article is: would a "solar-imperialism" (similar to the "oil-imperialism" described by E. Altvater) be possible? Or are renewable energies per se preventing a "solar-imperialism" to occur, disregarding their implementation scales and projected aims (think also of big projects like e.g. DESERTEC)?
- What is the role attributed to fossil fuels in the capitalistic economy? What are the main characteristics of fossil fuels contributing to this economic system?
 - What are the main properties of renewable energy different from those highlighted as

3.4 Energy and Capitalism: is also a "solar-imperialism" possible?

central for fossil fuels in the economic system? Could renewable energies also play a similar fundamental role for the capitalist economy? (You do not need to follow the argumentation of E. Altvater!. State what are his claims and state also your own ones justifying them properly!!)

- Highlight the correlation between economic growth and population growth before and after the industrial revolution (i.e. in pre-industrial and industrial societies): try to find data supporting the trend stated by E. Altvater and make a diagram to show it clearly!
- The paper argues about the great dependency between the need for economic growth and financial systems based on debt and credit: would renewable energies as such per se change this fundamental relation of the economic system? Or could they also be part of it, contributing thereby to the capitalist economy? Justify your statements!
- Why is the mechanism of "internalizing external costs" not a feasible option for E. Altvater (e.g. pp. 9-10)? Argue whether you agree on this or not with the author, justifying your answer!

M. P. O. Connor. "Is Sustainable Capitalism Possible? In Is Capitalism Sustainable? Political Economy and the Politics of Ecology to Is Sustainable Capitalism Possible ?" In: January 1994 (2014). DOI: 10.2307/3791899.

Main questions to be answered:

- What is the role attributed to energy and technology use in the capitalistic economy?
- Which are the two main contradictions within the capitalistic economy and how does the energy supply and technology use influence them?
 - Which is the role given to nature in this economic system? Shall the economy or nature be remade? What implications does it bring about to the energy supply? (i.e. rebound effects, ever increasing demands,...)
 - Which are the main limiting factors to the contributions of renewable energy systems to a sustainable energy use within the growth-based economic system ? (e.g. steady increases in forecasted demands, economic constrains...)
 - How could renewable energies contribute to shifting the economic/political systems towards more sustainability? What would be their limitations?

Additional reading:

P. Singh. "Capitalism, Nature and Eco-Socialism". In: xlv.12 (2010), pp. 29–33.

You find here a book review where exactly the opposite argumentation to that of E. Altvater is given. ..."arguing that the logic of capital accumulation is not hampered by the exhaustion of non-renewable sources of energy."

GUIDING QUESTIONS FOR DISCUSSION

Do you think that Renewable Energies are per definition congruent with the capitalistic economy? Would their increased implementation lead to a collapse or change of the

capitalistic system?

- Does the congruence of Renewable Energies with capitalism depend on their implementation scale and logic? Name, in your opinion, their most influential attributes and criteria for making them non-congruent with the capitalistic economy. Justify your statements!
- What are the main advantages and drawbacks of "internalizing external costs" for addressing the environmental damage of current (or future) energy production? Would it be favorable for implementing renewable energies? Do you think this is a feasible strategy for reducing CO₂-emissions and climate change?

3.5 Energy as "Common"

Learning objectives

- Get to know the framework for defining resources or technologies as "common"
- Explore the necessity and possibility of different conceptual frames other than liberal market for energy supply
- Critically address the logic underlying the privatization of energy as consumer good / commodity
- Critically address the strengths and weaknesses in the "commoning" paradigm for being applied to the energy sector
- Reflect on the importance of the implementation scale of renewable energy systems for their contribution to sustainable development

Guidance for discussion **ABSTRACT**

This paper discusses the main motivation, advantages and possible weaknesses or drawbacks of defining energy as a "common". The role attributed to energy and technology use in the capitalistic economy as explored in the previous unit (Energy and Capitalism) is used as a base for showing the importance and necessity of searching for suitable management schemes. "Commoning" is, besides private ownership and centralized governmental control, a possible management scheme for energy resources and is the one explored in depth in this paper. The paper gives a definition of "commons" and outlines its management principles relevant for energy as a common as found in relevant literature on the field. The sustainable energy utility as one concrete proposal for such a commoning management of renewable energy sources is then presented. A well supported personal statement on the strengths and weaknesses of defining energy as a "common" as compared to current private implementation of renewable energy systems follows and opens the room for a critical discussion of the topic.

BIBLIOGRAPHY

Primary reading for this topic:

P. C. Stern. "Design principles for global commons: Natural resources and emerging technologies". In: 5.2 (2011), pp. 213–232.

Main questions to be answered:

What is the starting point (relate it to major literature mentioned in the article on environmental disaster and the basic underlying assumptions on human nature) for regarding energy as a common? (additional background information on this can be found on the additional reading proposed)

- When did the debate on energy as a common began and when it loss importance?

- Try to work out a definition on the commons based on their six characteristic principles. Discuss on whether Renewable Energies shall always be considered as a global or local common based on those principles or whether their definition as local or global common depends on their implementation scale.
- Present and discuss the main management principles for the commons as introduced by Ostrom and those enhanced in the article: which would be relevant benefits for a transition of energy supply to renewable sources on a global scale (e.g. dealing with complexity, risk assessment and governance, participation...)? Which would be main drawbacks of this approach (e.g. cost, monitoring schemes,...)?

B. John, C. Martinez, and C. Ruggero. "Relocating Energy in the Social Commons". In: (2009), pp. 81–94. DOI: 10.1177/0270467609332315.

Main questions to be answered:

How is the energy obesity discussed by the authors related to the previous contradictions present in the capitalistic system?

- Why huge scale centralized technological implementations of renewable energy systems might not satisfactory contribute to a more sustainable energy supply?
 - What are the main benefits or addressed issues in a commoning frame for energy supply?
 - Outline the proposal of the sustainable energy utility: what would be its main benefits as compared to a state of the art private implementation of (renewable) energy supply systems? Do you see difficulties or drawbacks on implementing such a system?

Additional reading:

W. E. B. edited by: E. Ostrom. *GOVERNING THE COMMONS: THE EVOLUTION OF INSTITUTIONS FOR COLLECTIVE ACTION*. By Elinor Ostrom. 1990.

Introduction to the commons debate with a sound view of other existing paradigms for resource control and their related drawbacks, underlying assumptions and inherent logic.

GUIDING QUESTIONS FOR DISCUSSION

According to the six characteristics attributed to commons, shall Renewable Energies be characterized as a global or local common? Support your standpoint

- Could large-scale centralized technological implementations of renewable energy systems lead to a sustainable energy use if energy is depicted then as a "common" (e.g. limiting energy use via quotas, \$)?
 - Do you agree on the benefits of defining energy as a common? Do you agree on the drawbacks of this approach? Justify your answer!
 - Do you see more advantages or disadvantages on the proposed Sustainable Energy Utility? Justify your answer!
 - If you could decide upon that, would you try to foster conceptualizing energy as a global or local common? Or none of both? Why?