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Abstract

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2 (Serious) games and social media

One can distinguish two major game types in the context of economics. One type arises from the motivation to enhance the study of "real" economical processes, the other type uses "invented" economical processes. With a game a real economic scenario can only be approximated, however the basic motivation for the first type of games is to get a better understanding for real processes and examples may range from kids playing "store" to online broker games. The main goal for the second type of game is to play or simulate "invented" economic scenarios. Examples are classic board games like Monopoly or the Landlord's game, in those games the study of real economics is rather limited - that is the emphasis in those games lies on playing with toy-like or "invented" economies. In most games the distinction between "real" and "invented" is rather blurry, it is however interesting to investigate games with respect to these aspects.

In particular it is interesting to look at games where the game rules are reaching into the real world, like this is the case in betting games, because in some sense these games may provide "alternatives" for real life features. In those games economical scenarios (here seen as rather complicated rules, which mimick an economic process) or just simple (game) rules are used to have a real (economic) impact. In particular in most of these games the aspect to use "invented" economic rules which differ from real life (economic) rules is important. So these games allow to deviate from "real life rules". A famous ancient example is already the board game Patolli, which is a kind of backgammon game, but where the betting on a result and the inclusion of "real values" was a crucial feature (see e.g. the website of the University of Veracruz [pat]⇔). In short with these kinds of games an "invented reality" takes place, let's call games of this type *invented reality game (IRG).*

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In the sequel an emphasis will be put on the investigation of games which make use of "invented" economic rules. Furthermore a focus will be put on games which use information technology, like computer and video games.

A socalled *serious game* is usually a computer or video game, whose purpose is not pure entertainment but rather the training of skills, the mediation of information (like in advergames), the learning/role-playing of possible scenarios, psychological encounters etc.

Serious games - especially in the educational sector were used since the onset of computer/video games but their possible impact for society has rather been realized in the last fifteen years. Initiatives like e.g. the serious games initiative [Sera]⇔ emerged. From the Serious Games Initiatives website: *"The goal of the initiative is to help usher in a new series of policy education, exploration, and management tools utilizing state of the art computer game designs, technologies, and development skills."*

The amount of serious games is meanwhile big enough so that the information about serious games is sought to be collected in an collaborative effort at the site Serious Games Classification [Serb]⇔.

Last but not least the newly established GaLA games and learning alliance [Gal]⇔ which is a Network of Excellence (funded by the European Union in FP7) on Technology enhanced learning and Serious Games which started only in Oct 2010 (it will last 4 Years) displays a strong public interest in this rather new topic.

Moreover serious games are increasingly appearing in connection with social media. Wellknown examples are of course advergames, i.e. games in advertising which can meanwhile be called a standard part of marketing. A famous example is the game "I love bees" which was part of the viral marketing campaign of the Xbox video game "Halo 2". In general it seems that video game developpers are orienting themselves more and more towards social media, cross media and cross-platform applications, see e.g. the game "assassins creed", which exists on video game platforms like the Playstation or Nintendo DS, but also as a Facebook game and as a game for mobile phones. Assassins Creed is apriori a single player game however the variant Assassins Creed II multi is a multiplayer game. Jade Raymond of Ubisoft states in an interview: *"...that whole arena of social, obviously since it's a hot topic now, is going to get a lot more crowded." [Jad]⇔.*

A particular branch of serious games are "business simulation games" or "economic simulation games". These are games that utilize game methodologies to simulate and investigate in particular economic processes. Usually these processes appear mainly in business' thus "business simulation games" include simulations of management tasks, role-based decision making etc. The International Simulation and Gaming Association [ISA] hosts a lists of links to international associations which foster Simulation games and in particular business simulation games.

Another line of serious and economically oriented games, which can partly be seen as economic simulation games are games which appear in the context of the simulation of policy making issues, social role formation and overall societal challenges like climate change, poverty etc. Notable is here the "Games for Change Initiative" [Gama] which is according to their website: *"Founded in 2004, Games for Change is the leading global advocate for supporting and making* *games for social impact."* Thus the listed games on the games-for-change website [Gamb] include business simulation games but usually only in a broader societal context. As an example in the game "Oiligarchy" the player can: *".... be the protagonist of the petroleum era: explore and drill around the world, corrupt politicians, stop alternative energies and increase the oil addiction. Be sure to have fun before the resources begin to deplete."*

Socalled *alternate reality games (ARG)* are software- and usually internet-mediated games that include the real world into the game. Usually in these games a narrative is used as a partial replacement for game rules, moreover the game-play is mostly controlled by real persons rather than by software. So an alternate reality game (ARG) is a kind of *invented reality game*.

