
POWERED BY THE POLIS

How post materialistic values in consumers enable usage
of renewable energy sources in a consumption economy



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SUMMARY

It has been argued for several decades that the fossil-fuel powered methods of generating energy are causing environmental degradation and should therefore be replaced by other means of energy generation which do not suffer from these problems. This argument has so far not led to a world wide switch towards renewables, as at present about 10 per cent of global energy is generated in a sustainable fashion. This has to do with the fact that negative future consequences of using fossil-fuel powered methods of energy generation are presently not accounted for in their price, which mean that they are considered as cheaper in use compared to renewables.

In this thesis I apply insights into the changes which have taken place in values which people hold dear in present western-style societies. These insights have been developed – in empirical fashion – by Inglehart and Schwartz, and show that values in western-style publics have consistently moved from those values which are considered as ‘materialist’ to those which are considered as ‘post materialist’.

I argue that post materialist values lend themselves ideally in a role as motivating reasons for consumers in western-style consumer economies to invest or participate in the acquirement of renewables; despite of their economic disadvantage. This repositions renewables as a means for consumers to be able to acquire value-congruent products and services, which increase their subjective well-being as well. In this way renewables add value for those consumers, instead of ‘take’ value, because such products are being acquired based upon their added value, instead of individual responsibility by a consumer.

In order to further support this argument I present two perspectives on respectively the constraints which technological artefacts have and their social contexts, in order to provide two concrete methods for producers of sustainable products and services to derive characteristics of their products. These characteristics could then be assessed as being value (in)congruent with a particular position in Schwartz’ value model. This provides concrete directions for either design changes or marketing and framing efforts designed to optimize the fit between renewables and post materialistic values.

Finally I discuss the extent to which consumers are able to concretely ‘act’ upon their values, and provide two strategies, based upon empirical research, for persuading consumers to behave according to their values.

In this way, concrete methods and theories are being supplied which enable designers and producers of renewables to increase the ‘fit’ between their products and services and the post materialistic values prevailing in western-style societies.

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CHAPTER ONE: INTRODUCTION

Ever since the club of Rome's "Limits to growth"-report came out in the early seventies it has been evident that the sustainability of western societies' consumption economy is limited. In this report the issue of environmental degradation and possible consequences has been put to the fore, however with few concrete implications in day-to-day practice. Scientists and climatologists are in agreement that issues such as pollution, climate change and resource depletion are serious and will have to be addressed at a certain point in time in which earlier action is easier than later action. However, so far insufficient urgency has been raised for the issue, with the lack of concrete action after the ratification of the Kyoto-protocol being the negative 'cherry on the pie'. It remains to be seen whether the latest Paris climate accord will change this practice in reality.

In order to address the situation that renewables are considered desirable, however are not having the uptake which is deemed necessary as of the 1970s I have formulated the following main research question:

"How could renewable energy generation technologies be designed and marketed in such a way that they fit optimally with post materialist values in consumers"

I depart from the position that this lack of action is largely due to two reasons:

Firstly (1), responsibility for environmentally degrading practices is shared among many different actors causing difficulty in assigning concrete restorative action towards those responsible.

Secondly (2) the large separation both in time and space between causes and effects of environmental degrading practices limits our ability for sensing urgency for addressing the problem. This means that no pressure is applied onto relevant actors for coming up with a solution towards stopping environmental degradation.

In order to address both issues regarding how to limit environmental degradation this thesis proposes a single approach for addressing both issues.

In order to do so I have broken up my main research question into four sub-questions which taken collectively answer the main research question.

Firstly, I answer the fundamental question about what sustainable energy generation is, and what are its associated technologies. Furthermore, I discuss how they are situated in the (future) economic market. Here I conclude that technological limitations are not the main reason for the lack of uptake for renewables.

Secondly, I discuss post materialistic values, how their historical development is characterized, and how they are related to behaviour. Here I conclude that the prevailing values in western economies have slowly shifted in a particular direction, namely those values which are considered as post materialistic.

Thirdly, I use economic theory in order to answer what design and marketing issues are of importance for sustainable energy generation technologies given that they have to compete in the consumption economy. Here I conclude that non-sustainable electricity generation technologies often do not include future – expected – costs associated with the fact that they cause resource

depletion and pollution, meaning that for the time being renewables will be more expensive when viewed in economic terms.

Finally, and I combine the conclusions from the previous chapters to theorise as to how producers and marketers of sustainable electricity technologies could exploit design and marketing efforts in their products and services. This in order to let their products and services appeal to post materialistic characteristics of consumers in present western-style societies, in order to provide a concrete motivational reason for the fact that they tend to be more expensive.

CHAPTER TWO: THE NEED FOR SUSTAINABLE ENERGY GENERATION, ASSOCIATED TECHNOLOGICAL CHALLENGES AND PROPOSED SOLUTIONS

Technologies play a vital role in enabling the spectacular growth and survival of the human population in the past two centuries. As of about 1750 extensive usage of energy-hungry technologies start to take off. Mechanized food production, water treatment and the heating or cooling of our shelter by technological means have enabled our species to grow their numbers considerably while increasing lifespan; health and comfort.

Interdependence between growth of western societies and technological developments which support it could be considered as a socio-technical system in which both technologies and humans thrive and co-evolve into a shared future. It is however not free of problems, among one in particular is the problem of environmental degradation associated with the production and usage of technologies.

Resource depletion, climate change and loss of biodiversity in particular are important undesirable aspects of environmental degradation. These issues need to be addressed if we are to continue to build a thriving society which relies on the extensive usage of energy-hungry technologies which support it. This becomes especially important if we consider the needs of future generations (Gardiner, 2004).

Most of the technologies used in western societies on a day-to-day basis, such as fridges and telephones, require energy in order to be able to function. This means that a certain amount of energy has to be produced in a particular timeframe for powering them. The activity of producing energy is an example of a technological practice which is extensively used and which has particular degrading effects on the environment. That is why I have selected power generation technologies, and electrical power generation technologies in particular, as the technology of focus in this thesis.

It has been argued that one solution for addressing environmental degradation by usage of energy-intensive technologies could be to lower their usage or stop their usage altogether. This solution, which is probably effective in diminishing environmental degradation, does however have at least one problematic drawback. Technologies which are associated with causing environmental degradation are the same which are responsible for improving western-societies' quality-of-life in the first place. It is hard to argue that a life without disease control, mechanized food production and water treatment is desirable, or even possible for that matter, with current population numbers. That is why I will focus my attention upon technological solutions for generation large amounts of sustainable electrical energy, instead of changing energy consumption levels.

Addressing environmental degradation issues associated with large-scale electricity production is an important step towards providing an adequate solution for stopping environmental degradation in general. In order to provide more insight into the technological aspects of electricity production and environmental degradation, this chapter will be used to explain and discuss what energy is, and how it could be generated in a sustainable fashion. Subsequent chapters will deal with issues related towards the practical problems with realising a switch towards renewable energy sources; and considers behavioural, additional economic and societal issues regarding renewable energy technologies' implementation.

2.1 ENERGY AND POWER

The concept of energy is abstract and difficult to define without losing some of its meaning. Effectively it is a description of a characteristic in a thermodynamic system, and in practice this means that politicians and theoretical physicists are not talking about the same concept (Dincer, 2002; Dincer et al., 2001). Politicians usually refer to the 'power' when they say 'energy', which is confusing and therefore I will elaborate it here.

What I am about to elaborate could be seen as simplistic by engineers. Knowledge about thermodynamic concepts such as enthalpy, entropy and exergy would be needed in order to provide an adequate analysis. However, for my line of reasoning it is unnecessary to delve into the specifics of how exactly to determine power usage and discuss ways to determine it or optimize it. That is why I will stick to energy in the applied form of power – for fridges and telephones - for specifying and clarifying practical issues regarding using technologies on a large scale.

Energy can be characterized as the potential of a system to deliver useful work (for us). For physicists it is the result of a force acting over a distance, as evident in the description of the unit of measure for energy: the joule (for a definition of which I quote the SI):

“The joule is the work done when the point of application of 1 MKS [Metre, Kilogram or Second] unit of force [newton] moves a distance of 1 metre in the direction of the force” (Page et al., 1974, P. 21).

A certain amount of joules is thus representative for an amount of work necessary in order to perform a certain task. For example, it takes 1 joule to lift a mass of 100 grams one metre upwards on Earth, and when such a mass falls downwards one metre, 1 joule of energy has been moved. Important to mention at this point is that the dimension of time does not – yet - play a role in this concept of work. For example, if a person would lift the apple in one, two or three seconds, still the same amount of energy would be required for this task. This characteristic is important to consider because it is related to the environmental impact of energy-intensive technologies. I will explain this with an example:

Suppose one would want to move a 100-gram apple one metre upwards, 1 joule of energy would be required. If the amount of time would be limitless, one could spend an infinite amount of time for moving the apple; because the amount of work (1 joule) remains constant. However, in practice time is limited, which means that the work will have to be performed in a certain limited amount of time. This requires a certain amount of energy moved per unit time: this is called 'power'. If one would for example spend no more than 300 seconds (five minutes) for moving 1 apple; at least $1/300=0.003$ joules should be available per second. Energy related to time is thus what defines power in practice. This amount of joules per unit time is relevant because it specifies power usage of a certain process at a certain speed.

Energy requirements of supportive technologies – such as phones and fridges - are usually measured while taking the time elapsed in performing a certain task into account. This is because an advantage

of supportive technologies is that they enable us to perform tasks at a much faster pace compared to performing such tasks without them. This brings energy in relation to time, and the amount of energy delivered per unit time is as such a more relevant unit for us both on a day-to-day basis. The SI-unit for measuring power is the number of joules per second, or watts.

In order to provide some perspective, a healthy well-fed labourer can deliver a continuous mechanical power output of about 75 watts over an eight-hour shift. This means that for every hour this worker is working, 75 watts of useful energy will have been moved. A trained cyclist can manage a sustained power output of about 400 watts in the course of an hour, after which such a cyclist would have moved 0,4kWh of energy (Avallone, 2007). In comparison; the average electrical car uses about 20 to 25 kWh for driving 100 kilometres (fueleconomy.gov, 2015), and the average Dutch household (2.2 persons) energy usage for electricity amounts to about 3500 kWh a year (Milieucentraal, 2015).

This means that in order to produce such an amount of energy (3500kWh) in one year by an average human workforce, you would need roughly 26 persons in a fulltime “40-hours a-week for 45 weeks a year” working pattern, just to produce the energy to power one household’s amount of electrical energy.

The orders of magnitude at stake leave us with the conclusion that:

- If we continue to make use of energy-intensive technologies in order to continue present societal models.
- And desire to address environmental degrading practices associated with fossil fuel use.

The practice of saving energy or creating more efficient energy-intensive technologies will at best only be a part of the solution.

In other words, although important in preventing environmental degradation, lowering energy consumption is not a viable long-term alternative for addressing the side-effects of large-scale energy generation. This is because even when we would put power consumption levels at one tenth of current levels; we would still need technologies with which we are able to deliver power.

Finally, the usage of the terms ‘energy’ and ‘power’, where ‘power’ seems to be the most appropriate is omnipresent. Within the scope of this thesis it is safe to assume that energy and power can be used interchangeably, and for stylistic reasons I will do so.

2.2 ENERGY-INTENSIVE TECHNOLOGIES AND ELECTRICAL POWER

Scientific debate about the relationship between human (technological) activities and environmental degradation has shifted focus in the late twentieth and early twenty-first century (Brown, 2002). The issue has moved from the question of whether this influence exists, towards the extent of it and ways to address it (Gardiner, 2004). Either way, the – perhaps long-term - necessity of changing towards an economic model, and associated technological practice, which causes less environmental degradation can be considered as a given. Especially if western-style consumer societies continue to expand and develop into the future similarly to the way they have in the past centuries.

Given the need to switch to a more environmentally sustainable economy, electrical power is expected to play a more important role in the future compared to what it is now (Hadjipaschalis et

al., 2009; Williams et al., 2012). Examples of electrically powered technologies which are able to help address environmental degradation issues are heat pumps, electrical vehicles and IT hardware. All of which require large amounts of electrical energy. Therefore, it is reasonable to assume that developing an answer to the question of how to generate electricity in a sustainable fashion will aid in addressing environmental degradation on a substantial level.

In the previous sections I have established that energy-intensive technologies are necessary in order to run present western-style societies. In order to clarify further when energy usage can be considered as causing environmental degradation I will distinguish 'external' and 'internal' energy in order to clarify when energy usage becomes problematic in the sense of it being sustainable on the long run.

2.2.1 INTERNAL AND EXTERNAL ENERGY SOURCES

Technologies such as those mentioned in the previous section require more energy than can reasonably be delivered by ancient power sources. Before the industrial revolution commenced, technological artefacts were applied as well in transportation systems or agriculture, however they relied on power sources such as human labour, beasts of burden and natural sources of energy such as wind (e.g. sailing) and sun (e.g. drying and growing crops). This is what I label as 'internal energy sources', or sources of energy in which the process of extracting energy takes place at roughly the same pace as it is generated.

These power sources can be characterized by them drawing power from renewable long-term energy sources in the same pace as their sources were able to provide energy (such as the sun). Furthermore, they have a relatively low energy density, which mean that they do not consume or transfer energy in a rate which is close to technologies developed during the industrial revolution in which energy was required in much larger quantities.

This development is important because it has necessitated us to generate energy from sources which are able to deliver power at a (much) faster pace compared to the past, it is these sources which I label as 'external energy sources'. External energy sources are those which are able to provide usable power at a rate which is much higher than the rate it has taken them to develop. This increase in pace is of specific importance if we take environmental degrading practices into account because generating large amounts of power by renewable sources is difficult due to the sheer quantity of power required.

The technological solution applied for this large power demand has been the usage of fossil fuel sources which have been naturally stockpiled in the past. These have a high energy density and do not require effort to develop due to them being effects of long ongoing natural processes. They are therefore preferred as a power source. These fossil power sources have at least two fundamental issues:

1. In the end every stockpile is limited, and fossil fuels are no exception. This means that the availability of such fuels will become problematic at some point in time, perhaps on the (very) long run.
2. Their tendency to cause pollution – and indirectly climate change and loss of biodiversity - in the process of combustion cause them to be unattractive.

Preventing resource depletion and pollution are therefore two important reasons for the desirability of moving towards other means of power generation, namely those who do not suffer from the above drawbacks.

Energy sources which comply with the characteristic of internal energy and are also able to deliver power on the rate which modern societies require are available in the form of renewables.

They have the same qualities as those used in the past regarding using energy from a long-term (and thus sustainable) source. Furthermore, technological developments have lead them to be a viable alternative for fossil fuels in the foreseeable future as I will explain below.

2.3 (SUSTAINABLE) ENERGY GENERATION METHODS

Given the fact that we need to produce energy to power our societies' technology, several options are available to us for meeting this need. Below I will explain what our current energy needs are, with which methods we are currently meeting this need and why this fosters environmental degradation. Also I will further narrow my focus on a specific types of energy production, namely electricity. Finally, I will present methods which address the issue of generating power while taking into account the issue of environmental degradation.

2.3.1 REQUIRED ENERGY PRODUCTION

Current energy needs could be seen as a benchmark for which to design an energy production system. It is unfeasible to discuss the energy usage of the entire planet due to limitations in datasets, therefore I will limit my discussion to energy usage in the Netherlands. It is my expectance that energy usage of the Netherlands per capita is comparable to other western EU-countries due to similar lifestyles and technological development levels, however this remains merely an assumption.

Measuring the power used in a geographical area such as a country is difficult because not all energy is generated and used in the same spot. Also, different countries have different net energy usages compared to what they import or export. The statistics office in the Netherlands has however provided figures which roughly estimate the energy usage in the Netherlands.

The figures below are an estimation of 2013 energy consumption levels for the Netherlands:

		Total energy carriers	Coal and coal products	Oil and oil products	Natural gas	Renewable energy	Electricity	Other energy carriers
Energy supply 2013		All units in PJ (petajoule)						
Total energy supply		3 255	342	1 233	1 396	135	66	83
Production		2 871	-	65	2 587	135		83
Import		9 943	1 063	7 950	810	-	120	-
Export		8 852	683	6 108	2 007	-	54	-
Change in stocks		-31	-38	1	6			
Fuel stocks		676	-	676	-	-		
of which	Shipping	529	-	529				
	Aviation	146	-	146				
Energy transfers 2013								
Allocated total for transfers		4 258	378	3 144	519	118	16	82
Total production in transfers		3 817	111	3 099	7	-	361	239
Net result of transfers		441	267	45	512	118	-345	-156
Energy consumption 2013								
Grand total end usage		2 814	75	1 188	884	17	410	239
Grand total energy transfers		441	267	45	512	118	-345	-156
Of which	Electricity and heat-power transfers	386	248	28	492	102	-346	-138
	Fuels and heat	56	18	17	20	16	1	-18
Total consumption		3 255	342	1 233	1 396	135	66	83

Table 2.3.1a: Energy usage in the Netherlands (CBS, 2014)

Total production of energy results in 3255PJ (petajoule), of which the vast majority is derived from oil (1233PJ) and natural gas (1396PJ), accounting for over 80 per cent of energy production.

Consumption wise the row labelled 'grand total end usage' is relevant for my purposes (marked green). Given the fact that electricity is generated using several energy sources the direct consumption of electrical energy 'directly as electricity' is 66PJ (and thus depends on the form in which this energy enters the country, usually imports). Total electricity consumption amounts to 410 PJ (petajoule), or roughly 113 billion kWh.

2.3.2 CURRENT ELECTRICAL ENERGY PRODUCTION MIX

Energy sources for producing the total amount of 410PJ of electrical energy consumed are found primarily in natural gas (492PJ of which is allocated for combined electricity and heat production) and coal (248PJ of which is allocated for combined electricity and heat production). 102PJ of present energy production (all types of energy) is renewable and allocated for the production of electricity and heat.

According to the statistics office, 43PJ of electricity production in the Netherlands is produced using sources which are renewable (CBS, 2015). This means that in the Netherlands, 43PJ out of 410PJ (10,5%) of electrical energy is produced using renewable production methods.

In the Netherlands, most electrical energy is produced by making use of either coal or natural gas. Both of which result in resource depletion and cause pollution (primarily in the form of CO₂, which itself is harmless but is believed to indirectly cause global warming). This means that almost 90% of electricity presently consumed in the Netherlands contributes to resource depletion and pollution.

If oil and gas are no longer applied as an energy source in a direct form, such as for powering vehicles and heating systems, a substitute will have to be implemented. Present alternatives for oil and gas usually rely on using electricity as an energy carrier, stored in batteries (vehicles) or consumed directly using efficient systems (heat pumps). This means that the total amount of 410PJ is going to be much larger in the future, given that the clean characteristics of electricity will lead it to substitute oil and natural gas as an energy carrier.

2.3.3 ENVIRONMENTAL IMPACT OF PRODUCING THE CURRENT ELECTRICAL ENERGY PRODUCTION MIX

Environmental degradation as a problem is usually understood as being a prudent one. This means that environmental degradation has something to do with the quality of our environment *for us*. When and to what extent the quality of our environment has intrinsic quality is an ongoing philosophical discussion, it is however not necessary to engage in this discussion in order to properly assess the possible negative consequences of continued use of fossil fuels.

Other, more mundane, reasons are sufficient for motivating the necessity for a different technological practice for generating energy. Here I argue in favour of two of the most powerful.

- (1) Large-scale energy production using fossil fuels causes resource depletion, which mitigates possible negative consequences now by moving them towards the future.
- (2) Current fossil fuel powered energy production results in pollution which is of direct concern for our health; as well as an important contributor to climate change which might have undesirable effects on our living environment in the (near) future.

First (1) I will argue for the former by using (again) the Netherlands as an example. The Netherlands are in possession of a large field of natural gas located in the northern part of the country. Currently it is estimated that the gas field originally contained roughly 2750 billion cubic metres of usable natural gas, which has led to the development of a national natural gas grid and extensive dependence on natural gas for heating and selling to other countries. It is estimated that the current energy reserve of the field is roughly 1075 billion cubic metres of natural gas, the remainder of 1675 billion cubic metres has either been sold to foreign countries or used for heating and electricity production. Natural gas is a resource which has a high energy density and requires relatively little treatment in order to be practically used. Natural gas is formed through processes in which remains of early life are compressed and heated in natural processes which result in large deposits of high-quality energy stored as natural gas. Developing energy systems dependent on this gas suffer particularly from the problem of having a faster pace of consumption compared to the rate to which they could be replenished, and as such can be considered as being a form of 'external energy' which is not replenishable. On average it takes about 60 million years for natural gas to form, and it will (probably) take less than a hundred years to deplete the Dutch reserve, over half of which has already been consumed.

Furthermore, regarding the second (2) issue, large-scale combustion of natural gas aids to the problem of global warming through increased levels of CO₂-gas in the atmosphere. Climate change is expected to have dramatic effect on the lives of many people, especially those who are poor and living in areas which are prone to floods due to rising sea levels.

Both of the above effects are characterized by having short-term advantages at the expense of long-term disadvantages. A particularly troublesome aspect of such practices is that they might be considered as being unjust to future generations; whom are no party in deciding what to do with current resources; however it could be argued that in principle they have similar rights to such resources (Gardiner, 2004). That means that it would be prudent and logical to develop or start using resources which can be replenished by the same generation that has benefited from its production, and have no long-term ill effects. The desirability for switching towards more sustainable forms in which to organize our society has been evident since at least the Club of Rome report in the early seventies. However, many barriers prevent its widespread adoption which I will discuss in section 2.4 and 2.5.

2.3.4 TECHNOLOGICAL SOLUTIONS FOR ADDRESSING ENVIRONMENTAL IMPACT OF CURRENT ELECTRICAL ENERGY PRODUCTION MIX

In the history of electricity production, a large array of technologies has been proposed and applied, of which only a small part of is to be considered as being sustainable. A sustainable energy source is one which can be replenished in the same amount of time it is used, or does not require replenishment.

A source of energy which does not contribute to environmental degradation and is readily available is the sun. Energy sources which extract their energy from the sun – either directly or indirectly – can therefore be considered as fundamentally – as I will explain further in section 2.4 – sustainable.

This section lists three sustainable electricity generation methods which are both sustainable as well as commercially available at time of writing. Usually these are technologies which have shown their technological potential on a relatively large scale, and adoption on the macro scale is not a strictly

technological issue. Instead adoption is impeded by other barriers such as political or economic commitments or requires systematic changes necessary to implement them. Three technologies which adhere to the above characteristics and produce electricity are:

- Solar PV-panels, which are able to convert energy from the sun directly into electricity.
 - If one would want to generate 410PJ of electrical energy, roughly 475 million standard-size solar PV panels would be necessary.
 - Discrepancies in time between supply and demand have not been taken into account.
 - If one would want to power the entire Dutch electricity demand by using current 15% efficient solar PV panels, when laid out flat they would take roughly two times the surface area of the Netherlands.
- Wind turbines, which convert wind directly into electricity. This is a derivative of solar energy because wind is powered by pressure differences in the air which in turn develop because of solar irradiation.
 - Large wind turbines have a shaft height of about 100 metres, have a blade radius of about 35 metres and deliver a peak power of about 3MW. Their production factor (percentage of time when operating at peak capacity) is roughly 22 for the Netherlands, which means that such a turbine delivers about 5782mWh/year.
 - If wind power was to be used to produce 410PJ of electrical energy, roughly 20.000 3MW wind turbines would be necessary.
 - Discrepancies in time between supply and demand have not been taken into account.
- Biogas combustion for electricity which is generated through fermentation processes (biomass).
 - Fermenting for biogas requires input which to ferment. This can be a large variety of organic materials such as animal waste, landfill waste or industrial by-products.
 - It is also possible to use crops which have been grown with the purpose of being used to generate energy, so-called energy crops. They could be considered as unsustainable because of 'food-for-fuel'-issues; in which some opponents argue that using arable land for the production of energy crops is unethical because food prices will rise, which for some parts of the world is clearly a problem. However, it is a technological solution to the question of how to generate sustainable energy
 - Maize is often used as a bio crop due to favourable characteristics.
 - Though yields vary significantly, roughly 284031MJ per acre can be generated in the form of biogas from maize as an energy crop.
 - Using biogas as a source for electricity production is roughly 37% efficient, which means that 284031MJ of biogas is transformed into 105000 MJ of electricity; which amounts to 29192kWh.
 - If all electricity consumed in the Netherlands would be generated using solely biomass fermentation roughly the entire land mass of the Netherlands would have to be allocated to growing maize.

Taken together the above three technologies could be applied in order to replace current fossil fuel based power plants. The energy requirements of western societies are tremendous, and therefore it is important that these requirements are reduced significantly in order to let sustainable energy sources be a viable alternative. This thesis is however not primarily concerned with the technological specifics of a sustainable economy; much more emphasis is placed on the way in which fossil-fuel technologies and humans co-evolved into what it is now. Even more important is to develop a model in which this human-technology relationship could develop into one which is sustainable.

2.4 WHEN AND WHY ENERGY BECOMES SUSTAINABLE: A SYSTEMATIC APPROACH

In the previous sections I have argued that:

1. As the industrial revolution took off our energy consumption levels necessitated us to apply what I have labelled as 'external' energy sources. These are sources which take (much) more time to replenish their energy than the time to extract it.
2. Energy production by technological means is necessary if we are to continue our present way-of-life as a society.
3. Reducing current levels of energy consumption is useful, however at best only part of the solution towards realising a completely 'internal' energy system.
4. Side-effects of the current production methods of energy should be addressed, and the most important issues to address are fossil fuel resource depletion and preventing pollution.

Current practices for addressing environmental degradation effects associated with power generation are often focused on reducing power consumption. I argue, following McDonough & Braungart, that reduction only can never amount to a serious long-term solution for stopping environmental degradation (McDonough et al., 1998).

Given the fact that we are able to generate more power than we are able to supply with our bodies – or other forms of 'internal' energy for that matter - means that our societies have been able to use more power than they are able to produce in their lifetime. According to the second law of thermodynamics energy cannot be produced as such; it is merely transformed in its appearance and potential and as such energy is never lost. This means that the activity of energy generation, transformation, transportation and storage is what we are discussing when the issue of power generation is at stake.

As such a discussion about power generation is necessarily about the activity of converting energy from one form to the other and stockpiling it, often into a relatively compact form depending on desired technological application. The question about what exactly is sustainable energy generation is important to consider in order to be able to answer the main research question. Therefore, the relevant subject of analysis with regards to the activity of energy generation are its associated technologies. Current methods of energy generation rely on stored energy from the sun; mostly in the form of oil, natural gas or concentrated pockets of carbon deposits (Drobinski, 2012).

The three technologies mentioned in section 2.3.4 are merely those which are commercially available, and is by no means exhaustive. This chapter is intended as descriptive and clarifying with regards to sustainable energy generation technologies and provides a sharp definition of what kinds of technologies and/or practices can be considered as - what I label as - 'fundamentally sustainable'. In order to clarify and argue for this concept I will use classic economic theory as well as historical

data about energy generation practices in clarifying the distinction between sustainable and unsustainable practices. Finally, I will discuss a possibility of a fundamentally sustainable economy as discussed by McDonough and Braungart (1998). This leaves us with a technological option for fundamental change in energy generation methods; the way in which such a technological option could actually be adopted is further discussed in chapter 3, 4 and 5.

A generic definition of the word 'sustainable' is: "pertaining to a system that maintains its own viability by using techniques that allow for continual reuse" (Dictionary.com, 2013). This definition is not compatible with current policies by governments and businesses which are being labelled as 'environmentally friendly' or 'sustainable'. This is because current approaches by companies and governments towards sustainability are being described as the approach of reduce, reuse and recycle (the 'three R's-approach') by William McDonough and Michael Braungart (McDonough & Braungart, 1998). Such approaches focus on the reduction of energy consumption of industrial processes, reusing of artefacts and recycling waste products. The net result is that the process of environmental degradation is slowed down; instead of halted and as such this does not address the issue of environmental degradation effectively. Therefore, I have introduced the term 'fundamentally sustainable' in order to be able to make a distinction between general popular use of the word 'sustainable' and its proper meaning.

The 'three R-approach' is potentially dangerous because of several reasons, of which some have consumer and producer behavioural effects and others are located in the practical domain.

2.4.1 CURRENT APPROACHES FOR ADDRESSING ENVIRONMENTAL DEGRADATION

The three R-approach is potentially dangerous because it can lead to a situation known as Jevon's paradox (Alcott, 2005). This paradox, although very difficult to prove empirically; holds that with increased efficiency of products and services, they will also be used more and as such damage the environment even more by consuming more net energy. A practical example of this paradox is the increase in distance driven in an energy-efficient car, in which the additional distance travelled outweighs the energy efficiency gains of the vehicle. This practice leaves the environment in a more degraded state compared to the alternative less environmentally friendly vehicle.

Furthermore; the publicity related to the three R's approach allows both governments as well as the consumer to think that the problem of environmental degradation is being adequately dealt with (Peattie et al., 2005). This is predominantly due to marketing practices using terms as 'green', 'environmentally friendly' and 'sustainable'. Packaging solutions which are less polluting, and as such labelled as 'environmentally friendly', and marketing fuel efficient cars as 'green' is a misleading practice. This is dangerous because these practices decrease environmental concern in the consumer by providing only a partial solution to the problem; herewith lowering the urgency of action.

Furthermore; a very important practical characteristic of the current three R-approach is its financial attractiveness. Consumers are increasingly growing aware of environmental degradation and are prepared to pay more for products that are manufactured in a sustainable fashion (Seyfang, 2009). This means that sustainable practices have become a business opportunity for companies. It is attractive because the company can cut spending costs; for example, on raw materials by recycling them or reusing packaging; and sell products at a premium to customers for engaging in this practice. This is important to notice because it tells us that a possible alternative economic system can be

stimulated by providing producer's opportunities for generating profit from fundamentally sustainable products. A word of caution is however necessary with regards to this practice; because it can easily lead to a situation of inequality in which only wealthy are able to afford fundamentally sustainable products. (An example would be the tax-exemption for purchases of 'green' vehicles; which are only applicable to those who can afford a new vehicle in the first place)

These practices call for change. McDonough & Braungart refer to this change as the next industrial revolution.

2.4.2 FUTURE PRACTICES FOR ADDRESSING ENVIRONMENTAL DEGRADATION: THE NEXT INDUSTRIAL REVOLUTION

The concept of the next industrial revolution is an excellent proposition for change towards the fundamentally sustainable energy production methods necessary for addressing environmental degradation properly (McDonough & Braungart, 1998). Instead of pursuing a strategy of reduce, reuse and recycle a more fundamentally sustainable strategy of equity, economy and ecology (the three E-approach) is proposed. This necessitates a strict separation of biological and industrial metabolisms; in which great care must be taken to avoid cross contaminations of the spheres on each other.

The basis of the three E-approach notes that many industrial products are designed to be durable and avoid natural degradation. This fact, which may sound obvious and logical, is important to note because when an ecological perspective is taken it shows itself as a harmful practice. Transforming fossil resources towards energy and waste is an example of a process which is by its design are incompatible with natural degradation and regeneration processes. Current energy generation technologies which are being labelled as fundamentally sustainable largely do not take into account this ecological perspective. Solar panels for example are still manufactured using materials which are not biodegradable.

Natural processes are unable to deal with the rising portion of greenhouse gasses in the atmosphere, neither are they able to deal with soot from diesel vehicles or nuclear waste. It is therefore necessary to start designing an energy generation process which is comprised of either biological ingredients, industrial ingredients or a clear cut combination of both (McDonough & Braungart, 1998). In order to maintain ecological balance, necessary to achieve fundamental sustainability, it is of vital importance to design more intelligent artefacts. They should be designed in such a way that after their lifecycle it is possible to put its biological parts back into nature (the biological metabolism), and its industrial products back into the industrial system (the technical metabolism). This assures fundamental sustainability because both systems remain ecologically neutral in over the lifecycle of artefacts. When taken in an ethical philosophical stance, this approach has an additional advantage; when both producers and consumers are engaged in the transition towards a fundamentally sustainable economy it might make them happier because of it. This is because empirical research into subjective well-being has shown that a contribution towards a meaningful activity is correlated with well-being (Dasgupta, 2001; May et al., 2004).

A second principle is the respect for diversity of environment. Contemporary design practices are universal and impose and extract their requirements from the environment; McDonough and Braungart use the office building as an example. These buildings are alike all around the world and do

not take into account local materials and requirements. Designs should be adapted to fit into their surroundings and as such should not impose unreasonable demands on their environment. This practice does not only have an environmental advantage; it can be argued that in this fashion their aesthetic value is improved as well. Berleant, in his 'aesthetics and the environment', has proposed several models for appreciating the environment. Here he has argued that contemporary aesthetic insight is too much focused on artefacts themselves instead of their aesthetic value in relation to the environment (Berleant, 2005).

As a third and final principle, and by far most important given the notion of fundamentally sustainable electricity, energy required for these conversion processes should be extracted from the sun as directly as possible. Current reliance on fossil fuels for energy usage is both wasteful (natural oil reserves are a rich resource and a waste to use for combustion) and polluting (exhaust emissions of combusting fossil fuels are known to harbour health-degrading effects) (Jaccard, 2005). Furthermore, technology available for extracting energy from the sun is already available; as I have discussed before.

In this way; McDonough and Braungart's ideas provide a general theoretical proposal on the question as to where a sustainable economy should be headed, and places a dash on the horizon for the future.

2.5 ECONOMIC FUTURE OF RENEWABLE ENERGY SOURCES

In the past sections I have argued that a few centuries ago pre-industrialized societies relied on internal power sources in order to be able to function. After the industrial revolution took off these power sources were slowly replaced by external sources, in which larger power delivery was gained at the cost of introducing pollution and resource depletion.

Also I have argued that, although important for easing the transition towards renewable fuels, power saving initiatives can at best only be a partial solution towards 'internalizing' power sources. This is because our present society cannot function without energy-hungry technologies in a similar way that previous societies were able to.

This means that the technological challenge we are facing now, and especially in the future, is the provision of large amounts of power which will have to be delivered by making use of similar internal power sources which were used before the industrial revolution.

It has often been argued that the sheer quantity of required power will be impossible to deliver by Renewable sources due to both technological as well as economic reasons. In this chapter I aim to provide a short overview of why – at least in the very long run – it is still to be expected that renewable energy sources have both a technological as well as an economical future.

2.5.1 A TECHNOLOGICAL FUTURE OF RENEWABLE FUEL SOURCES

At present about ten per cent of the Dutch electrical energy mix is being generated by renewable sources, and electrical energy is only a small part of the total amount of energy consumed (CBS, 2014, 2015). In section 2.3.4 I have concluded that if it would be decided that three commercially available renewable energy sources were to be used in order to generate sufficient electrical power, the land mass available in the Netherlands would be insufficient in size. There are however several

reasons for arguing that it would still be technologically feasible to use these three technologies as the sole power source for electrical energy generation.

It seems logical that the issue of generating sufficient sustainable electrical energy could be addressed on at least three points:

1. The required amount of electrical energy could be lowered. For example, by addressing technological inefficiencies in electricity users which have low efficiency. This could mean that incandescent lighting and poorly insulated cooling appliances should be replaced and more intelligent control over energy usage should become design practice.
2. It could be possible to increase the amount of land mass available for Dutch electricity generation, for example by buying sustainable energy from abroad. Given that the Netherlands has a relatively high population density, it is feasible to allocate foreign soil for the purpose of supplying necessary goods towards the Netherlands. This practice is considered normal in the case of, for example, coffee or tropic fruits which are imported towards the Netherlands.
3. Finally, it is theoretically possible to improve the efficiency of the three technologies at hand. This could be done by, for example, increasing the efficiency of solar-PV panels. Present commercially available solar-PV panels have an efficiency of about 16 per cent, which means that in a certain surface only 16% of its energy potential is presently harvested by solar PV-panels. High-tech appliances such as space vessels have led to extensive research into high-efficiency solar power solutions which in some cases have increased efficiency to over 40 per cent ("New World Record For Solar Cell Efficiency Set At 46%," 2014).

Furthermore, examples already exist of developed western societies which have extensively invested in sustainable electricity generation and have had considerable success as well, such as Germany and Denmark. Both of these countries have already experienced situations in which the sustainable electricity supply exceeded the required amount in specific circumstances (Neslen, 2015; Shankleman, 2016).

All of the above leads me to conclude that; at least for the present electricity demand for the Netherlands, no fundamental technological obstacles exist which impede the desire to renew electricity supply towards sustainable sources.

2.5.2 A ECONOMIC FUTURE FOR RENEWABLE ENERGY SOURCES

The vast majority of methods for electricity generation applied in the Netherlands rely on the consumption of fuels, such as coal and natural gas, in order to generate a desired output. This means that for every kilowatthour of electrical energy generated, a certain amount of costs will have to be made in the aquirement of fuels required for generation of it. This method of electricity generation has specific economic and practical implications:

1. The consumption of such fuels leads to depletion of the fuel stock, because the fuel stock is a limited quantity.
2. Although a sensible difference can be made between the entire fuel stock (theoretically) available, and the portion of it which is economically competitive to apply for electricity generation, the fact that the grand total amount of fuel stocks is limited holds.
3. The usage of fuel stocks for electricity generation holds that such fuels will be combusted; which is polluting and contributes – indirectly – to climate change. Climate change has

specific costs associated with it – such as causing draughts or additional financial investment for securing portions of land – which at some point will become a costly affair.