A combination of alternate reality games with "games-for-change" can be seen e.g. in the game "Evoke". The Worldbank who coinitiated the game writes on their blog: *"Evoke therefore is designed to empower young people all over the world, and especially in Africa, to start solving urgent social problems like hunger, poverty, disease, conflict, climate change, sustainable energy, health care, education, and human rights.; to collaborate with others globally; and to develop real world ideas to address these challenges"* [Evo].

Flashmobs or social media sites with a rather strong gamelike component like sites where people have to solve "challenges", "group together" etc. are carrying characteristics of an invented reality game. Here certain invented rules (like e.g. for a flashmob a rule could include to dress in a specific way) are having a real life impact. In particular it can be said that the border between some of these games and real-money business is blurry. That is not only "shadow-economies" like virtual economies in massive multiplayer online role-playing environments/games (MMPORGs), but also social media sites like the crowd-funding site kickstarter.com [kic], where the emotional appeal plays an enormous role carry a direct game(-like) component and are thus somewhat constituting an "invented reality". On the other hand this goes along with the simplified societal image of real-life traders being "gamblers".

Although the border between "invented reality" and "reality" is blurry it is to some extend possible to identify distinguishing characteristics of the rules which govern a real or "invented real" process. Those include the characteristics

SOCIETAL - "real" rules are usually prone to a historic and/or societal process that is they emerge more or less slowly given the societal circumstances

ADAPTED - "real" rules are rather incremental, that is they are adjusted in an adaptive way (exeption: revoulutions)

DEMOCRATIC - "real" rules have often been made/approved by a bigger group of people rather then only by a few individuals. (exeption: dictatorships)

In an "invented reality" rather the opposite characteristics hold, that is in an "invented reality" rules are set or imposed by a few individuals (like individuals who decide to play or set a game), the rules usually do not emerge out of societal processes. Moreover the rules may be adjusted (like e.g. by a game master) but this doesn't need to be adaptive.

3 economic and political failures

3.1 Intro

Article 22 of the The Universal Declaration of Human Rights from 1948 [otUN48] ⇔ states:

Everyone, as a member of society, has the right to social security and is entitled to realization, through national effort and international co-operation and in accordance with the organization and resources of each State, of the economic, social and cultural rights indispensable for his dignity and the free development of his personality.

However as everyone knows the political and economical structures of the world have failed to grant everyone a realization of the right as stated in Article 22.

In their report "The State of Food Insecurity in the World, 2010" [FAO10]⇔ the Food and Agriculture Organization of the United Nations (FAO) writes:

However, a total of 925 million people are still estimated to be undernourished in 2010, representing almost 16 percent of the population of developing countries. The fact that nearly a billion people remain hungry even after the recent food and financial crises have largely passed indicates a deeper structural problem that gravely threatens the ability to achieve internationally agreed goals on hunger reduction: the first Millennium Development Goal (MDG) and the 1996 World Food Summit goal. It is also evident that economic growth, while essential, will not be sufficient in itself to eliminate hunger within an acceptable period of time.

This problem is of course not new and yet it is still strongly debated what to do about it. In fact various social-economic movements and social, political, economic and technological installments throughout history had tried to change the given structures, with only partial success.

Despite scientific innovation the problems seem to be unsurmountable.

Positive achievements of technological improvements like in health and infrastructure are easily thrown back like by changes in the political landscape and/or a crisis in the economical sector. Both components are often not independent. Political circumstances may have an influence on the given economic situation. Likewise an economical crisis may in particular eventually damage existing political structures:

The long-term economic, social and political consequences of the economic crisis on developing and transformation countries are very difficult to predict. A great deal will depend not only on the duration of the crisis, but also on the varying extent to which individual states are affected. Ultimately, these two variables will prove crucial in determining whether the external shock precipitated by the global recession develops into a systemic threat for individual governments and undermines the legitimacy upon which they are built. (Transformation Index 2010 [BTI]⇔)

3.2 Economic growth and social conditions

The in the introduction of this section mentioned report of the FAO indicated that even a **positive economic development** which manifests itself in economic growth **may not be sufficient to overcome the social problems**. But even more contrary to common belief are the findings that **it may be that economic growth is not even a key component to social improvements**:

One of the most surprising results of human development research in recent years, confirmed in this Report, is the lack of a significant correlation between economic growth and improvements in health and education. Our research shows that this relationship is particularly weak at low and medium levels of the HDI. (United Nations Human Development Report 2010 [HDR]⇔)

For the time being let's leave these new empirical results without further discussion and look at other societal components which are concerned with economic growth.