4. For every kilowatthour of electricity generated, certain costs will have to be made in aquirement of the fuels required.

Now, sustainable sources of energy such as solar-PV panels and wind energy have a different set of characteristics which lead them to have a different set of practical as well as economic consequences:

1. Renewables do not suffer from resource depletion because they do not depend upon a fixed amount of fuel stock.
2. The electrical energy delivered by present sustaianable sources has a lower degree of control than the fossil fuel sources in that the exact amounts of delivery are unknown beforehand. This needs them to – in practice – delived more power compared to fossil fueled alternatives because of allocation and storage issues.
3. Each additional extra amount of electricity generated has no costs, because renewable energy sources require no fuel – which will have to be bought - in order to operate.
4. Especially in comparison with fossil fuel alternatives, renewables have a negligible impact on climate change due to then being unreliaint on combustion in order to function. They have therefore – at least – much lower costs associated with external impacts of their usage.

The short and crude comparison between renewable energy sources and fossil fueled sources above mean that, inevitably, a point will exist at some point in the future in which the costs of renewable fuels will match those of fossil fuels. This mainly due to the fact that fossil fuels are limited in quantity and at some point will be either technolgically – due to increasingly more difficult extraction - or economically - due to expensive side-effects of their usae - unattractive to apply as the main source of electrical energy.

Given the fact that this point in time which renewbles become more economically attractive than fossil fuels – popularly known as ‘grid parity’ – will exist at some point in the future, it seems risky to invest in fossil fuels longer than strictly necessary.

2.6 CONCLUSION

In this first chapter I have explained what sustainable energy generation is by demarcating a difference between external and internal energy sources.

External energy sources are those which exploit natural phenomena, such as high pressures on carbon-rich deposits in the earth’s crust leaving oil and natural gas, in order to use a past stockpile of fuel in order to generate large amounts of power in a short amount of time. This practice is however theoretically limited due to the limited amount of fuels available for this process, as well as a limited capacity of our planet of dealing with the consequences of large-scale combustion processes.

Furthermore, specific usecases such as usage of natural gas in the Netherlands show that the depletion of these resources is a practical matter at present.

Internal energy sources are those which are able to replenish themselves in roughly he same time it takes them to be depleted; hence putting them in the category of ‘sustainable energy sources’. Three technologies which adhere to the criterion of being an internal energy source have been presented: Solar-PV panels, wind turbines and biomass processes.

I have shortly assessed these three technologies and their potential for replacement of the current fossil-fuel powered methods for electricity generation.

Finally I have shortly assessed both a technological as well as a economical dimension of the future of renewables in the Netherlands, in which no theoretical barriers were established which could impede the movement from fossil fuels towards renewables.

CHAPTER THREE: POST MATERIALISTIC VALUES AS MOTIVATIONAL REASONS FOR CONSUMERS

Environmental degradation issues associated with widespread usage and generation of power have been discussed in chapter two, as well as possible technological solutions for its prevention. Given that humans rely on their environment for continued survival, environmental quality is related to our well-being. This also implies that practices which affect the quality of our environment could be considered as having at least a prudential moral dimension, herewith not claiming that the environment does not have a particular value in its own right. The question of how to develop future energy generation methods is thus – given their direct relationship with environmental quality - more important for us than evident at first sight. Or, as Dale Jamieson puts it:

“The questions that such possibilities pose are fundamental questions of morality. They concern how we ought to live, what kinds of societies we want, and how we should relate to nature and other forms of life.” (Jamieson, 1992, p. 147).

This implies that choices regarding the selection of means of power generation also gain a moral dimension. Moral decisions can be regarded as those which are about what is good, what is bad, what is right and what is wrong. Different strategies for answering these questions are available, and usually they have something to do with determining what ‘good’ or ‘bad’ entails or when something is ‘right’ or ‘wrong’ (depending on which ethical theory is applied in order to make a deliberation). It is not my aim to determine whether such practices would be either of those, I merely argue that the usage of certain energy generation methods have moral implications.

Problematic about environmental issues is, as Gardiner has argued, that even if some sort of consensus could be established among the relevant actors it would not be enough to motivate concrete action (Gardiner, 2004). Consensus about the presumed ‘rightness’ or ‘wrongness’ of causing environmental degradation is simply insufficient as a motivator for concrete action. In terms of logic, it might be a necessary condition for taking action, it is however not sufficient.

This is because other barriers, such as commercial interests or insufficient theoretical knowledge about environmental degradation, impede the establishment of concrete policy change or collective action. These issues are at present more important as a barrier for realising a switch towards fundamentally sustainable energy generation in comparison to the mere technological challenges.

That is why I have decided to put forward the role of the consumer as an important market pull-factor in creating increased demand for sustainable energy generation technologies. This chapter is focused on arguing for a theoretical case in which consumers could be motivated to choose for sustainable energy (technologies) explicitly because the choice itself is suited to particular values within such consumers. This is a different strategy compared to most other incentives for consumers for engaging into sustainable energy, which usually appeals to some sort of - often individual - responsibility. I argue, following Gardiner’s position on ‘problems of many hands’, that this strategy is doomed to fail because consumers are only partly responsible for causing environmental degradation. Hence it is psychologically unreasonable for them to *solely* carry the burden for developing or implementing solutions for it on a basis of responsibility.

In order to sketch a scenario in which sustainable energy generation methods become viable for such a consumer – situated in a consumer economy - I will argue for a different approach. Namely that sustainable energy generation technologies such as solar energy and wind power have specific characteristics which allow them to 'fit' with particular human values which are becoming more important in the present consumer. Concrete examples of these values, often labelled as being 'postmodern', are the importance of environmental protection, social participation and engaging in meaningful activities. This approach is – at least partly - in opposition of current strategies for getting consumers to change their behaviour regarding the environment which are often focused on financial incentives.

Using financial incentives as a basis for changing environmental behaviour by consumers has at least two problems. Firstly, using sustainable as an energy source is often considered as expensive compared to using fossil fuels as a source. I will discuss this position further in chapter four. Secondly, literature about the issue of how to foster environmentally friendly behaviour suggests that a mere financial approach would only work on the short term. This is because financial incentives do not contribute towards changes of norms in consumers, norms which are expected to have a much more permanent effect on consumers' behaviours (Steg et al., 2014).

This chapter will discuss what values are, how these could be organized in a value system and discusses empirical evidence about changes in such value systems over time. After this elaboration I will discuss implications of changing value systems with regards to application of sustainables in chapter four and five. This in order to sketch a scenario in which the fit between sustainable energy generation methods and post materialistic consumers is optimized, or at least improved upon compared with the current situation.

3.1 VALUES AND VALUE SYSTEMS: INGLEHART

In order to motivate how values in consumers are linked to sustainable energy generation I will commence with introducing values, in this case perceived as a more concrete model of morality in consumers, and discuss how these values could be organized in a value system. Values can be seen as a representation of concrete issues which relate to morality, and to some extent, moral behaviour.

A value (as suggested by the word) is something that is important to an individual, or to be desired by an individual or a society. Examples of values are security, benevolence and equality and those are useful to grasp moral decisions in language and help in guiding the reflection process on why a certain decision could have been - or should have been - taken. Values will help me to explain on what specific grounds sustainable energy generation technologies could be construed as morally desirable. Also theories about value systems combined with empirical research provide insight on the question of how to apply knowledge about values in practice to influence behaviour.

3.1.1 RESEARCH INTO VALUES

Historically, values are not explicitly connected to morality. Values were topic of research in the 1960s in an attempt to better understand how decisions are taken and are linked to behaviour. This research goal, embedded in the concept of 'values', is visible in the early definition of values by (for example) Kluckhohn (1951, p. 395):

“A value is a conception, explicit or implicit, distinctive of an individual or characteristic of a group, of the *desirable*, which influences the selection from available modes, means, and ends of action.”

This definition supposes a concrete link between values and behaviour and was as such desirable because of the supposed normative link between values held by individuals and concrete behaviour. Perhaps the underlying expectations in this definition were a bit optimistic, however a direct link between values and behaviour would enable psychologists to predict behaviour in various value-laden settings which was desirable nonetheless.

Experiments designed to trigger concrete actions based upon values (as suggested by this definition) have however not been very convincing, as evident by classic experiments performed upon the relationship between values and behavior (Darley et al., 1973). This supposes the existence of other items related to concrete behaviour which could explain the apparent gap between values held and concrete action observed. It has for example been theorized that the distance between values and concrete action is simply too big, necessitating an intermediate step such as attitudes or valences in theoretical behavioural models (Homer et al., 1988). Other research, such as by Maio et al. and Torelli et al. discussed below, is theoretically linking values directly to behaviour. This research explains the lack of empirical success by proposing that certain – yet to be proven - barriers prevent people from acting in congruence with their held values.

Particular barriers, of which I name a few relatively recently researched examples, could be the apparent ‘mundaneness’ of day to day decisions which do not allow a careful consideration of one’s values in the process (Bardi et al., 2003). Or the role which one’s mind-set has on the relationship between values-as-truisms and behaviour (Torelli et al., 2009). Furthermore it has been suggested that communicating explicit motivational reasons for holding certain values dear aids people in deciding in congruence with their held values (Maio et al., 2001). Given the problematic relationship between values and behaviour a different definition of values was developed at a later point in time which I will use as a definition of values in this thesis:

(Values are) “(a) concepts or beliefs, (b) about desirable end states or behaviours, (c) that transcend specific situations, (d) guide selection or evaluation of behaviour and events, and (e) are ordered by relative importance.” (Schwartz et al., 1987, p. 551)

Despite theoretical and practical problems in the relationship between values and behaviours in my view they form the best entry point into the relationship between desires in consumers and characteristics of sustainable energy generation technologies. This is due to three reasons:

VALUES AND SUSTAINABLE ENERGY GENERATION TECHNOLOGIES

Firstly, values by their very definition are relatively stable over a large time period, as opposed to attitudes and valences. This has to do with the formation of values taking place during one’s development into adulthood, and personality traits developed in that time period have found to remain stable over time. This allows for implementation of long-term strategies for motivating choice for sustainable energy technologies. This is relevant for implementing fundamentally sustainable energy generation technologies which is per definition a long-term issue.

Secondly, research into emerging values suggests that prevailing values are moving towards those which link up with moral characteristics provided by sustainable energy generation technologies for a large portion of society alive today. Either by aspects of the technologies themselves; or by societal impacts which such technologies have. As such this is a possibility to allow consumers to behave or act in such a way that their state-of-affairs in general is more congruent with their values. (Maio et al., 2006).

Thirdly, despite the (empirical research) problems with linking behaviour to values; a defining characteristic of values is that they have some direct influence on concrete behaviour, as is evident in the definition by Schwartz & Bilsky above. It simply makes sense to suppose that some sort of relationship exists between what one desires, and concrete decisions taken or action performed in practice. Or stated more philosophically; given that free will exists, it makes sense that desires and concrete behaviour are linked at least up to a certain extent.

In a quest for improved understanding of values and the role they play authors of different fields such as sociology and psychology have constructed systems in which values are being ordered and clarified. A value system can be viewed as a more concrete model of values held inside an individual, group or even society and provides insight in the relationship between particular values and the relationship between them. Several value system theories have been developed out of different research fields and have been tested in empirical research. Below I will discuss two of such models for clarifying the above three reasons for using values as a starting point for motivating consumers to choose for sustainable energy generation technologies.

3.1.2 VALUE SYSTEMS

As previously clarified above I have three major reasons for using values as a construct for estimating morality in consumers. Values are (supposed) to be stable over time, and slowly transforming in relevant groups in a particular direction, and linked to behaviour. In order to discuss the former two points, I will primarily rely on the sociological theory of post materialism by Ronald Inglehart. The latter issue about the relationship between values and behaviour will be discussed in section 3.2, by discussing Schwartz' value model and subsequent empirical research.

Ingleharts' research into values has been derived from empirical research over time using a grounded theory approach. Stated somewhat simple, Inglehart collected large amounts of data about values in publics and deduced trends from them.

Schwartz' value model is more specific and combines earlier models of value systems with extensive data analysis and empirical research results. This approach uses theories about the logical structure of values and is primarily concerned with the question of:

- Whether values are truly ordered by relative importance.
- At which point does a specific value warrant its own category or label.
- And which values are close to each other, and which oppose each other.

In this way both authors develop valuable knowledge, based upon empirical research, about the nature of values and the way in which they could be theoretically approached.

INGLEHART ET AL.

Ronald Inglehart is considered one of the driving forces behind the world values survey (WVS). The WVS is a large scale longitudinal research survey into values conducted in roughly 75% of societies around the world (Inglehart, 2000). Results of these surveys show that structural changes into value systems are currently taking place in western industrialized societies. Inglehart labels one of these shifts the movement from materialist' values (related to 'the bare necessities of life') towards postmodern ones (which focus on non-materialistic needs). The WVS shows that values present in members of western societies are being slowly but structurally transformed in the subsequent research waves. As Inglehart explains in his own words:

"This societal-level [values] shift is linked with individual-level value changes, from giving top priority to economic and physical security towards giving top priority to self-expression values that emphasize participation, freedom of expression, and quality of life. Under conditions of scarcity, people focus on survival needs, giving top priority to economic and physical security. Economic development increases people's sense of existential security, leading them to shift their emphasis from survival values toward self-expression values and free choice, which is a more direct way to maximize happiness and life satisfaction. "

(Inglehart et al., 2008, p. 266)

Values associated with materialism are economic and physical security. Examples of post materialist values are autonomy, self-expression and quality of life. The particular place which such values take in a value model is discussed later in section 3.2.1.

Support for the presumed shift from materialist to post-materialist values is found in empirical longitudinal research by questionnaires which show that older generations place more emphasis on materialist values compared to younger generations. Inglehart attributes the particular direction of these changes to the societal conditions which were prevailing during the "formative years" of people belonging to the younger cohorts (Inglehart, 2008, p. 131). Although Inglehart does not seem to specify which ages come to mind when he discusses the notion of formative years, he seems to refer to a specific time period during the youths of such cohorts' members.

As such a relationship is postulated between the external conditions in which cohorts are being born and spend their formative years, and their prevailing values. Ingleharts' most simple description of the societal conditions leading to the development of post materialistic values is the idea that existential security is no longer uncertain. This fact 'frees up' attention from the materialistic – basic necessities of life – to the post materialistic – values which are considered as important, given that there is sufficient freedom, security, prosperity etc. to be able to be concerned about them.

Inglehart spends considerable attention towards the question of whether such lasting effects of values could be attributed to some other, external, phenomenon and concludes that the societal conditions prevailing during the formative years seems the best explanation.

Before discussing Inglehart's theories further; several problems arise with such a research method and associated assumptions. Some are classical issues associated with using questionnaires as a research method, and others are related to theoretical assumptions necessary for Inglehart to assume in order to argue for his conclusion. The most pressing issues are discussed below.

CRITIQUE(S) ON INGLEHART'S CONCEPTS OF MATERIALISM AND POST MATERIALISM

Firstly, it might be the case that the age difference slowly developing in a cohort is causing shifts in values, not the presumed difference in value systems caused by increasing senses of existential security. Secondly, existential security is a relative concept. It might be that, although concrete factual circumstances are similar, a certain group or country still feels more or less existentially secure. This leads to empirical research challenges because this means that it is difficult to perform research on the relationship between circumstances and felt existential security. Thirdly, it is assumed that most people desire for freedom and autonomy, and it is theorized that conditions in the past prevented people from actually pursuing these desires because bare materialistic needs of life were dominant. This assumption requires some clarification.

AGE AS AN EXTERNAL CAUSE

Inglehart recognizes most of these problems and proposes solutions for them. Given that the WVS has been conducted over a large timespan, roughly between 1970 and 2006 for particular countries, it is now possible to test for the causes of shifting values, or at least to exclude age as a possible source. This is because if age would be an independent variable causing shifts in values, early cohorts in the research should be moving towards materialist values due to their increasing age. The VWS shows quite conclusively that this is not the case; exemplified by figure 2.3.1a. If levels of (post) materialism would be changing due to natural ageing of cohorts, then we would see that lines in the figure would slope downwards or even cross each other as the cohorts age. This is not the case, supporting the conclusion that if a certain cohort is found to have a certain level of (post) materialism, they more or less stick to this level. As always in sociological research, (post) materialism levels are not stable over all cohorts all of the time, however a trend is clearly visible and does not support the claim that age explains levels of (post) materialism.