An economic measure for satisfaction is the notion of utility:

Utility is taken to be correlative to Desire or Want. It has been already argued that desires cannot be measured directly, but only indirectly by the outward phenomena to which they give rise: and that in those cases with which economics is chiefly concerned the measure is found in the price which a person is willing to pay for the fulfilment or satisfaction of his desire. (Alfred Marshall, Principles of Economics [Mar90]⇔)

Following Marshalls argumentation that a measure for desire or want/need is the price a person is willing to pay for satisfaction it is thus an interesting question in which sense a greater demand for goods and wealth can be seen as an indication for non-happiness. In particular the role of "price" is here interesting. That is if one would regard "price" in pure monetary terms then the needs or desires of rich people (who are able but not oblidged to pay high monetary prices) could be way greater than the ones of poor people.

In this context it is also instructive to look at quantifications of satisfaction. In the details to a chart where Gallup World Poll data for mean life satisfaction is plotted versus GDP per capita in 2003,2000 the author writes:

...it is not true that there is some critical level of GDP per capita above which income has no further effect on life satisfaction. Instead, each doubling of income adds about the same amount to life satisfaction, across poor and rich countries alike.[1] (Angus Deaton, Worldwide, Residents of Richer Nations More Satisfied [Dea08]⇔)

This means roughly speaking that even rich people seem still try to get happier, but that for the **same amount of additional happiness a rich person has to make use of way more money than a poor person**.

It is already at this short discussion visible that apart from other factors psychological indications may play a crucial role in the difficult assessment on

[1] I.e. the author says that the curve is approximately given by the function $f(x) = x_0 \log_2 x$, where x_0 is a constant amount to be determined from the diagram.

how economical growth and wealth influence social conditions.

This will be further investigated later on.

A useful ressource for the discussion of progress and well-being - especially in the economical context - is the project Progress of Societies [Mea] ⇔ and it's Internet Plattform Wikiprogress. [Wik]⇔

3.3 Economic growth and labour

The probably currently most exhaustive collection on labour statistics is the Database on labour statistics (Laborsta) of the of the International Labour Organization (ILO) [(ILb]⇔. In particular with the socalled Key Indicator of the Labour Market (KILM) Labosta provides a tool for assessing the gathered data. [(ILc]⇔. The tool is still in development though. Let $Lgrowth$ denote the (percentage) growth in employment, and $GDPgrowth$ the growth of GDP as defined by ILO, then following the non-formula explanations in the document "8. Employment elasticities indicator (KILM 19)" page 5, table 19b [(ILa]⇔ The elasticity seems to be given by $Lgrowth/GDPgrowth$, where probably $GDPgrowth = (GDP(year) - GDP(year-1))/GDP(year-1)$, analogously for employment [2]. On page 5, table 19b the worldwide elasticity is since 1992 at about 0.3 with even a slight trend of decline (see text to the table). That means that on average the growth in employment is about one third smaller than economic growth. For East Asia the elasticity is even only 0.1. That means while East Asia had a GDP growth of about 8-9 % the growth in labor was only 0.8-0.9 %. One can see this trend also if one compares the productivity increase at KILM. Following KILM alone for Germany the GDP per hour worked was raising from 102.0 in 1992 , 112 % in 1996 points to 133.0 points in 2008. This means that economic value is going way less into labour development than into other sectors. Moreover given the above data it is to be expected that with no or a very small economic growth the job sector would even be in decline (negative elasticity). Unfortunately the KILM doesn't yet provide elasticities for all countries, so the author couldn't confirm this claim. It would be interesting to assess where the more produced wealth went to. As pointed out in above the social conditions, like health and educational conditions were not necessarily improved with economic growth. Likewise, as the above shows the improvements in labor development are way smaller than economic development. Moreover wages in the manufacturing sector raise partially if at all only moderately. Unfortunately the KILM has not yet an automated world index, so let's look at the example at Germany. The real manufacturing wage index was in Germany in 1996 at 97.6 points in 2006 at 100.7 points. The biggest wage jump of 1.5 points was between the years 2002/2003 which gives a growth of $1.5/100.2 \simeq 0.015$ which is 1.5 % in those years, in some other years there was however even a decline in wage, despite the above mentioned giant increase in productivity. Likewise the employment ratio stayed about constant (Germany, 1992: 55.0 %, 2008: 55.3). As a comparision: in China the biggest wage jump was between 2006/2007. The index was in 2006 at 189.2points and in 2007 at 209.8 points, which gives $20.6/189.2 \simeq 0.11$, i.e. about 11 %, however on average the wages in the years before that grew rather by 6 % on average. (date of inquiry: 23.3.2011)

[2] The author is currently trying to get that formula confirmed

3.4 Economic growth and limitations

A well-known problem with economic growth is that in a rather close future the limitations of this planet will have concrete impacts on economic growth. Peak Oil, Peak uranium, Peak phosperous are just some catchwords which sketch the upcoming limitations. Up to this moment it is very unlikely that in an intermediate future space travel and the discovery of new ressources in new worlds would be a possible option to overcome the planets limitations. Thus **scientific innovation can rather only postpone and mitigate the effects of scarcer and scarcer ressources**.

A scientific countermeasure to greatly slow down the depletion of ressources is of course **recycling**. However any physical process - and recycling is a process - needs energy. This is a physical law. Thus the amount of energy which is e.g. needed to decompose a product back into its constituents is an indicator for its recyclability. The easier a product can be decomposed (and this is often a question of design) the better its recyclability. There may though be products, where the needed energy for recycling greatly exceeds the possible merits from recycling, there may be products where aspects of safety or demand (like for medication) are more important than recyclability, the recycling process may include risky technologies etc. in other words recycablitiy has to be balanced against these technological considerations. Recycling can be seen as a component of **reuse**. For reuse a product may be used again in a different context, i.e. reused. This includes often a "recycling component" like for the case of repair. A repair makes an unusable product usable by partial recycling and inclusion of new components. The border between recycling and reuse is often blurry, like if a product is not fully decomposed, but rather decomposed into highly integrated parts (like this is often the case for car parts) then the integrated parts are reused, however since the product itself had been rather disintegrated or decomposed into integrated parts some would probably also like to talk about recycling in this case. For a better analysis of the involved processes it is however useful to be able to distinguish between reuse and recycling . That is for recycling usually a higher degree of disintegration and reprocessing is assumed. Reuse and Recycling are parts of the socalled Waste hierarchy, which is e.g. known by the slogan: Reduce, reuse, recycle. They are in particular parts of the European Waste Framework Directive [Was]⇔

Conclusion: **technological limitations to recycling are mostly set by the technological feasibility of the recycling process and above all by energy demand.**

Economical considerations play and will play a role in the question how much recycling does and will take place. A very wellknown example for the problems of recyclability can be seen in greenhouse gases like in CO_2. Here CO_2 is produced rather as a byproduct of industrial processes than as a product in the traditional sense, but the question of reuse and recyclability is the same as for "products".

In particular the demand for recycling has to be balanced against the costs which arise due to the technological feasibility and energy demands. As a consequence:

If depletion is cheaper than these costs then in a (free) market economy recycling will generically not take place (A closer investigation of the basic economic mechanisms for that can be found in the essay Green Cherry-Picking: the Limits of Sustainability [Kut10a] ⇔)

As a consequence **recycling is often only taking place in a (free) market economy if there are political counter-actions or if material resources are already quite depleted**, like this is taking place in urban mining (see e.g. the article [Huf10] ⇔, which is about how rare earth metals are recycled from electronic waste and that scarcity leads already to political disgruntlement).

For the case of **reuse**, eventual partial recycling costs need to be taking into consideration, but apart from this the **attractivity** and price of a new product vs. the old product and the **logistical component** will play a major role. If a new product appears to be much more attractive and the price is about the same then reusing will take place less likely. Here again psychology and especially branding plays an important role. Furthermore the less **standard** the reused parts of a product are the more the logistical aspect will play a role. Like a repair makes only sense if the costs of getting extra parts is not too high. International standards are thus important. The probability to find a new user for a freaky styled furniture is smaller than for a rather standard matter-of-fact counterpart, so here the logistical task of (re)-distribution plays a big role. In particular it is cheaper to transport a large amount of the same product on a well frequented path to one point (like a department store) than the same amount but with different products to a lot of different end users. In a (free) market ecomomy with a considerable market size the logistical infrastructure is less likely to be adapted to a refined (re) distribution. Amongst others for reuse often labour costs are important etc.