COHORT ANALYSIS: % POST-MATERIALISTS MINUS % MATERIALISTS IN SIX WEST EUROPEAN SOCIETIES, 1970–2006

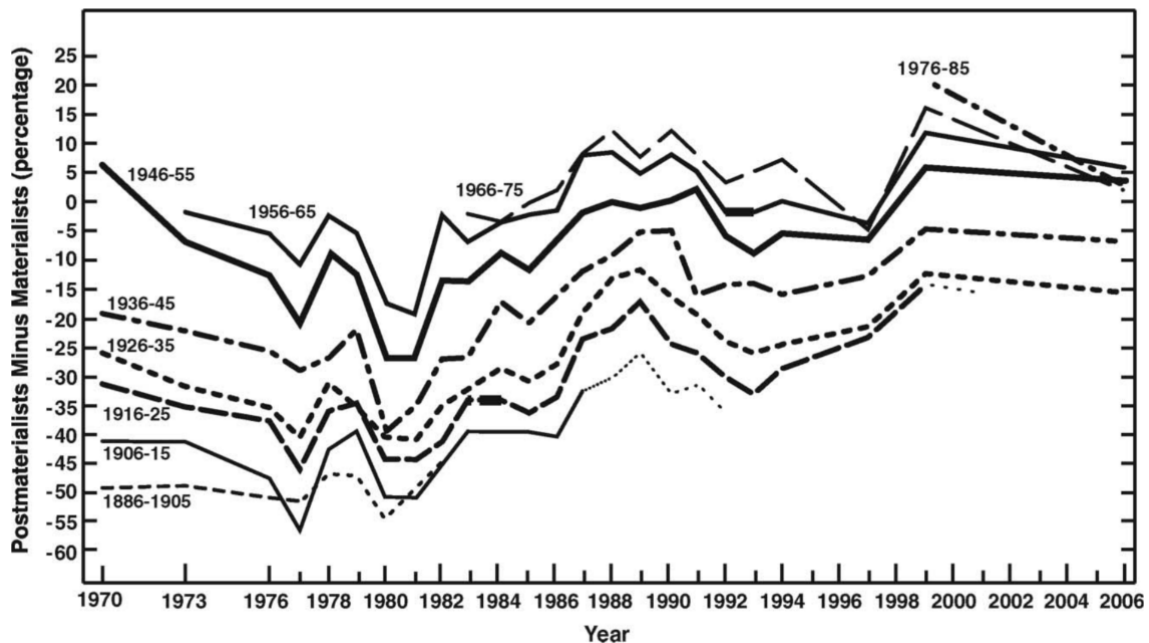
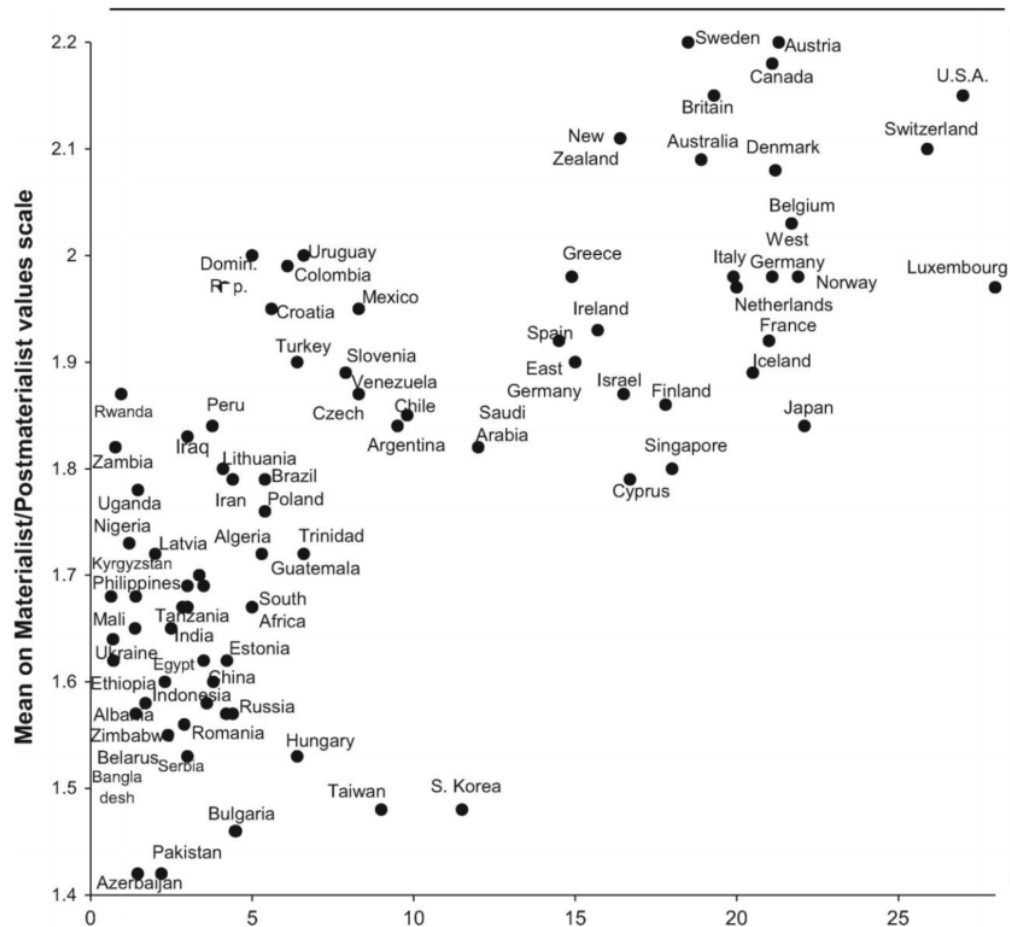


Figure 3.2.1a: Post materialists minus materialists. (Inglehart, 2008, p. 135)

RELATIVE EXISTENTIAL SECURITY

Regarding the second issue, it is in this case first necessary to describe what exactly is 'existential security'. Simply stated it is the extent to which an individual *feels* that her existence will be subject to threat during her life. If such an individual does not feel threatened, Inglehart assumes that she will take life for granted, freeing up attentional space – by figure of speech – for emphasising other values than those associated with survival. Here a difference between no longer focussing on survival values, and hence focussing upon – apparently desired – self-expression values becomes evident. Putting less emphasis on things one already possesses seems logical because of two reasons. The first is related towards the principle of diminishing returns, if additional units of desired product X are easily obtained, their relative value lowers. Or stated otherwise; the first litre of beer is valued more than each subsequent litre due to our limited ability to value it (or drink it). Secondly, if something (important) is possessed, and it is reasonable to assume that it will stay in possession, it seems logical that less attention is spent on keeping it or striving for attainment of it. The degree to which someone feels that something is valuable is perhaps relative due to cultural differences or other causes. Answering the question as to why this is the case is not directly relevant for my purposes; I merely need to support Inglehart's idea that if valuable item X is possessed with a large degree of security, it *feels* less important for someone. This has been researched by the WVS by cross-referencing people's existential security – operationalized by their GNP – and value placed upon (post)materialistic values. As is shown in figure 3.2.1b.

MATERIALIST/POST-MATERIALIST VALUES BY GNP/CAPITA



Note: 1 = 100% materialist; 2 = materialist and post-materialist evenly balanced; 3 = 100% post-materialist; GNP per capita in thousands, 1995 (PPP estimates) $r = .64$.

Figure 2.3.1b: Relationship between (post) materialism and GNP (Inglehart et al., 2008, p. 138)

Not representing an exact mathematical relationship, figure 2.3.1b however shows that countries with a high GNP, have higher scores on post materialist values. Other value models such as Schwarz' value model and Maslow's hierarchical model of needs show similar relationships between existential security and prevailing values.

PEOPLE'S IMPLICIT ASPIRATIONS

Concerning the third issue about what people tend to aspire to, the answer seems less clear-cut. The issue in question two is about the value of things already desired, and their importance for the amount of existential security. Question three is what to value or desire when things already valued or desired become less valuable because of their (relative) abundance. Inglehart simply states that most people tend to aspire freedom and autonomy (Inglehart, 2008, p. 131). His argument is constructed as follows: People ultimately want to aspire to freedom and autonomy, but due to scarcity in resources often they are unable to do so, because they are occupied with issues related to secure survival. If a situation is present in which survival can be – more or less – taken for granted, they will use this 'new attentional space' for aspiring to freedom and autonomy again.

This argument seems paradoxical, it makes sense at first sight, however the assumption that people will strive for freedom and autonomy seems a bit superficial. A relevant question in this regard is *why*

people would want freedom and autonomy, and what specific freedom and autonomy are to be aspired in what way.

Freedom and autonomy are two concepts which are closely related. Autonomy is related to independence from others; or an ability for a member of a species to exist without the need for others. Freedom is related towards ability and possibility for choice, and related to – possibilities to exercise - free will. It is in my opinion not possible to provide coherent proof that any individual will strive for freedom or autonomy, however other authors have quite fruitfully attempted to do so by for example interpreting and discussing JS Mill's 'On Liberty' (Bogen et al., 1978).

However, at least two arguments are quite persuasive in arguing that *most people* will strive for it.

The first argument is that most individuals will strive for freedom and autonomy because of its strong positive correlation with an increase in subjective well-being, despite lack of understanding in the exact workings of this relationship. It is hard to argue that it is in an individual's interest to act directly in opposition to its own well-being. Given that freedom and autonomy are positively correlated with an increase in subjective well-being, an individual should strive for it. This is the argument that Inglehart uses himself in his explanation as to why levels of subjective well-being tend to rise when GNP is rising (Inglehart, 2000). Despite evidence that this relationship is subject to the laws of diminishing marginal utility, it is quite evident that increase in experienced freedom and autonomy associated with increases in GNP play an important role in increasing levels of subjective well-being, at least up until a certain level of income.

Secondly and addressing weaknesses in the first argument; the capability approach is of value on this issue. The capability approach was developed as an answer to problems associated with classical welfare-economics, among which is the problematic relationship between increases of material wealth and increases of subjective well-being levels above a certain level of income.

The capability approach is useful in this regard because it is more individualistic compared to the empirical evidence between material welfare and subjective well-being levels, has a concrete theoretical foundation and appreciates the pluriform nature of individual sources of well-being.

When taken straightforward the capability approach supposes that capabilities, in this case seen as 'abilities to do X' or 'the freedom to do Y', of people are directly related to the amount of well-being they are able to attain. The extent to which people are able to freely engage in a certain desired activity is described as a 'functioning', a concrete set of conditions which enable an individual to perform a certain desired activity which is of value. I do not wish to engage in a lengthy discourse about the capability approach, however it is reasonable to suppose that at least a certain level of freedom and autonomy are a necessary condition for any capability and hence choice of functioning to be possible (Nussbaum, 2007).

If it is indeed the case that freedom and autonomy are facilitating factors in the development of capabilities and associated functionings, they are related to increases of subjective well-being as well. In this way Inglehart's assumption that people should logically strive for freedom and autonomy, unless impeded by external accounts, finds support on different grounds than the empirical relationship between material wealth and subjective well-being levels.

In this section I have discussed three possible issues with Inglehart's research primarily regarding its assumptions and validity. I have concluded that these issues are reasonably dealt with and I will continue with discussing the relationship between Inglehart's research and its possible relationship with certain products and services.

INGLEHART AND STABILITY AND CHANGE OF VALUES (REASON ONE AND TWO)

In order to design a certain technology, or use some of its marketing potentials, based upon particular values it is necessary to support how values are of importance for such an approach. In section 3.1.1. I formulated three reasons for why values are a useful concept for use as a basis for developing such products and services. These reasons were respectively concerned with the long-term stability of values, the compatibility of values with characteristics of the products and services and the relationship between values and behaviour.

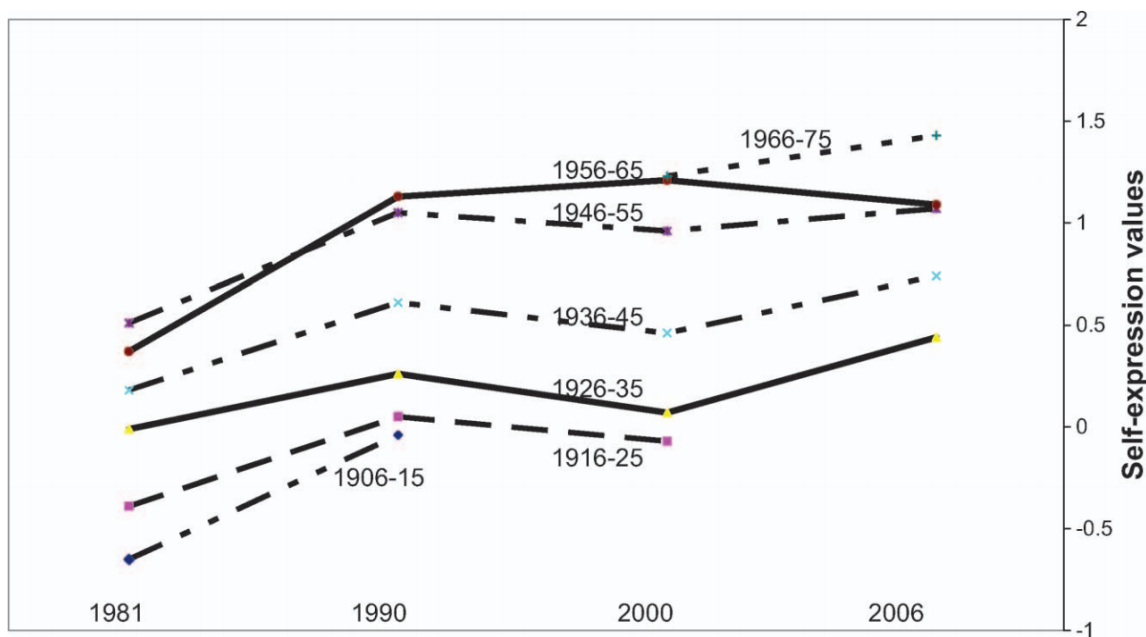
Of particular importance is the stability and tendency for change of (prevailing) values. This is due to the fact that marketing specific (new) aspects of a technology with no direct and personal advantage – an aspect of addressing environmental degradation - is difficult to communicate to a large audience. Therefore, a long-term design or marketing strategy is necessary, and hence values should be suitable for such an approach.

Firstly (reason one), values should be relatively stable, because otherwise a design or marketing campaign will fall to deaf ears when launched, due to the fact that it appeals towards presumed values which are no longer relevant when the marketing message becomes evident in the public.

Secondly (reason two), particular values prevailing when designing or marketing certain technologies should be compatible with characteristics of such technologies or their marketing. This is because it does not make sense to link certain technological designs or marketing characteristics to values which are not held in high regard in the public for which it is intended.

Inglehart provides theoretical ground in support of these two reasons for using values (Inglehart, 2008). It is often claimed that one's personality develops during the process of reaching adulthood, and stabilizes afterwards. According to Inglehart this also applies to the value system in a person. The – more or less final - state in which the values become stable is dependent on the conditions that prevailed during one's formative years. This means that on the macro level values seem to change only between generations which explains their relative long-term stability, and change mechanism, at least theoretically. Empirical data shows considerable support for both the relationship between circumstances and formation of value system, and stability of values over time. As evident in Figure 3.2.1c:

SELF-EXPRESSION VALUES BY BIRTH COHORT, 1981–2006



Note: Mean scores on self-expression values dimension combined data from France, Britain, W. Germany, Italy and Netherlands.

Figure 2.3.1c: Self-expression by birth cohort (Inglehart et al., 2008, p. 141)

Figure 2.3.1c shows the relationship between importance of self-expression for different birth cohorts.

In the figure the lines do not cross each other, showing that the relative distance between generations and their values held stays relatively stable. Also the lines stay relatively horizontal, meaning that values are stable over time, especially given the extended time period between the measurements.

This implies that, as always with sociological research ‘generally speaking’, research supports that generations are tending to become increasingly post materialistic due to their improved existential security when growing up. Also they tend to keep their values relatively stable over time, even when external conditions deteriorate.

3.2 VALUES, VALUE SYSTEMS & RELATIONSHIP TO BEHAVIOUR: SCHWARTZ (REASON THREE)

Inglehart’s theory and research provide constructive support for the long-term stability of values as well as slow changes in the hierarchical importance for particular values. Another issue, however, remains which is about the relationship between values and behaviour. Ingleharts’ research about values is not specifically aimed at behaviour in practice, however part (d) of our definition for values: “guide selection or evaluation of behaviour and events” does, and it has often been subject to debate and scepticism and needs to be addressed.

Most critiques on theories directly linking values to behaviour are focussed on (1) the distant relationship between values and behaviour; and suggest that an intermediate step would be necessary in order to link values to behaviour. Furthermore, such critiques question (2) empirical

research methods applied in order to validate theoretical value systems such as Inglehart's. They do this for example by mentioning the problem of socially desirable responding (SDR), surfacing in questionnaires evident in a difference between *I would do X* in a questionnaire, and *actually doing X* in a concrete situation. These critiques are relevant for our aim of linking values in consumers to actual behaviour. In order to address these issues I discuss research into values which has produced a different model, the Schwartz value model, which has been extensively tested and particular subsequent research is relevant for question (1) and (2) above.

3.2.1 THE SCHWARTZ VALUE MODEL

In 1992 Shalom L. Schwartz presented a comprehensive model of human values which is relevant for answering the questions above. Of particular interest is explicit attention for the relationship between values and behaviour, both by Schwartz and subsequent researchers, in which I will spend considerable attention. The Schwartz value model is based upon earlier research by Schwartz and Bilsky, and has been refined in order to come up with a list of universal human values which are recognized by most people (hence; universal), comprehensive (covers all values), similarly interpreted among people (representative) and follows a logical structure (e.g. similar values should not oppose each other) (S. H. Schwartz, 1992, p. 3).

As previously stated values are: (a) concepts or beliefs, (b) about desirable end states or behaviours, (c) that transcend specific situations, (d) guide selection or evaluation of behaviour and events, and (e) are ordered by relative importance. This definition does not explicate specifically what the concrete content of such concepts or beliefs are, and how they are related to behaviour. The Schwartz value model is of help in this issue.

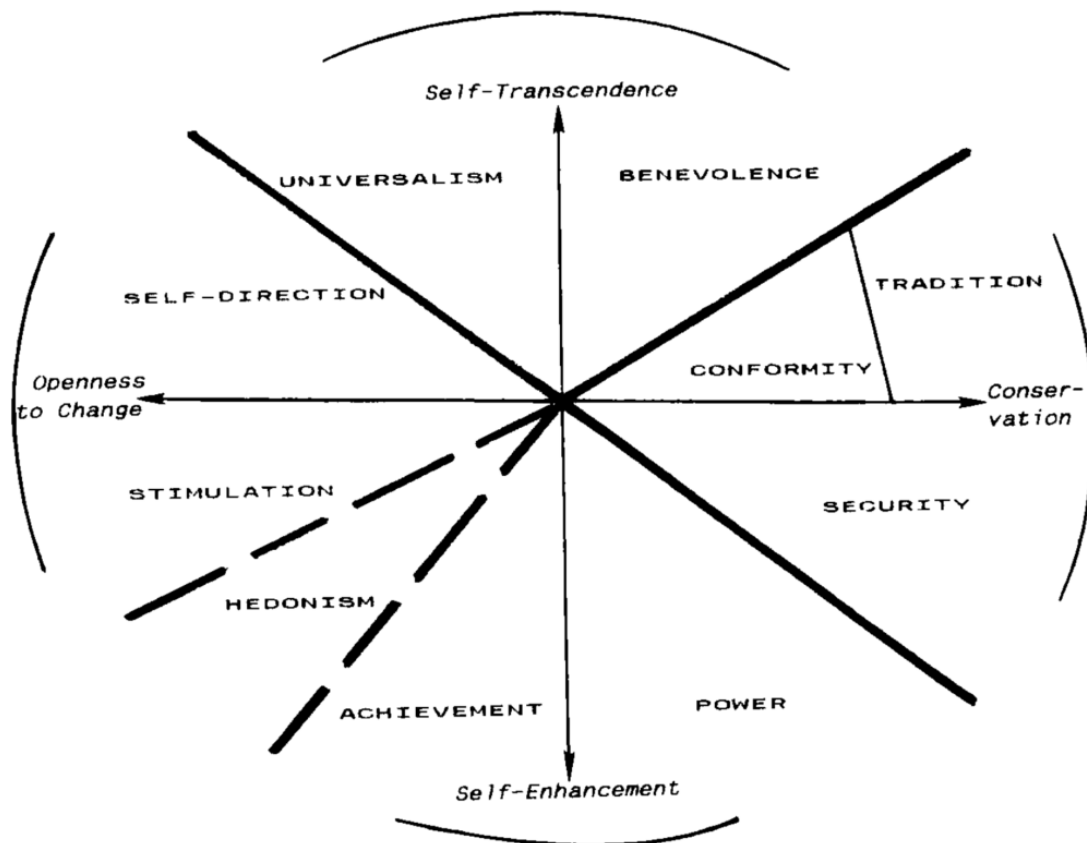
In earlier research Schwartz and Bilsky state that the specific *content* of values is related to what they represent for survival of biological organisms (Schwartz & Bilsky, 1987; Schwartz et al., 1990). In that sense the concrete values derived in the Schwartz value model are values *as conscious goals* which relate to: "universal requirements of human existence to which all individuals and societies must be responsive: needs of individuals as biological organisms, requisites of coordinated social interaction, and survival and welfare needs of groups" (S. H. Schwartz, 1992, p. 4). Here a concrete link is established between prevailing values (stated as goals) and concrete behaviour. This is because such values are directly related to biological needs of organisms (Buss, 1986), which can presumably be met or approached by certain behaviours - guided by values - of individual specimens of a species.