Although the above mentioned principle mechanisms at work are rather evident, there is still a lot of discussion about the issue of free market and market regulations. That is there seem to be even incoherent views on what may constitute a market regulation, like for example it is perceived in some economical reasonings that e.g. opening borders (which apriori means there is more global free market, which appears rather to be a feature of deregulation) may constitute a "political regulation", because it may affect the respective national free market economy in a negative way. In part these discussions are due to the fact that elder economical reasoning had to be based on a global market which was way less permeable and environmentally more robust. The interconnectedness of the planet with regard to its ressources and environment, the rapid expansion of speeding trade are relatively new features. In 2011, the OECD will thus deliver a socalled "Green Growth Strategy", which is "*providing a host of policy recommendations that can help governments green their economies."* [Gir] ⇔.

But let's look again at the example of CO_2 and the conclusion that recycling is usually only taking place in a (free) market economy if there are political counteractions or if material resources are already quite depleted: it is clear that the ressource "carbon" or "oxygen" isn't yet scarce enough so that the CO_2 in the air of our planet would be recycled based on pure market demand. Hence in a (free) market economy "recycling" of CO_2 doesn't take place. Due to climate change it is however known that CO_2 has either to be recycled (this holds somewhat in the long term also for carbon sequstration), reused and/or that its production has to be diminished [3]. In principle there are some possibilities to "reuse" CO_2 like for the case of biofuel production (e.g. with genetically modified blue algae) hence here the logistical aspect and its economic context will play an important role. Thus in some cases it may even be cheaper to produce CO_2 than to use the byproduct CO_2 from energy production. Up to now the reuse options of CO_2 are still very small in size and it is not clear how big the market for this kind of CO_2 reuse can grow. Here investments in research are again important, moreover there may be other limitations, like for the case of blue algae e.g. area need plays a role, eventually toxins etc.

As a consequence the reuse/recycling costs or the additional costs of not producing the "byproduct" CO_2 have to be currently included into economy via political counter-actions, like by laws or cap-and-trade etc. There is basically almost no (free) market mechanism, which would encourage the "recycling" or "reuse" of CO_2.

3.5 energy demand and consequences

The above subsection dealt with the fact that the more the material resources are going to be depleted the higher the energy demand for recycling and/or reuse will be. At the same time due to climate change and other environmental concerns the percentage of recycling/reuse needs of energy production itself (like for the CO_2 byproducts) may rise. One can call this a **recycling-run-away-effect**. Moreover this increased energy need goes along with a rising energy demand by a growing population and higher civilization standards.

Current calculations of energy demands and possible energy mix scenarios are usually based on nowadays costs and average needs. If at all, then they often take the above decribed recycling-run-away-effect only partially into account (like by considering climate change costs). Where it has to be said that there are rather few concrete scientific calculations and models about the rising energy demands and mixes and that these models are rather in development. It is however already in these "simplified" calculations visible that the current energy production has to be largely extended. For example a scenario which assumes an increase of globally averaged GDP per capita by 1.4 % (i.e. 1.4 % economic growth) and assumes the averaged energy intensity $\dot{E}/GDP$ [4] decreases (due to improvements in technology) comes to the conclusion that the world energy consumption rate is projected to double from 13.5 TW in 2001 to 27 TW by 2050 and to triple to 43 TW by 2100 [LN06] $\Leftrightarrow$. However if recycling costs are taken into account then the averaged energy intensity may eventually even rise and thus - if economic growth is assumed to be the same - lead to an even gloomier prognosis.

As a result quite a lot of energy mix studies see e.g. the implementation of nuclear (fission) energy production as inevitable (Nuclear fusion is still in

[3] The author is aware of the fact that there are still debates about climate change and its consequences, however the reader is kindly asked to read further also if there is disagreement about this point

[4] $\dot{E}$ is the socalled energy consumption rate, i.e. it is the averaged energy consumption per year

a research state). Unfortunately in that context a broad negligence about the possible costs and risks of in particular *future* nuclear (fission) technology takes place. Mostly due to peak-uranium future nuclear fission technology will use very different technology (notably breeders). However the fact that some reactor technology of breeders is way more risky than most of nowadays reactor technology is not the central concern here - the major problem may be the waste problem.

Up to now the nuclear waste problem has not yet reached an analogous visibility (and impact) like it is for example the case for greenhouses gases. However it is to be expected that for nuclear fission the same mechanisms as already decribed above for the case for the byproduct CO_2 (will) take place. That is the recycling or diminishment of waste byproducts from nuclear (fission) energy production (here a simple reuse is usually not possible and recycling of waste is often only possible to a certain extend) will not automatically take place in a (free) market economy if ressources are abundant. However **ressources from nuclear breeders can be seen as abundant** on an intermediate timescale. That is e.g. Uranium 238 and Thorium are largely available and apart from extracting the bred fuel often not much further reprocessing takes place. So one can observe again that as for the case of CO_2 - **there are basically no (free) market mechanisms, which will take care for the recycling or diminishment of nuclear energy waste**. It should be clear that nuclear waste is already now an environmental problem [5], but the future nuclear waste (especially the one from breeders) may pose not only by its sheer amount, but also in part by its new physical properties a very drastical environmental threat. At the case of CO_2 (and at the case of nuclear waste itself) it has however become clear how difficult it is to invigorate political actions which adress this growing waste problem.

On the other hand solar energy, which has among the renewable energies may be the greatest expansion potential and which has a relatively small waste problem (especially in comparision to nuclear energy) is seen by proponents of nuclear energy as no realistic substitute for fossil and nuclear fuels, while environmentalist see solar energy as an easy and sufficient alternative. Let's look a bit at the facts.

Apriori the energy which is transported from the sun to the earth is not only enough to satisfy our nowadays energy needs but could provide a lot more. However this energy has to be captured and converted into electrical energy.

The area of the deserts is according to the White Book by Desertec [Gra09] $\Leftrightarrow 36 \cdot 10^{12} m^2$ the average power received per square metre in deserts is according to the White Book $260 W/m^2$ [6], which gives in a year an energy of $36 \cdot 10^{12} \cdot 260 W \cdot 8760 h \cdot \simeq 82 \cdot 10^6 \cdot 10^{12} Wh = 82 \ million \ Twh$. The fossil and nuclear energy consumption in 2005 was according to the white book $107 \cdot 10^3 TWh$, so the energy arriving in a year in the worlds desert is approx. 750 times more than the fossil and nuclear energy needed in 2005. Currently the conversion efficiency from solar energy to electricity from mass produced photovoltaic energy is about 15-20 %. Let's be pessimistic and assume an efficiency of 10 % then filling the

[5] Again, the reader is kindly asked to read further also if disagreeing

[6] as a comparision in northern european areas solar power per area is only about $100 W/m^2$

deserts with photovoltaic elements would still give **75 times more electric energy than from the fossil and nuclear fuels in 2005**. However it is clear that filling alone 10 % of the deserts with solar energy conversion systems is a giant technological and economical task, but still -it leaves us with 7.5 times more energy than from the fossil and nuclear fuels in 2005. And even if energy demand doubles by 2050 this still leaves us with 3.75 times more energy then from the fossil and nuclear fuels a.s.o. Moreover the principle efficiency of photovoltaic solar cells can be largely improved. Currently an efficiency of 35.8 % for photovoltaic conversion [SoV] ⇔ can be achieved. Conversion from solar thermal energy may currently reach an efficiency of 31.25 % [SoT] ⇔. These rough calculations display that in principle 10/3 % = **3.33 % of the deserts area would in principle suffice (in fact by the calculations one would have 3.75 times more) for replacing the fossil and nuclear fuels of the world by solar energy until 2050**.

However one has to keep in mind that also here there may be limitations in terms of the materials needed for conversion, also with regard to waste. Moreover high efficiencies are currently very expensive. Technological undertakings which try to harvest solar energy from space are still in their infancy state and even more costly with regard to other energy production methods. But still - the current existing technology can be improved, also beyond the above efficiencies. However as long as other energy production means are cheaper there exists no (free) market mechanism which encourages investments in research and development.

3.6 Conclusion

The reasonings in this section were intended to display that the paradigma of economic growth has to be put under strong scrutiny, there are indications that economic growth may not be sufficient and may not be always necessary for a happier, socially balanced planet. Moreover economic growth fuels energy and material ressource needs, which may drive the planet to its boundaries. Especially energy generation from fossil and nuclear fuels pose a very drastic environmental threat. With a free market economy there exist basically almost no countermeasures to adress this problem. However alone solar energy could e.g. make the replacement of fossil and nuclear fuels possible if the economical and political measures are going to be changed. Unfortunately the implementation of political regulations is not always desired, the specific political countermeasures may be inappropriate and/or too weak etc.

In particular it is thus to be asked wether the basic economical structures could be changed, while keeping the political measures in mind.

4 Economical scenarios in games

remark:see blogpost [Kut09]⇔
for related IT issues see blogpost [Kut10b]⇔

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