In this way part (a) of our definition 'concepts or beliefs' is concretized by describing motivational types which are constitutive of establishing a certain value, and also adhere to part (d) of our definition: 'guide selection or evaluation of behaviour and events'. After refining the original Schwartz and Bilsky (1987) model, Schwartz presents a revised list of motivational types:

Self-direction, Stimulation, Hedonism, Achievement, Power, Security, Conformity, Tradition, Spirituality, Benevolence and Universalism.

These motivational types are arranged in a circular model which is constructed based upon empirical research into what values, underlying the different motivational types, are related and how they are related. The model is presented in figure 3.2.1a.

UNIVERSALS IN VALUE CONTENT AND STRUCTURE



3.2.1a: The Schwartz universal value model (S. Schwartz, 1992, p. 45)

The Schwartz value model shows the values and their structure established in empirical research. Values that are similar are adjacent, and those dissimilar are in opposition to each other. Furthermore, four general quadrants have been established; conservation vs openness to change and self-enhancement vs self-transcendence. (S. H. Schwartz, 1992)

3.2.2 SCHWARTZ AND INGLEHART

Inglehart's notion of post materialism and subsequent research reveal four types of direction, namely survival vs self-expression values and traditional vs secular-rational values. Schwartz' model shows similar dimensions.

It seems reasonable to suppose that Schwartz' conservation vs openness to change is a similar dimension as Ingleharts' traditional vs secular-rational values, and Schwartz' self-enhancement vs self-transcendence is similar to Ingleharts' survival vs self-expression.

This is important to notice because Inglehart has established the *stability* and *direction of movement* for values; where Schwartz has established how such values are organized and *relate to behaviour*. In order to provide a theoretical link between values and consumer behaviour relating to moral decisions all three are important.

For my purposes values which can be described as 'post materialist' are of particular relevance, given that currently people in western societies are increasingly becoming post materialist. This means that universalism and self-direction are of interest, because they are most 'post materialist' in terms of

Inglehart. Or in Schwartz' terms most open to change or self-transcendent. As such they link-up best with prevailing values in people which have grown up in societies with high levels of existential security (Inglehart, 2008).

Self-direction is described by Schwartz as:

"The defining goal of this value type is independent thought and action, choosing, creating, exploring. Self-direction was derived from organismic needs for control and mastery [...] and interactional requirements of autonomy and independence [...]. Although the goal of this type remains unchanged, we have changed the set of values intended to measure it so as to fit this goal more closely (creativity, freedom, choosing own goals, curious, independent)." (S. H. Schwartz, 1992, pp. 6, 8)

Universalism is described by Schwartz as:

"The motivational goal of universalism is understanding, appreciation, tolerance, and protection for the welfare of all people and for nature. This contrasts with the narrower focus of benevolence values. The motivational goal of universalism values can be derived from those survival needs of groups and individuals that become apparent when people come into contact with those outside the extended primary group and become aware of the scarcity of natural resources. People may then realize that failure to accept others who are different and treat them justly will lead to life-threatening strife, and failure to protect the natural environment will lead to the destruction of the resources on which life depends. Although such values may be absent in the few remaining small, isolated, homogeneous cultures, they are likely to be recognized to some degree in virtually all others." (S. H. Schwartz, 1992, pp. 11, 12)

In this thesis I will use Schwartz's definition of self-direction and universalism as a synonym for Inglehart's post materialist values, although they are not perfectly overlapping they comprise a similar dimension of an individual's value system. Moreover, specifically this part of an individual's value system is a likely candidate for being congruent with characteristics of sustainable energy generation technologies.

Furthermore, the WVS is not specifically focused on those specific moral relationships which people might have with their environment as its aim is to provide a comprehensive list of all the values which people hold in a certain regard. Other authors have, however, developed insights into the concrete relationship between people and their environment. Examples are the way in which individuals deal with the challenge of addressing environmental degradation and associated moral conflict (Opatow et al., 2000) or the role of grassroots (environmental) activism in the shaping of government policies (Bullard et al., 2000). Such approaches suggest that environmentalism itself could be conceived of as a value on its own right, which is itself worth of pursuing.

3.2.3 SCHWARTZ' MODEL AND CRITICISMS

In the lead-up of section 3.2 I noted that most critiques on linking values directly to behaviour such as Schwartz is intending are aimed at (1) the theoretical distance linking values directly to behaviour and (2) empirical research methods, mostly based upon questionnaires, used as a research tool in

linking values to behaviour. I will present two papers which present empirical research findings which address these issues.

TORELLI AND KAIKATI

Torelli et al. postulate that values are abstract representations of desired end states, and due to their abstractness they are more likely to influence behaviour in individuals who maintain an abstract mind set abstract vs a concrete mind set. (Torelli & Kaikati, 2009)

They test this hypothesis using several experiments which more or less follow the following schema:

1. Measure a subject's current position in a value system, by applying an operationalized version of Schwartz' value model through a questionnaire.
2. Let subjects perform a task which requires either abstract or concrete reasoning (in order to change a subject's mind-set).
3. Let subjects act in a specific situation which is value-laden, or ask their behavioural inclination.
4. Correlate a subjects' pre-value measurement with actual behaviour and analyse whether mid-set is of influence.

Of particular interest is 'Experiment 2' in which participants who had a particular rating on the value 'universalism' in step 1 above, were significantly more inclined to actually help an outgroup member after they received an abstract mind-set priming condition compared to those who received a concrete mind-set condition. Furthermore, in 'Experiment 4' participants who were distracted from values relevant in a particular situation – self-direction - responded stronger to those distractions when their mind-set was primed at concrete vs abstract.

This research is relevant for answering question (1) because its results indicate that values and behaviour have a direct link, however particular circumstances lead people to act in a way which is incongruent with their values. Furthermore, this research has paid particular attention to question (2) regarding socially desirable responding (SDR), in asking and preparing subjects for actively performing the expected behaviour. The researchers also asked the respondents afterwards whether they expected to be actually delivering the behaviour they had indicated. Research subjects indicated that they were expecting to actually perform behaviour or actions they had promised before.

MAIO, OLSON ET AL.

In their 1998 research Maio and Olson postulated that values are considered as cultural truisms, which are widely shared and rarely questioned (Maio et al., 1998). Later, they conducted two experiments in which they supposed that priming reasons for holding certain values dear, should aid in displaying behaviour which is congruent with those values (Maio et al., 2001).

The first experiment was designed using the following schema:

1. Let subjects contemplate their reasons for regarding the value of equality
2. Let them take decisions in a so-called minimal group paradigm
 - a. In this case by including an incentive to discriminate in a situation in which helpfulness was important.
3. Compare behaviour of subjects whose *value of equality itself* was primed to those whose *reasons for* holding a value of equality were primed.

The second experiment was designed as follows:

1. Let subjects contemplate their reasons for holding the value of helpfulness
2. Let subjects decide in situations where helpfulness was important.
 - a. In this case by eliciting helpfulness in a situation where being unhelpful would be considered as reasonable.
3. Compare subjects which had contemplated their reasons for regarding the value of helpfulness, towards those who rated their feelings about helpfulness on the way in which they participated in the decision situations.

Both experiments measured the subjects' inclination for behaving in congruence with their values by facing them with concrete decisions which presented them with a situation in which it was favourable for them to behave in a fashion which was incongruent with their values. This research design is supported by earlier research which often succeeded in letting subjects behave incongruently with their values if the situation presented it as reasonable.

Experiment one shows that when the reasons for holding the value of equality were primed, subjects tended to behave more egalitarian in comparison to subjects in the control group who were directly primed on the value of equality. A control test 'experiment two', using a different priming method for the value of helpfulness replicated the results of experiment one.

Maio et al. conclude that the results of these experiment support their earlier thesis that values are usually regarded by subjects as truisms; meaning that particular reasons for holding values dear are not particularly associated with such values in a subject. Values are simply regarded as 'true'. This is supported by the experiment because if values were held in a specific regard, because subjects would consciously know good reasons for holding them in that specific regard, priming motivational reasons for holding values dear would not have led to a difference in behaviour in both experiments.

The above experiments show that values and behaviour are related; however, in order to activate behaviour based upon these values it is more fruitful to stress motivational reasons for holding certain values dear instead of providing support for the values themselves.

CONCLUSION REGARDING (1) THEORETICAL DISTANCE AND (2) RESEARCH METHODS

The above experiments show that a particular relationship does seem to exist between values and behaviour, by showing that certain barriers exist which indeed do prevent people from acting congruently with their values. Furthermore, these experiments take into account criticisms on extensive usage of questionnaires by actively persuading subject to perform concrete actions in order to prevent bias by SDR in questionnaires.

Finally; specific Dutch research exists with regard to behaviour displayed and the issue of sustainability. This research suggests – congruently with the 'priming' of values – that if normative positions on the issue of sustainability are being explicitly motivated; subjects will tend to behave more congruently with the norms they have. Furthermore this research suggests that the increase of awareness of normative positions on sustainability leave a more lasting effect on behaviour compared to other incentives such as financial rewards (Steg et al., 2014).

3.3 CONCLUSION

In this chapter I have established that values in western societies have slowly changed their emphasis in the past decades. The WVS clearly shows that value developments follow a particular direction based upon the circumstances of those who hold the values.

Post materialist values are those values which are found in the self-transcendence/openness to change part of Schartz' value model. Such values are concerned with topics which Schwartz describes as stimulation, self-direction, universalism and benevolence. Materialist values are to be found at the other quadrant of the model and are related to achievement, security, power and tradition.

Furthermore, I have discussed as to how these values are related to concrete behaviour, and presented two strategies for fostering this relationship. The first strategy uses the motivating effect of explicitly communicating reasons for values and the second strategy uses the priming of subjects' mind-set in order to use the degree to which it is abstract as a motivator for displaying value-congruent behaviour.

CHAPTER FOUR: RENEWABLE ENERGY TECHNOLOGIES SITUATED IN THE CONTEMPORARY CONSUMPTION ECONOMY

In the past chapter I have focused upon the micro-position of consumers in western societies in order to assess as to how they could be motivated to explicitly engage in or buy sustainable electricity technologies.

This chapter will attempt to answer a similar question, however takes a macro-perspective in order to explain why it is difficult to be attractive to a consumer as a producer of sustainable electricity technology.

The commercial viability of renewables is problematic in comparison with current fossil-fuel powered methods for generating electricity. This may be one of the most important reasons for why it is generally acknowledged that sustainable development with regards to (electric) energy production is desirable (Meadows et al., 1972), however only 10 per cent of electricity production can be considered as sustainable in the present day. In this chapter I will argue that the reason for the disconnection between the desirability of sustainable energy generation and actual sustainable production can be explained by applying classic economic logic.

I will then use chapter five to argue how sustainable electricity generation methods could be made more attractive by using marketing and design changes in order to move a part of a consumer's utility from the materialistic/monetary type of utility towards utility related to value congruence. The advantage of this approach is that it is not necessary to include (future) costs of certain disadvantages in unsustainable methods of electricity production into account for these methods, which is at present practically and politically unrealistic. Instead the perceived value of sustainable energy is increased, by explicitly exploiting its post materialistic value congruent characteristics, which warrants their higher costs for consumers.

4.1 CLASSIC PRODUCER'S ECONOMIC APPROACH OF PRODUCT AND VALUE

Classic economists describe a production process as one which converts 'input' (usually factors of production such as a natural resource, labour, knowledge and capital) into an 'output' (usually an end or intermediate product or service, here I will limit myself to products). The difference between the added values of the input factors of production and the end product's value is considered added value, and usually described in terms of its price. The output has to have a price which exceeds the price of the individual inputs combined in order to become commercially viable [CITATION].

If a production process is described as above, it immediately becomes clear that the product's value is dependent upon the values allocated towards the factors of production. Determining the value, and associated prices, of the factors of production is important to consider if we want to assess the commercial viability of sustainable energy production.

4.1.1 DETERMINING PRODUCTION FACTOR VALUE — A MATTER OF (IN)CLUSION

A factor of production which is of particular interest for the matter of sustainable electricity generation is a natural resource. Such resources have a certain value which is useful to disseminate into its primary value and its secondary value. It is important to realize that the border between primary and secondary value is not fixed, it is a relative border and provides insight into the pricing strategies for factors of production in most products which include natural resources as one of their

production factors. Therefore, I will provide my definition of a possible border between primary and secondary value below; my intention is not to show where the difference between primary and secondary values is precisely located. With my definition below I merely intend to show that such a distinction between certain value types is valuable in explaining why fossil fuels are priced more competitively compared with renewables.

Primary value is value attributed to something 'directly', without taking into account context. For example, a value of a certain product can be what someone is willing to pay for it, or its contribution towards reaching a certain end such as achieving sufficient nutrition. This means that if a certain actor is willing to pay or receive a certain amount of money for a product or service, that amount is its primary value.

Secondary value of a natural resource is more sophisticated and intricate. It can be defined by stating that it is the value attributed to a natural resource, whilst taking into account all possible relevant contexts. An example of such a context can be the fact that establishing a certain price for a natural resource has a moral significance given that natural resources are limited and in principle not open for ownership by someone according to some theories of justice. Other secondary values can be attributed to a natural resource due to possible effects which its use might have, such as causing pollution when sold or the fact that they can be a source of political instability. This means that the establishment of secondary values is intricate and sophisticated because it relies on expectance and scenarios in order to appreciate the proper value of natural resources.

4.1.2 SECONDARY PRODUCTION FACTOR VALUES FOR NON-RENEWABLES

I argue, as natural resource economists have done, that present methods of accounting input factors do not properly assess the secondary value of natural resources. This is due to them merely accounting for the 'direct costs' (primary value) of such resources, for example accessing a certain area or acquiring a permit for extraction. The secondary costs of such a natural resource, such as its lower economic value due to depletion or possible harmful future effects, are left unaddressed as a part of the production factor's price. This is problematic because this means that the value for which the product is sold does not include all possible problems (or benefits) associated with use of the production factor.

At the very least a problem of responsibility is created because the party responsible for extraction of a natural resource is usually not accountable for negative side-effects of its use which would have been defined if a secondary value would have been established.

This practice of ignoring secondary value in a production factor's price is an important reason for why most economies and world leaders acknowledge the necessity of movement towards a more sustainable practice, however are unable to argue for it. This is because prices of products derived from natural resources, which include most plastics and fuels, would rise steeply and this is a politically unattractive message. However, renewables *do* deal with secondary values because this is their *raison d'être*.

This leaves us with a situation in which fossil fuelled electricity generation is economically competitive compared to sustainable electricity generation, even though clear negative effects of fossil fuel use have been known for a long time.

Furthermore, it could be argued that positive effects of switching towards renewables could be seen as increasing its value due to the worth of secondary production factor increasing. This might be theoretically sound; however, it has proven to be difficult to monetize this characteristic as long as the competition is not prepared to do so as well. In other words, this means that such practices would put the first-mover out of business if competitors in the market are unwilling to participate in such practices as well.

4.1.3 SECONDARY PRODUCTION FACTOR VALUES FOR NON-RENEWABLES

Renewables could be characterized by them having both primary and secondary values of production factors necessary for production accounted in the final product value, and hence they are often considered as expensive. Especially in comparison with the current fossil fuel powered electricity generation methods which do not include all factors of production.

The usual approach for including all factors of production in the price of renewables in this regard is that negative aspects of electricity generation are mitigated by technological means, instead of taken into account beforehand in an economic fashion. Said otherwise; negative aspects of fossil fuel powered electricity generation such as resource depletion and pollution are not dealt with by including their costs in the factors of production. Instead the factors of production are chosen as such that resource depletion is mitigated as well as other possibly expensive secondary values of production factors.

As such most renewables are able to take – possibly expensive – future costs into account because exactly the fact that they are incapable of causing high levels of pollution or resource depletion leaves them in a position in which includes secondary values of natural resources by design.

This situation however leaves them as economically uncompetitive compared to fossil fuel electricity generation, because they historically do not include secondary values of natural resources.

4.2 CLASSIC CONSUMER'S ECONOMIC APPROACH OF PRODUCT AND PRICE

In the previous section I have described the process of valuing factors of production by a producer. However, end-products are usually bought by consumers. Given that it has been proven to be difficult to get producers to price their products differently, for which they have sufficient reason, I argue that the key to addressing the issue about commercial viability of renewables is in changing value it has for consumers instead.

In order to be able to describe and assess characteristics of renewables which *do* allow them to be successful in a (commercial) consumption economy, I firstly discuss the logic and ends of such an economy for consumers. Here I will argue that the relationship between material wealth and happiness has historically been an important reason for the desirability of tolerating a consumption economy in the first place.

In order to present my argument for the relationship between the consumer economy and happiness I will focus on the level of the individual consumer and producer; the micro level. This is because my motivational space for changes in choice by consumers is also argued upon the micro level of the individual.

An important argument in this thesis is that the idea that economic growth – more or less – represents well-being is no longer valid due to the fact present western-style economies are suffering from the effects of diminishing marginal utility (Diener et al., 2004). This effect is also visible in Schwartz' research which shows changing values in western societies due to their capacity to supply the mundane necessities of life. This means that the products and services which the present consumption economy has to offer are often no longer those contributing to an individual's utility, which is related to an individual's well-being. In order to clarify the relationship between utility and well-being I discuss it and its relation with well-being.

4.2.1 VALUES AND UTILITY

Most western societies have an economy in which consumer demand is an important factor in the determination of supply and demand of goods and services. Consumers therefore have a large amount of influence on the qualities of products which are desirable. The consumption economy is a part of the public domain in which consumers take decisions about what to buy, and value changes are likely to have an effect on consumer decision outcomes. This means that value changes in consumers (could) indirectly effect the way in which products and services could being offered by producers. Producers which offer products which appeal to a particular set of consumers' values are therefore likely to increase such an individual's utility; and it is precisely these values which have changed in the past decades and leaves room for specific attention in marketing and design of renewables.

In order to theoretically situate effects of value changes in consumers in the consumption economy I will use micro-economic theory, and especially the concepts of utility and indifference in order to explain how post materialistic consumers could behave differently from materialistic consumers when faced with economic choice alternatives.

4.2.2 UTILITY

Economic growth is desired by most politicians. The rationale for why this is tending to be overlooked, however it is important to consider given the wish to reduce environmental degradation.

Usually economic growth means that the value of all that is, such as products and services, as a whole is increased. This means that for an individual actor in such an environment the amount of effort required for acquiring a specific part of the pie gets lowered, because the pie as a whole is bigger.

Utility can be considered as the amount of 'usefulness' or 'value' placed upon a certain acquirable good or service. For example, an individual actor might value two apples as being worth as much as one orange, in economic jargon it is said that such a consumer is indifferent about the choice between two apples or one orange, given that they are worth the same. Economic growth, taken naively, means that the effort/acquirement ratio is becoming more positive for the individual actor in such an economy, and hence welfare is increased.

So: utility is the value an individual actor places upon certain acquirable items or services; and economic growth is related towards the quantity of the products or services available for an individual. Usually economic growth means that individuals are able to acquire more of the goods or services they require or desire; which is often related to their wellbeing through the idea that welfare is – arguably indirectly - related to well-being.

4.2.3 UTILITY AND WELL-BEING

The relationship between economic growth and well-being (or happiness) for individuals is not as straightforward as sometimes assumed.

Problematic in discussing economic growth is that the meaning of growth for an individual is not uniform. Economic growth can be considered as the monetary value placed upon all products and services combined in a certain geographical area. This means that when the economy grows, the total monetary value placed upon all products and services increases as well, we already know this from section 5.2.2.

However, this 'relative value of growth' is exactly what is of importance if an individual is dealing with diminishing marginal utility.

Economic growth is highly valuable to individuals who are in a situation in which scarcity of resources limits their development; as argued by Schwartz (S. H. Schwartz, 1992). If such consumers are able to meet their basic necessities through increased welfare it seems reasonable to assume that their well-being will be increased as well. However theoretically, and supported by empirical research (Diener & Seligman, 2004), it seems reasonable to postulate that this relationship is not a linear one.

Some critics, notably Ed Diener, have therefore argued that the relationship between well-being and economic growth is not as simple as supposed. Specific attention has been spent on empirical research results which suggest that increases in wealth are suffering from diminishing returns when a certain level of income has been reached. This effect has been known as the law of diminishing marginal utility.

4.2.4 DIMINISHING MARGINAL UTILITY, WELL-BEING AND VALUES

Marginal utility is the value placed by a consumer upon each *additional* acquirement of an item or service. For example, if an individual is in possession of 10 apples and is able to acquire the eleventh one, this transaction is worth a certain value.

The concept of diminishing marginal utility holds that each additional item acquired is worth less; or in other words the 33rd apple is worth less than the 32nd and 31rd and so on. Theoretically diminishing marginal utility is sensible because the amount of goods a person is able to consume is limited, and hence when more goods become available their relative worth is lowered.

This means that even when the economy grows, it becomes less 'worthwhile' to acquire more goods or services because their additional worth is not worth the effort of acquirement. The direct effect of this, as has been theorized and researched by Inglehart and Schwartz (among others), is that material possession becomes of lower value. This also had a particular effect upon the values which members of western societies are claiming to hold dear.

Consumer values in rich western-style societies have been shifting towards those which are less related with possessions; or materialism; as both Schwartz and Inglehart have argued (Inglehart, 2000, 2008; S. H. Schwartz, 1992; Schwartz & Bilsky, 1987).

This means that in order to optimize one's economic utility; products will have to be developed which are not made attractive by their materialistic characteristics. They will have to; somehow; appeal to post materialistic values in order to be of value to post materialistic customers. This is

exactly where the technological solution of sustainable energy links up with consumer requirements because it can be argued that the product characteristics of fossil fuel generated energy links up with materialistic values such as security and conformity, whereas sustainable electricity generation links up with post materialistic values such as self-expression and universalism.

4.3 DESIGN AND MARKETING FOR POST MATERIALIST CONSUMERS

In classic economics consumers are depicted as behaving as an actor who optimizes the relationship between price, quality and quantity. This depiction is often criticized as too simplistic (Jackson, 2005). However empirical data suggests that a causal relation between price of a product and its demand is present. Assuming that a consumer actually applies this economic reasoning it is often unreasonable to ask an individual to change her personal behaviour in order to address a problem which should be addressed on a global scale; such as environmental degradation. After all: How can an individual be held responsible for getting to work in a polluting car; if there is no sensible alternative for a similar price?

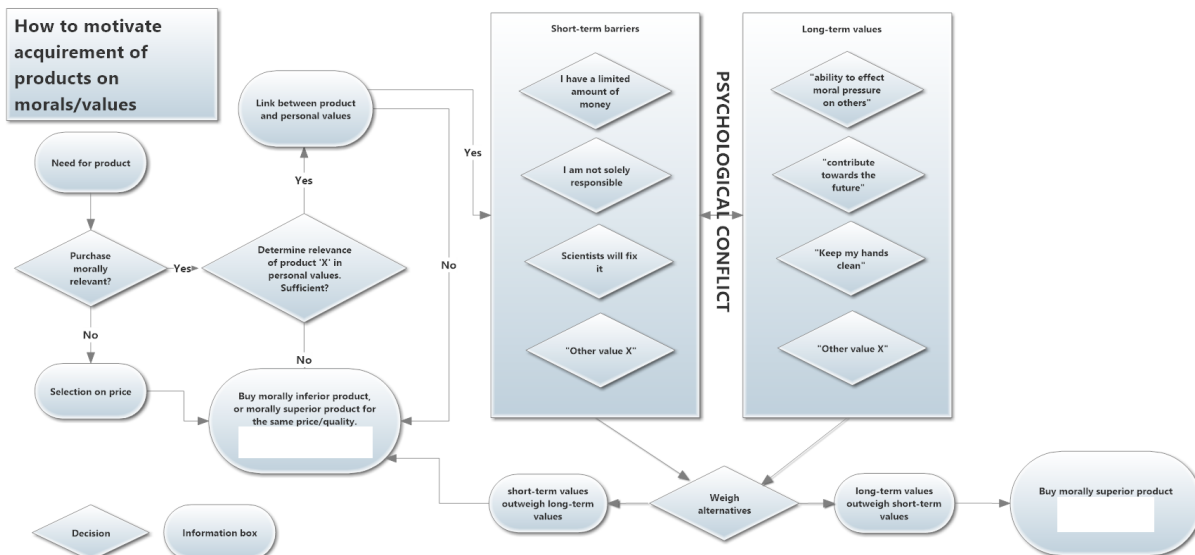
If we turn to personal responsibility or ethical conduct (Gardiner, 2004) with regards to sustainability; problems of unreasonableness occur as well. Why should an individual buy expensive sustainable produced food when there is a cheap alternative? Especially if buying expensive food puts the individual in an economic position in which she is worse off compared to other economic actors; the first-mover disadvantage. The obvious solution would be that governments, companies or other powerful actors should act in favour of the environment in order to prevent unreasonable decisions from individuals. Attempts to address sustainability issues have been undertaken; some with a reasonable amount of success such as the feed-in tariffs in Germany and the Paris climate summit; however, it remains to be seen to what extent this will properly address environmental degradation. Given the fact that issues surrounding environmental degradation, and more specifically resource depletion, have been in public awareness at least since the early seventies I remain sceptical. A solution to this problem seems out of reach for now since temporal and spatial separation of cause and effect with regards to environmental degradation does not create any sense of urgency or responsibility.

Also on a more fundamental level; cutting CO₂ emissions and lowering energy usage is not a solution if the goal is a sustainable economy which preserves the status quo (McDonough & Braungart, 1998). Or put simply; lowering emissions merely slows down the pace of environmental degradation, but it does not stop it. So; the question remains how to motivate the individual towards change when such an individual is situated in a consumption economy? In order to show how this might be done I have discussed the reasons why producers of fossil fuel powered electricity are unable to move towards sustainable alternatives. Also I have argued for the reasons why consumers are choosing certain economic alternatives and how they are able to optimize their utility. The question then remains as to how producers are to change the design and marketing of sustainable energy generation technologies in order to appeal to postmodern values in consumers.

4.3.1 A DECISION MODEL OF CONSUMERS

In order to develop a simplified model of a consumers' decision-making process I have used the theoretical approaches of chapter three and four in order to graphically represent the theoretical decision-flow in a consumer. This model shows where barriers are located, and how such barriers could be addressed. This model serves as a guideline for development of strategies with which

consumers could be motivated to engage into acquirement of sustainable energy generation methods. Presently, this graphical representation of a consumers' decision-making process should not be interpreted as a fully verified, theoretically supported model of such a process. Its aim is to provide an accessible, step-by-step approach to how such a process is taking place in order to further theorize as to where interventions in this process might be at their most effective.



4.3.1a: A model of a consumers decision-making process

Basically the model shows that producers are able to increase their products' value on at least three moments in the decision-making process:

1. They could change their product's technological characteristics or marketing in order to put focus on the moral significance of the product's acquirement.
 - a. For example, by stressing the moral relevance of the product's acquirement.
2. They could explicitly link qualities of their product towards the expected post materialistic values in consumers.
 - a. For example, by explicitly communicating that acquirement of PV-panels increases the amount of self-direction for individuals.
3. They could for example apply research results by Maio. et al. or Torelli et al. for influencing consumer behaviour.
 - a. For example, by arguing the motivational reasons for behaving in an environmentally-aware fashion, while their product is obviously a method with which to do so.

In this way producers of sustainable technologies are able to link up specific values in consumers with their technological solutions in order to motivate consumers to choose their product's offerings.

4.4 CONCLUSION

In this chapter I have explained which design and marketing issues are of importance for producers in order to introduce a competitive product in economic terms. In case of renewables this means that they are often economically uncompetitive, because negative impacts of extensive usage of fossil-

fuelled alternatives are not taken into account when merely viewed from an economic perspective. In order to theorize as to how this psychological economical loss might be substituted by increases of value-congruence in consumers, I presented three points in the decision-making process of consumers where they could be explicitly targeted in order to motivate their choice for renewables. This in order to let them experience utility which is at least similar to the 'fossil' alternative option and result in an explicit choice for renewables.

CHAPTER FIVE: POST MATERIALISTIC VALUES APPLIED AS A MOTIVATIONAL TOOL FOR FOSTERING ADOPTION OF SUSTAINABLE ENERGY

In chapter two I have discussed which methods of electricity generation are to be considered as 'sustainable', and provided examples of three sustainable electricity generating technologies which are commercially available today. Furthermore, I argued for the position that sustainable electricity generation is not primarily a technological issue, because social/behavioural issues are at least as much a barrier for a desired switch towards sustainable energy generation. This then raises the question as to why sustainable electricity generation is both desirable – because of its environmental benefits – and technologically feasible as well; however still only a small portion of present electricity supply uses sustainable sources. In order to explain why this is the case, I use Gardiner's ethical approach towards the issue of global warming and establish that the problem of shared responsibility for environmental degradation leaves us in a situation in which no particular actor is accountable for negative effects of fossil fuel powered electricity. A preliminary conclusion, following Gardiner, in this chapter therefore is that using (collective) responsibility for motivating relevant actors to change towards a more sustainable energy model would be very difficult (Gardiner, 2004).

Chapter three then takes a micro-perspective on the matter and argues that consumers are often unaware of the fact that they have a choice concerning where their power comes from, and if they do they tend to select on financial arguments alone. This warrants an inquiry into the rationale behind the usage of financial arguments for selecting products and services, in which it seems reasonable that people expect that the selection on financial characteristics is in their best interest. In order to gain knowledge on the relationship between financial characteristics and people's - often implicit - desires I explore the concept of value(s), as an operationalized concept of 'what people desire'. By doing this I learned, following Inglehart and Schwartz (Inglehart, 2008; S. Schwartz, 1992), that values in western societies have slowly evolved in a particular direction, namely towards those values which are considered as being post materialistic. This development supports the idea that mere financial motives for selecting between products and services is an insufficient means of selection between economic choices, especially when those choices could be associated with particular – desirable - values. Furthermore, chapter three discusses and theorizes the problematic relationship between values and behaviour, and provides two concrete strategies for improving value-congruent behaviour of subjects.

Chapter four then takes a different – macro - perspective on the matter which is of particular relevance for producers in a consumption economy which desire to apply the knowledge about value changes established in chapter three. Here I argue that consumers would be better off – at least in an economic *and not monetary* sense – in a situation in which they are able to acquire value-congruent products and services because they increase their utility. Most producers of homogeneous products – such as fuels or bulk products - in a consumption economy implicitly market and sell their products based upon modern values such as security and power. This means that they do not exploit characteristics of post materialistic consumers, whose values leave them to appreciate more than the mere material quality of products or services acquired.

Finally, it is reasonable to suppose that matters of tradition and habit will impede most consumers for explicitly including non-financial arguments in their supposed deliberation to choose for sustainable electricity or associated artefacts. It is not my intention to suppose that a large

percentage of post materialist' consumers will immediately switch to those decision alternatives which link-up with their values best. Luckily for them they do not have to because a decision to participate in renewables is not one which is black or white, often sustainable alternatives are merely X percent more expensive (in monetary terms) or require X percent more effort (in behavioural terms) compared to unsustainable modes of electricity generation. This means that when their motivational reasons for taking certain decisions is what is of discussion, only a X amount of it could lean on their post materialist' values, where the rest follows classic patterns of product and price which are strongly institutionalized in consumer societies.

In this final chapter I will combine the conclusions of chapter three and four by theorizing as to how post materialistic characteristics of consumers could be utilized best by producers of sustainable products and services. I will do this by explicitly establishing artefactual characteristics of sustainable electricity generation technologies, or their social interpretations, which leave them to be compatible with specific post materialistic values. These characteristics close the motivational gap between the economic competitiveness of fossil fuels and renewables, and leave consumers in a position in which their net utility has risen, while at the same time a desired shift towards sustainable electricity is being realized.

5.1 DEVELOPMENT OF A PRODUCER'S METHOD TO INCLUDE POST MATERIALIST VALUES

In order to structure the approach of including values in design and marketing of products or services I have established steps which are part of a preliminary method for improving the 'fit' between products and services and post materialistic values.

These steps are aimed at producers of products and services of renewables, which aim to improve their products' position in the consumption economy by increasing their attractiveness for consumers through explicit increases in value congruence.

These steps are (and are respectively set forth below):

1. Define target user group/market segment using specific approaches for homogeneous and respectively heterogeneous products or services. (section 5.2)

Often, producers of renewables are already situated in the market, or have a concrete idea about which customers they aim to attract (for example customers which buy non-renewable products from a utility company). It is useful to specify the market segment beforehand because this directly effects the way in which additional research into the target users' values is valuable. The basic idea is that the more heterogeneous/specialist the product is expected to be, the more research into the specific values of the target users is worth as a knowledge source for the intended improvement of the fit between values on the one side and product or service on the other.

2. Establishment of both technological and cultural characteristics of the artefact or service by explicit application of an artefactual as well as a contextual perspective. (section 5.3)

After the target user group/market has been established, and the target values for which to develop the product or service have been decided, it is a logical next step to evaluate the product or service itself. This could also a – 'to-be-developed' – product or service. Technological philosophical views on artefacts – which I interpret broadly as including services as well – are used in order to provide theoretical entry point with which concrete aspects of the products and services are established.

3. Theorize as to how decisions for renewable or product or service alternatives could be motivated by consumers due to either design changes of the product or marketing/framing efforts in order to increase the value (in)congruence of such products and services. (section 5.4)

With this step I refer to the relationship between particular – artefactual or social contextual - aspects established in step 2 of the intended product or service on the one hand, and concrete design and marketing efforts on the other.

4. Operationalize values towards concrete behaviour by applying theoretical insights upon the relationship between values and behaviour as set forth by Torelli et al. and Maio et. al. in order to optimize the effect of design changes or marketing efforts (Maio & Olson, 1998; Maio et al., 2001; Torelli & Kaikati, 2009). (section 5.5)

This step is valuable because it has been difficult in empirical research to directly link concrete values to behaviour, partially explaining the lack of value-congruent behaviour. Two explanations in particular – motivational reasons and mind-set – are useful for explicitly eliciting value-congruent behaviour.

5. Create a list of design changes or marketing initiatives. (section 5.6)

This is a final step in which possibilities for design changes or marketing/framing activities will have to be weighed against each other in order to decide which set of both measures is expected to be the most effective.

5.2 POST MATERIALIST VALUES

In order to design and market products for post materialistic consumers it could be of value to perform research on the desired target audience in order to determine whether, and to what extent, they could be placed in the post materialistic section of Schwartz' value model.

The explicit consideration of post materialist' values for producers in a consumption economy is theoretically not limited for use to those in the market segment of sustainable electricity and/or associated artefacts. It is however noteworthy that the technological and societal interpretations of renewables tend to link-up well with post materialist' values; which I will discuss in more detail in section 5.4. Now I will commence with the issue of performing market research.

5.2.1 MARKET RESEARCH IN AUDIENCE CHARACTERISTICS

It is good practice to perform market research before new products or services are introduced – or re-introduced - in the market in order to determine the market size and estimate whether the product or service have market relevance.

The fact that the *general* public in western consumer economies have become *more post materialistic* with regards to their values provides a new perspective on which to focus next to the classic price vs quantity/quality economic deliberation. Producers of products and services could aim to establish specific values prevailing in their target audience. These values are then applicable for designing or marketing products and services to be value-congruent, which yields them as more attractive. Such explicit value-congruent products and services could also serve as a means for producers of economically unattractive products – often sustainables – to increase their utility by other means.

It is logically sound that such research relevance increases if the target audience becomes more specific (or forms a particular segment in the market).

Or, viewed from the perspective of the intended product or service, if the product or service is characterized as a *homogeneous product* which is targeted at a *large audience*, generalized results from the world values survey suggest that the audience *is* already susceptible for post materialistic values to a considerable extent.

If, however, the intended product or service is *heterogeneous* to future customers, limited degrees of generalizability of the WVS suggests that additional research into the value systems of such consumers might be of value. This in order to fine-tune such products or services to 'fit' the values prevailing in this market.

This means that if a specific producer has a desire to introduce a homogeneous product aimed at a large audience in a developed western-society, it is perhaps sufficient to integrate general postmodern values into such a product – or marketing thereof - because it is already evident from the WVS that most customers are susceptible for such values.

Usually, however, particular products are being designed for specific target groups in a general population, which means that a specific market segment is being targeted. This implies that the specific characteristics of value systems are of interest in such market niches, which in turn means that the added value of additional research increases when the target audience becomes more specific.

5.2.2 DEFINE A TARGET AUDIENCE/MARKET SEGMENT

Above I have mentioned that situations could exist in which producers have a particular target audience in mind, however it could also be the case that they do not at all have a target audience in mind and are aiming to define a such a target audience (or market segment). In order to theorize as to how such a market segment could be defined I will shortly elaborate upon specifics about how such an enterprise could take place in order to provide a departure point for those who require it.

The activity of defining a market segment is one in which a particular part of the market is selected – and later targeted - based upon a set of characteristics with a certain goal in mind (such as enabling them to buy a product). Such characteristics are valuable because it improves the degree to which a marketing enterprise or product design is offered to the 'right' consumers, or to which degree a product is expected to be successful.

It is difficult to concretely develop a method for selecting a target audience because such an enterprise is quite product or service specific. However some general approaches are always of value.

Firstly, I immediately distinguish between two categories of customers, a distinction which is useful in establishing a sensible - and superficial - market segment.

This is the distinction between those who are willing to buy a product, however are – reasonably - unable to do so; and those who are not willing to buy a product, however *are* able to do so. The first category of customers will not be able to ever acquire the products they desire no matter what the external conditions. However the second group could be persuaded to do so because they are

capable of doing so, unlike the first group. In terms of logic: the first group is not ever able to acquire a sufficient – set of – condition(s), where the second group is.

Now, characteristics upon which such a market segment of ‘capable consumers’ could be defined are factual properties of customers such as demographics and geographic characteristics. Other selection criteria are located in the behavioural/psychological domain such as values, motivation, identity and behaviour itself. Given that Schwartz’ value model specifically targets psychological qualities, I suggest that *if* a market segment is to be defined *beforehand* in the context of this thesis, it is useful to determine what part of the market is *able to acquire* the desired products or services using factual properties, before subjecting such a market segment to additional value research.

This might for example entail that, if the product is going to be one which entails ownership and exploitation of solar panels, perhaps people who own their own house are a more interesting market segment compared to those who rent a house. Also, if the product is going to be costly, it might be reasonable to target a wealthy part of the market instead of one in which financial means are limited.

In this way, specific general market segments could be defined which could then be subject to value research. An example of such a method is: ‘middle-aged people who own their house, have an X degree of education and earn X amount of annual salary’. Such preliminary selections aid in selection of market segments which are viable to target with general characteristics of products and services. Also, such a selection means that – often costly – research into values using questionnaires is performed in the proper target group.

If an additional selection - perhaps on a fine-grained market segment - is desired it might be of value to apply a specific model with which to further define market segments. More elaborate market selection methods such as Motivaction’s ‘Mentality-model’ or TNS-NIPO’s ‘WIN-model’ are examples of such models, which have been applied in other markets such as housing preferences (Jansen, 2011).

5.2.3 A VALUE RESEARCH METHOD

In order to establish concrete values in such a market segment, producers could then apply the Schwartz-inspired list of questions which was originally developed for the European Social Survey (ESS) (Davidov et al., 2008). This questionnaire asks participants about the similarity between themselves and particular proposed fictional persons in order to establish in which position such a person might fit in the value model.

In this way a specific part of the intended market is being placed in specific parts of Schwartz’ value model. This might for example entail the questioning of the current clients in an utility company in order to establish whether their prevailing values *are* indeed post materialistic, and to what extent they are generally in a specific section of Schwartz’ value model.

I have listed a few example questions below which are aimed at measuring a particular subject’s performance on specific values. If a subject is to be placed in a particular position in the value model it is necessary to ask questions about all of the values in the model; albeit in simplified form covering all of the model’s quadrants. This in order to establish whether the desired target values are indeed

considered as most important by the target audience. Example questions are (for the values in the 'universalism' quadrant of the model):

- 1: "He thinks it is important that every person in the world be treated equally. He wants justice for everybody, even for people he doesn't know." (Schwartz, 2003, p. 294)
2. "It is important to him to listen to people who are different from him. Even when he disagrees with them, he still wants to understand them." (Schwartz, 2003, p. 294)
3. "He strongly believes that people should care for nature. Looking after the environment is important to him." (Schwartz, 2003, p. 294)

By asking participants in the survey whether they feel that they are like such a person; or unlike such a person; it becomes clear in what particular position in the value model they might fit.

In this fashion producers of renewables are able to choose for either a low-precision, large scope approach or high-precision small scope approach, depending on the desired target audience for their product or service.

5.3 ESTABLISHMENT OF CHARACTERISTICS OF ARTEFACTS AND SERVICES

Now, the next step is to establish which particular characteristics of a – either existing or ‘to be developed’ – product or service could be made to fit a particular section of the value model. Given that Schwartz’ value model is aimed at assessing people’s values, this assessment does not imply the application of the value model towards technology itself. The aim is to establish whether certain aspects of a product or service could be said to link-up or ‘fit’ with towards particular values which people hold dear. The same way applies for its exact opposite; so particular products or services might hold characteristics which lead them to be particular ‘unfit’ with a certain (set of) value(s). In this way the part of values which appeal to realisation of certain states-of-affairs could be met by acquirement of certain products or services.

The issue of electricity generation is a difficult ‘artefact’ in this regard because it is on a more aggregated level. However, I maintain the application towards products and services at this point because sustainable electricity generation will require usage of physical technology at some point – which could also be the introduction of to-be-developed artefacts - and it is in principle unnecessary to limit the theoretical scope to artefacts which already exist now.

Implicitly this approach assumes that the acquirement or possession of products or services have a certain impact on people’s lives; which mean that such artefacts are not considered as mere instruments to a certain end. This position is necessary to take because otherwise the acquirement of a particular product or services would bear no specific relationship with the degree to which people could feel that acquirement of it is of value to them. This idea is similar to the concept of political consumerism; which taken straightforward implies that the acquirement of certain products or services – with specific characteristics - have political implications which could either be conscious or unconscious to human agents (Stolle et al., 2005). The idea that artefacts are *not* neutral objects deserves some further elaboration.

5.3.1 ARTEFACTS AND THEIR RELATION WITH THE WORLD

An ongoing philosophical discussion about the effects which artefacts – as artefacts - bring about in their environment has been subject to extensive debate in the field of philosophy of technology, especially after Langdon Winner’s ‘Do artefacts have politics?’ (Winner, 1980). In this paper, Winner argues for the position that technological artefacts are, opposed to common believe, *not* neutral items which affect our world merely by means of intentions or actions by those who use such artefacts. Instead Winner argues that the specific characteristics of objects *themselves* are sufficient to affect states-of-affairs in the world. This article has had considerable successive literature as a result – although some might argue that the ‘political aspects’ of artefacts were established in a different paper – and some clear positions in this debate have now been established.

The most prominent theoretical difference in this debate is found between those who hold a realist position and those who hold a constructivist position. Realists argue that technological artefacts themselves, by means of their properties, have a certain effect on states-of-affairs in the world. Those who hold a constructivist position recognize that artefacts have effects on their environment, however attribute these effects solely to non-artefactual things such as interpretation or social contexts in which artefacts are used (Brey, 1997, p. 6).

On the realist' side of the spectrum, further artefactual distinctions can be discerned. I will not discuss all of them in detail, however an important distinction is between 'hard' and 'soft' aspects of artefacts. This is the distinction between characteristics of artefacts which *always* have a specific effect when the artefact is used as intended, the so-called 'hard aspects' of artefacts. And aspects of artefacts which only have an effect in specific *contexts* in which an artefact is being used, the so-called 'soft aspects'. An example a hard aspect is for example the fact that a solar-PV panel does not produce any CO₂-gas when in normal operation. An example of a soft aspect is for example that solar-PV-panels lower the aesthetic characteristics of buildings upon which they are used.

Soft aspects of artefacts thus do not always reveal themselves, because not all artefacts are used in all contexts. If, for example due to government regulations, solar-PV panels would only be allowed to be installed on barren pieces of land the issue of aesthetic qualities of buildings would not have surfaced.

Such artefactual properties which have a certain 'interpretable' effect on their (social) environment are also typically those aspects who tend to be the result of explicit or implicit assumptions by the designers about the users of such artefacts in which specific roles for users are already built into the design of such artefacts (Akrich, 1992; Latour, 1992).

This is where the theoretical spectrum about artefacts slowly begins to provide room for arguments by the constructivists, of which the constructivist' position of Bijker et al's 'social turn' de-emphasize the role of technological artefacts and contribute the state-of-affairs in the world surrounding such artefacts as primarily being contributions of the surrounding social environment in which the artefacts are being used (Bijker et al., 1987).

Both positions and the spaces in-between have considerable support, and different positions between both extremes have been developed and discussed by for example Brey (Brey, 1997). It is not my intention to support particular positions in this debate at this point. I do however argue, following Brey, that it is plausible that some technological artefacts have particular characteristics which lead them to have a high – or near certain - likelihood to have a certain effect, where other aspects are strictly speaking not even dependent on the artefact in question and rely on other factors such as social context.

The entire spectrum between realists and constructivists provides a theoretical background in which specific positions upon how to assess artefacts and their surroundings become evident, which are more subtle than is evident from the preceding section. In this thesis, however, I aim to provide producers of products and services concrete approaches for assessing artefacts and their use contexts. With this aim in mind I think it is more important for producers of products and services to capture the entire spectrum between realist' and constructivist' positions regarding artefacts, than for such positions to be precisely embedded into a particular position in the theoretical spectrum available.

Therefore, in order to concretely use this theoretical background for my purposes I will develop only two perspectives, loosely based upon a realist position and respectively a constructivist position upon products and services. These perspectives on artefacts – or products and services for that matter - allow the development of a comprehensive but relatively shallow assessment of the artefacts in order to establish their properties and related effects.

Firstly, there is the perspective taken from the artefact itself, what are its characteristics, aspects and properties which leave it to have a certain relationship with values? This perspective is further narrowed down with the established difference between ‘hard’ aspects of artefacts, and ‘soft’ aspects of artefacts

Secondly, primarily dealing with the artefacts’ surroundings, there is the perspective on the social or political circumstances in which such an artefact is embedded.

By distinguishing and discussing these two perspectives upon the characteristics of products and services I do not intend to treat this distinction as a strict border between the two categories of characteristics. Both perspectives should be viewed from their intended goal, namely to a point of departure for the comprehensive description of aspects of products or services which *leave them to be value (in)congruent*.

These two perspectives link up respectively with two general strategies which producers have to change the value (in) congruence of their products or services. Firstly, they are able to design artefacts in a different fashion in order to let the physical design of the artefact have a particular value congruence. Secondly they could use marketing efforts in order to change the social contexts of such artefacts to the same end; to let the social context in which artefacts are situated ‘fit’ with a particular value set. Again, each method is not strictly limited towards a specific category of artefactual characteristics. However, given that ‘hard’ artefactual characteristics tend *not* to lend themselves towards particular interpretation, where contextual properties explicitly *do*, particular preliminary conclusions could already be drawn. Namely that it is sensible to suppose that synergy between aspects of artefacts and value (in)congruence is likely between the artefacts’ perspective and its design on the one hand, and the artefacts’ context and marketing and framing thereof the other hand.

5.3.2 A PERSPECTIVE FROM THE ARTEFACT

Brey, after analysing several authors’ conception of a similar construct, labels particular effects which artefacts have on their environment as *constraints*, and more specific endows artefacts with *powers* which loosely interpreted refer to as “[those effects which] manifest themselves and effect change when the artefact is used” (Brey, 1997, p. 7)

Aside from these constraints the notion of *object of constraint* is introduced. An object of constraint is *that what is affected by* the effective use of the artefact in question, such as the amount of CO₂-gas in the atmosphere, amount of coal left to be burnt or political, social or gender constraints.

This means that it becomes possible to assess an artefacts’ constraints by means of its effects.

In the previous section I have already described the difference between hard and soft aspects of artefacts, I will continue to use the difference in this section.

Hard aspects of artefacts, such as its physical size, *always* have their effect in every use case conceivable for the artefact. This means that constraints of artefacts dependent on hard aspects of artefacts *always* have their particular effect on value (in)congruence of such an artefact. An example of which is – again – the fact that solar PV-panels do not emit CO₂-gas when in use, and a coal-fired power plant does. Also a coal-fired power plant is, by its very design, capable of varying its power

output at will. This means that, when the value (in)congruence is in question, solar-PV panels link-up with particular values, as well as coal-fired power plants.

Furthermore, soft aspects of artefacts lead to particular constraints. Such constraints could refer to the artefacts' effect on politics, demographics or division of wealth among social groups.

It might for example be argued that the fact that solar-PV panels have a lower energy density than traditional power plants mean that it is likely that such a system should be supported with a decentralized energy transportation infrastructure. Also it might be argued that they are applicable on a small scale, as opposed to traditional power plants, which leave them in a position in which they are fostering individual autonomy.

If certain values could be attributed to appeal to particular artefactual constraints their value (in)congruence immediately becomes clear. Also it becomes possible to change the designs of such artefacts in order to leave them with constraints which fit more optimally with the values which are prevailing in the target user base.

It might for example be fruitful to develop solar-PV panels which have an integrated storage device which changes it's constraint 'power generation is directly dependent upon sunshine' towards 'in general use the solar-PV panel delivers X amount of electrical energy'. Both constraints could fit optimally to certain values; which designers of such artefacts could take into account in order to optimize the fit between the artefact's properties and its relationship to values.

If, for example, a producer of Solar-PV panels is intending to draw up a list of the artefacts' properties, it could look like the list below:

Artefactual perspective – hard aspects:

- Physical properties: Size, weight, appearance, electricity production, colour
- Effects of such properties which are *always* relevant:
 - o A solar-PV panel which produces a maximum of 250 watts will not be able to power loads which exceed this value.
 - o A solar-PV panel requiring a certain ballast for keeping it from being susceptible to high winds will require a certain strength of its supporting structure
 - o Etc.

Artefactual perspective – soft aspects:

- Physical properties: Size with regard to sizes of rooftops. Weight with regard to prevailing laws. Temperature tolerance with regard to the climatological conditions.
- Effects of such properties which are *sometimes* relevant; depending on external conditions:
 - o A solar-PV panel which is too heavy for installation on particular rooftops is only being affected by this characteristic if such rooftops are abundant in the solar-PV panels surroundings.
 - o A solar-PV panel which is not allowed to exceed a temperature of 45 degrees C is perfectly applicable in northern Europe, however inapplicable in desert areas.
 - o Etc.

5.3.3 PERSPECTIVE FROM THE ARTEFACT'S ENVIRONMENT

The second perspective assesses products and services from the surroundings of such an artefact and specifically includes the interpretation of such artefacts by those who are affected by it and ways in which they deal with their presence. Several authors in the field of science and technology studies, such as Woolgar, Pinch & Bijker and Pfaffenberger have theorized as to how new artefacts are being imbedded in their relevant social contexts by actors of significance such as producers, users and sometimes also non-human actors (or actants). These authors pay specific attention towards those parts of a social context development which specifically does not adhere to the product designer's intentions, because users and other actors in the social context have their own particular agendas when products are being acquired or used.

While perhaps not maintaining a strict separation between realist and constructivist positions; I have included non-deterministic hard aspects of artefacts in this section. Such aspects of artefacts have both a hard as well as a contextual aspect, for example the association between colour and gender. Given the fact that physical changes of artefacts in this regard are often trivial, discussing their social contextual aspect is of much more interest and therefore it is included in the artefacts' environmental perspective.

By presenting and developing the concept of a technological drama, Pfaffenberger shows how artefacts or new technological practices are being implemented in their social contexts.

Technological dramas give rise to the development of social context in a process of back-and-forth motions between artefacts and the relevant stakeholders in order to finally settle on a day-to-day stable practice.

Pfaffenbergers' constructivist approach towards artefacts and their social context is valuable for this thesis because it explicitly links design characteristics of artefacts to particular political goals, this separates his approach somewhat from other approaches which assess the process of development without explicit attention towards such goals. Technological dramas provide room for producers to gain knowledge on non-artefactual characteristics of their products, and in this case might be appropriated to develop – scenarios of - desirable outcomes of dramas. Such outcomes could then leave products or services in a certain state-of-affairs which leave them to have a certain value (in) congruence.

In order to show how this might be done I appropriate specific parts of Pfaffenberger's technological drama-approach which assess the process of development of a social context of products and services. This will enable me to link those social contexts of artefacts to specific values.

Before I appropriate specific parts of Pfaffenbergers' approach it is useful to discuss the context in which this approach was developed, and in which context I will use it. He departs from the position that designers of artefacts include features in artefacts which are aimed to shape the distribution of wealth, power or other aspects of society (Pfaffenberger, 1992). Associated with such technological 'politically intended' design features are so-called *myths*, which purpose is to obscure the intended political qualities of the artefacts' features and introduce specific social contexts with which the artefact is legitimized in all of its features.

This approach overlaps somewhat with my first perspective on the artefacts itself, in that it could be that certain design features yield certain constraints, however Pfaffenberger emphasis is on the

myths surrounding these aspects of artefacts. In this way Pfaffenbergers' approach focuses primarily on *interpretation* of (designed) aspects in artefacts. That is why this approach is valuable for use in the second perspective, because it deals with non-artefactual 'constraints'. Or, usage practices of artefacts which are likely to have a certain effect – object of constraint – however whose origins are not attributable to the specific physical qualities of artefacts. If the first perspective would be the only perspective in use, these aspects related to artefacts' use would be invisible.

Now, those affected by the political implications of the artefacts' design have, according to Pfaffenberger, specific ways in which to deal with the political qualities *or* myths associates with such an artefact. These three strategies are countersignification, counterappropriation and counterdelegation. Pfaffenbergers' initial goal with establishment of these three strategies was to use them in an ideal-typical model of how an artefacts design features and associated myths would have been introduced by a design constituency. These design features and associated myths would then be dealt with by those affected by them by applying the three strategies. After these strategies would have been applied, design constituencies would have to re-develop their myths and/or product design features in order to answer to the three 'counter'-strategies as presented by the artefacts social context. Finally, after a undetermined amount of back-and-forth motions, both parties would then settle on a common interpretation of the artefact – which is necessary for both parties to achieve common goals. The development of the social context of the artefact would be complete after this common interpretation has been established.

Now, Pfaffenberger implicitly assumes that the political goals intended by the design constituency are not equal – either specifically or in their intention – to those of the social context (often users) of such artefacts. His method and associated terminology often show this implicit animosity, however I argue and hold the position that this method does not decrease in value if the political goals of both parties *are* in alignment. The method still shows a useful distinction between three strategies with which artefacts *design and myths* could be strengthened or weakened depending on the political goals of the parties involved. This part of the method is valuable in order to assess the position of renewables in their social context, in order for designers of renewables to specifically deal with social contexts surrounding their artefacts.

PFaffenBERGER'S TECHNOLOGICAL DRAMA AND THE ARTEFACTS' SOCIAL CONTEXT

So, Pfaffenberger departs from the position that designers of artefacts often include design features which have a certain political intention. Fortunately for stakeholders surrounding the artefacts' use it is often impossible to design artefacts with such features that they leave no freedom for their users to be appropriated to suit their own needs, or at least to let the artefact function in a way which is acceptable for them. This requires the artefacts designers to include *myths* with the introduction of such artefacts in order to still reach their political goals. Pfaffenberger then describes three ways in which users are able to change the social context of such artefacts for their own ends. These strategies are countersignification, counterappropriation and counterdelegation.

(Counter)signification entails the re-framing of the artefacts myths to suit a stakeholders' interpretation of it in order to better argue for negative aspects of a certain artefact which are deliberately understated by the designer of such an artefact. Examples of such strategies could entail the explicit introduction of issues at discussion of ambiguity regarding the introduction or presence of the artefact. An example of his would be the re-interpretation of shortening the due date of a

perishable product because of quality concern (producer), where the actual political goal is to sell more products (countersignification by a user).

(Counter)appropriation in its strict interpretation by Pfaffenerger entails the degree of access to artefacts by particular actors in the social context. However, there does not seem to be a theoretical reason for not interpreting 'access' in the broadest sense possible, which I will therefore do. Laws, regulations and norms in (sub) cultures of artefacts could all be appropriated to gain or impede access to artefacts for their intended use. An example of this would be the explicit ban on alcohol consumption by minors; however minors could break the law and have several strategies with which to obtain alcoholic beverages anyway.

(Counter)delegation entails changing the artefact in order to remove undesirable effects by stakeholders, this could mean that certain physical characteristics are being made or programming of the artefact is changed in order to remove negative effects experienced by the relevant actor. An example is the common practice of re-programming the electronic control unit of turbodiesel cars in order to make it more economical and powerful, at the cost of increasing its pollution of toxins or lowering its reliability.

As mentioned before, Pfaffenberfer uses several examples in which designers of artefacts design artefacts as such that they pursue certain political goals with their end users in order to get them to behave in a particular fashion, which they are in principle opposed to. However, I argue that that there is no theoretical limitation for applying Pfaffenberger's technological drama in a more positive fashion by producers of products and services, in mapping the specific strategies which relevant stakeholders apply in the technological drama. This could provide valuable knowledge for the development of products and services which could even entail a design, service or even business model which was unconceivable before the product or service was present in the first place.

Examples of such practices are the development of crowdfunding as a method of financing products for which no regular funding was attainable or even the appropriation of cars as means of emphasizing individual identity.

In this way the social context of artefacts could be mapped in order to establish how artefacts are being imbedded in social contexts in order to be able to function. Given that it is often hard to predict what is going to be the outcome of a technological drama, producers of products and services should view Pfaffenbergers' method with some reservation. It could be applied as a method with which to assess ongoing technological practices which are similar to a to-be-introduced product or service, or the method could be applied in scenarios which limit the extremes of interpretation possibilities by actors surrounding the artefact. Either way, insight is gained upon the possible interpretations of the artefacts in use, which could aid in developing particular marketing efforts for explicitly re-positioning of artefacts at particular positions in the social context.

LEARNING FROM A CURRENT PRACTICE

An example of an analysis of an artefact which is already present in the market are – again - solar-PV panels. Such panels are viewed by particular user groups as aesthetically unpleasing, which will motivate them to not desire their acquirement. Now, a producer could change the solar-PV panels' appearance in order to address the artefactual constrain by making use of the first perspective. However, an application the second perspective would be the usage of Pfaffenbergers' (counter)

signification strategy for such a producer in order to make salient that the solar panels might perhaps lower the aesthetic quality of a rooftop – bite the bullet – however its acquirement *does* improve overall quality of air. They might even go one step further in explicitly opposing solar-PV-panels towards lung diseases associated with air pollution. In this way the solar-PV panel is provided with a different significance, namely the bearer of higher air quality instead of a recipe for an ugly roof.

Similar strategies might be applied by producers in for example the (counter)appropriation strategy, by for example increasing the taxes on electricity consumption which will increase the financial attractiveness of solar-PV panels.

Finally, producers might apply (counter)delegation strategies in order to explicitly design solar-PV panels for easy delegation by their social contexts. For example by making them smaller in size and modular so they fit more surfaces more easily.

LEARNING FROM A FUTURE PRACTICE BY MEANS OF A SCENARIO

The method in the previous section implies that artefacts which are similar to future artefacts already exist and have their own particular social contexts. However, there are also those artefacts ‘to be’, which are still in the developmental phase and for which no specific social context is designed. For such artefacts the second perspective could still be of value in using specific scenarios in which such an artefact could be implemented. This could be implemented either theoretically; by for example letting a design team take specific roles of the artefacts social context and explicitly applying Pfaffenbergers’ three modes of counterstrategies. Or, a proposed artefact design could be introduced on a small scale in a focus group representing the intended artefacts’ social context, and they could apply Pfaffenbergers’ three modes of counterstrategies. In this way, valuable information about the future social contexts and counterstrategies is gained by the producers of such artefacts, in which they are already informed to provide adequate *myths* to accompany the introduction of their artefacts in the relevant social contexts.

A way in which Pfaffenberger’s approach might be of value for producers of Solar-PV panels is the:

- (counter)signification strategy of re-positioning solar-PV panels as a means for contributing towards more equality in the world as an alternative *myth* to presenting solar-PV panels as a method with which a certain financial reward is to be expected after an initial investment.
- (counter)appropriation strategy of *leasing* solar-PV panels instead of *selling* them, in order to allow groups which have insufficient funds for their acquirement to be able to participate in using solar-PV panels.
- (counter)delegation strategy of solar-PV panels which could entail the practice of increasing their yield by making use of mirrors or the development of automated sun-trackers.

5.3.4 A COMBINATION OF BOTH PERSPECTIVES

In the preceding sections I have presented two perspectives for assessing qualities of products or services, one is focused on the artefacts on product or service itself, where the second is focused on its social context. A combination of both perspectives is useful for designers of products and services because both perspectives deal with the entire spectrum between realists and constructivists in assessing technological artefacts and their relation with the world. After artefactual qualities have been established they could be assessed in order to determine their relationship with particular

values. Given that the artefactual qualities of artefacts tend to link-up with their design, and the social-contextual qualities of the artefact link-up with their impact and interpretation by society producers have specific means of dealing with these sets of qualities. Designs of artefacts could be intentionally changed in order to change the artefacts' constraints. Also, the social context of the artefact could be changed by marketing and framing efforts, in order to allow the artefact to be assessed differently during the process of social embedding.

5.4 PRACTICALLY LINKING QUALITIES OF ARTEFACTS AND THEIR SOCIAL CONTEXTS TO VALUES

In the preceding sections I have discussed how producers of artefacts and services are able to assess the prevailing values in their target user base. Furthermore, I have presented two views with which they are able to either assess characteristics of products and services as viewed from the artefact, as well as a view which considers the artefacts' social context.

This section will discuss as to how insight into prevailing values and both perspectives on artefacts and their social context could be used in order to increase the value congruence of products and services in order to increase post materialistic consumers' participation in such products and services.

5.4.1 DESIGN & MARKETING AND PERSPECTIVES FROM THE ARTEFACT AS WELL AS ITS SOCIAL CONTEXT

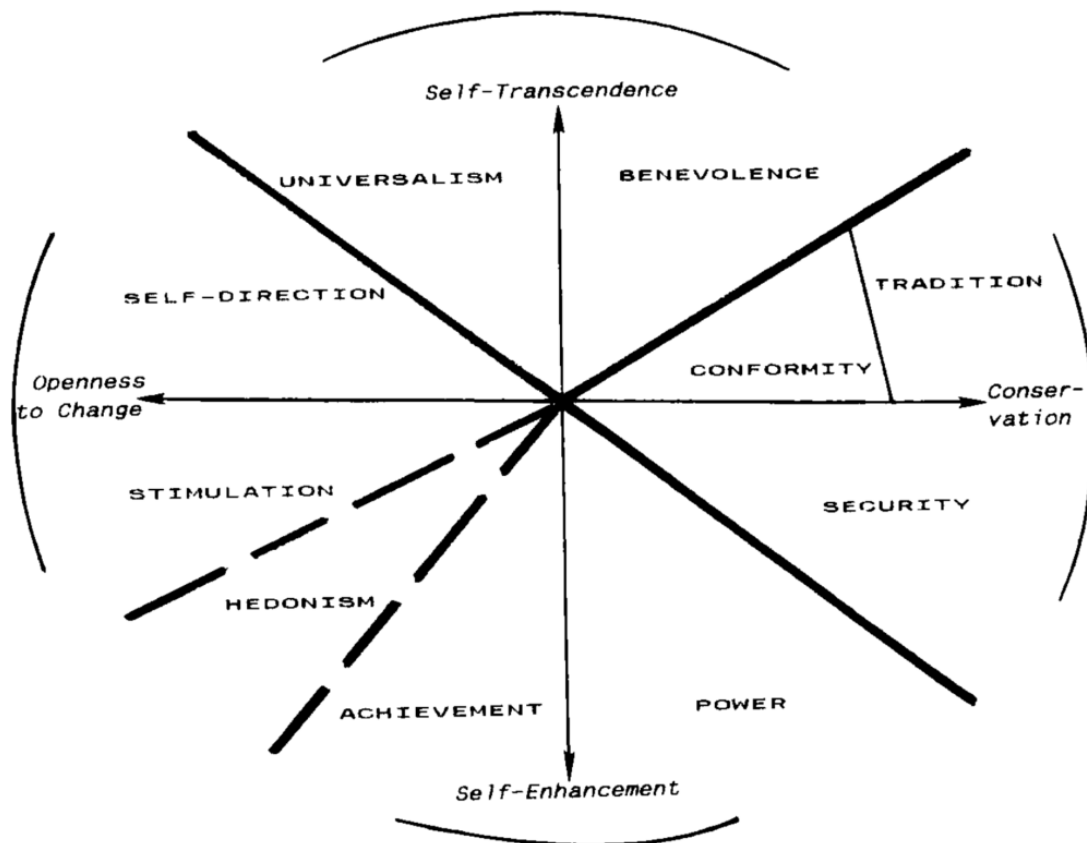
In the previous sections I noted that the artefactual perspective lends itself for deciding on design directions for artefacts, where the social context perspective lends itself for the development of marketing and framing initiatives by producers. Strictly theoretically speaking this distinction is not necessary and it could be of value to explicitly market artefactual design properties or change design features of artefacts in order to let them fit in a social context. In order to structure an approach for integrating values into design and marketing practices I will however largely stick to this separation.

THE SCHWARTZ VALUE MODEL

In section 5.3 I have argued that particular constraints of artefacts characterize them as such that they link-up with particular values.

The Schwartz value model is to be interpreted as being both hierarchical as well as graphically representative of the values' relationships. This means that if values are located closely to each other in the value model, for example Universalism: equality and Self-direction: freedom, both values will tend to strongly correlate on their importance for a subject. If values are located far apart from each other in the model, they will not correlate at all (Schwartz et al., 2004). This becomes clearer when the Schwartz value model is presented once more:

UNIVERSALS IN VALUE CONTENT AND STRUCTURE



5.4.1.1a: The Schwartz universal value model (S. Schwartz, 1992, p. 45)

This means that a user base which assigns high value emphasis to the 'self-transcendence-part' of the model, automatically have lower appreciation for the 'self-enhancement'-part. Also the values which are located at a similar distance from both positions have a similar moderating effect. If established that a certain target user base is located in a particular section in the value model (either through assuming they are because of the post materialist' increases derived from the WVS, or because of questionnaire-research on a smaller scale) specific conclusions could already be drawn. Namely that the graphical position which a user (base) takes in the model is directly proportional to the values which they hold dear, are ambivalent to or dislike. This could then be used by the two perspectives respectively artefacts and their social contexts in order to support value (in)congruencies.

DESIGN AND THE ARTEFACTUAL PERSPECTIVE

It is not my intention here to provide a full analysis of a certain product or service. I merely show that given that certain user (bases) value a specific part of the value model more than other parts in the model, particular constraints of artefacts become of use in order to emphasize their value (in) congruence.

Suppose for example that a target user base is largely located in the 'universalism'- part of the model. This would implicate that they are concerned with issues such as: equality, unity with nature, wisdom, a world of beauty, social justice, broad-minded, protecting the environment and a world at peace (S. Schwartz, 1992, p. 7). Now each of these terms are sufficiently broad to define or examine in a particular direction. The same goes for the exact opposite of the value model, e.g. the 'power'-

part, which is concerned with issues such as: social power, wealth, authority preservation of a public image and social recognition (S. Schwartz, 1992, pp. 6, 7). Even without specifying each of the values associated with a particular part of the value model it becomes clear that certain aspects of – for example solar-PV panels – link up better with specific parts of the model compared to fossil-fuelled alternatives such as a natural gas-fired power plant.

Using the artefactual type of constraint: a solar panel has the constraint that once it has been produced, it does not have an effect on the CO₂-levels in the atmosphere as opposed to a natural gas-powered power plant which has the constraint that it *does* contribute towards rising CO₂-levels in the atmosphere. This means that when the value of ‘protecting the environment’ is of importance to the user base, solar panels are clearly favoured over a natural gas-fired power plant. The same goes the opposite way; for example it has often been argued, for example by Winner, that nuclear power plants require a certain amount of authority in order to function due to their constraints (Winner, 1980). If subjects are located in parts of the value model which are far away from power and related authority-values – such as the ‘universalism’-part – I argue that this is sufficient basis for them to favour other alternatives towards such centralized, authority-requiring modes of electricity production.

Producers of products and services could explicitly exploit such artefacts’ constraints by changing them, so they become even more value congruent, or adding new constraints which move artefacts towards a particular section of the value model. An example of this would be the integration of solar-PV technologies in roof tiles in order to appeal to the ‘a world of beauty’-subtype of values. Also value-incongruent parts of products or services could be included in designs, such as the explicit focus on the decentralized production of solar-PV panels or the limitations of sizes of wind turbines in order to lower their amount of authority or wealth required for acquirement.

In this way the link between artefactual constraints and specific parts of the value model becomes evident.

MARKETING AND THE SOCIAL CONTEXT PERSPECTIVE

In section 5.3.2 I discussed Pfaffenbergers’ three ways in which stakeholders could deal with the introduction of new artefacts in order to let them fit into a social context. Those three methods were countersignification, counterappropriation and counterdelegation. Again, following the approach taken for the first perspective, I will not discuss specific examples in full detail. Instead I note particular examples of such counterstrategies which could be applied in already socially embedded artefacts, or scenarios thereof, in order to make visible which (counter)strategies could be developed in order to deal with particular artefacts.

Again I use solar-PV-panels as an example of a technology which is embedded into a particular social context. It has for example been argued by opponents of the application of solar panels that they are expensive and their aesthetic qualities are undesirable. A proponent of such panels could then appropriate a countersignification strategy and argue that solar panels are more ‘honest’ – and therefore value-congruent with ‘equality’ - compared to fossil fuel-powered strategies of electricity generation which cause environmental degradation for which nobody pays. Also, such a proponent could argue that solar-PV panels on rooftops are a much better alternative towards the introduction of a large-scale power plant on an industrial estate, and the fact that this industrial estate is not in

view of a solar-PV-panel's opponent is no valid reason for favouring it. It could be considered as a NIMBY-approach to the problem which in the end is no solution at all (Dear, 1992).

In a (counter)appropriation strategy, proponents of Solar-PV panels could argue for a different set of legislations which foster their usage, an example being the German model of feed-in tariffs which have had the effect that investments in Solar-PV panels have become much more attractive in recent years. This practice is related to values in the sense that they support, for example, equality or protection of the environment. Other (counter)appropriation strategies might entail the taxing of CO₂-pollution in the atmosphere or explicit design of future electricity infrastructure as such that it fosters a decentralized model of electricity production.

Finally, in a (counter)delegation strategy, proponents of Solar-PV could use storage devices in order to lower the amount of electricity they consume from fossil-fuelled power plants. Also they could evade tax costs for heating by optimizing heating systems powered by fossil - taxed - fuels or substitute them for sustainable alternatives. In this way they are able to behave value-congruently by actively impeding further usage of fossil fuel sources.

In order to foster such strategies for dealing with new products and services, producers might specifically market and frame artefacts as such that they link-up with particular values which are important for the target user base. An example might be to turn on the washing machine when the sun is shining, or emphasizing the explicit local character of certain types of energy in order to stress that usage of *this* energy does not contribute towards an increase in wealth in countries which support values which are in opposition of the user base. A concrete example of this is the explicit desire for some Dutch people to not buy any natural gas from Russia, for political reasons. A practice which itself might be related to values in the self-direction-part of the Schwartz value model.

In this way all three strategies for dealing with new products and services could be applied in order to let the entire state-of-affairs between artefacts and their social contexts be congruent with a certain set of values.

Now I have discussed both perspectives and their relationship towards values, it is logical to re-assess the problematic relationship between values and behaviour, because the fact that products and services are value congruent is insufficient for them to be chosen by most people. This issue is discussed in section 5.4.2.

5.4.2 A CONSUMERS' DECISION

As discussed before in chapter three, it is often hard to directly prove in experiments that consumers are rational agents who use their values in order to decide for a certain decision alternative. This has been shown in experiments designed to provoke value-congruent behaviour which has proven to be difficult in practice (Darley & Batson, 1973; Stolle et al., 2005). Real-life decisions are taken in a much messier environment in which other issues are at play as well which have their own particular effect on consumers' decisions. These factors could be human habits, the simple 'mundaneness' of day-to-day decisions and strong social contexts in which actors are unable to have sufficient freedom to take decisions which are congruent with their values.

This implies that the explicit inclusion of post materialistic values in products and services will not imply that all of those consumers which could be said to have a post materialistic value system will then favour those products and services. This is because the link between values and behaviour is often weaker in practice than supposed in theory which means that values often play a relatively small role as direct causes of consumers' decisions. More often things such as aesthetics or financial benefit are stronger motivators for concrete behaviour by consumers. Still the value-driven approach is a desirable one because of two reasons:

Firstly; there is considerable support for the notion that people who live value-congruent lives are happier because of it, at least when their well-being is operationalized as they score on subjective well-being scores (Inglehart, 2000; Inglehart et al., 2008)

Secondly; values are a much more long-term fashion of stimulating certain behaviour. Following research into the effectiveness of normative goals compared to those motivated by hedonistic desires it seems to be the case that the establishment of normative goals is difficult to achieve, however when they are there they show considerable resilience towards 'easy' alternatives (Steg et al., 2014).

Furthermore, the gap between costs of unsustainable methods of electricity production and sustainable methods of electricity production is getting smaller. This means that value congruence does not have to account for the entire amount of motivation necessary for acquirement of renewables. It merely has to close the motivational gap between the present financial attractiveness of unsustainable methods of electricity production, and those which are sustainable.

What I am arguing here is that the explicit improvement of the relationship between post materialistic values and products and services is not enough to motivate consumer choice for it if people are not taking decisions based upon such values; which is often the case. (E.g.: You might value the environmental 'goodness' of solar-PV panels, however if your spouse thinks they look ugly, you will probably not buy them)

5.5 VALUES AND BEHAVIOUR REVISITED

This means that it is important to explicitly appeal to people's values in design and marketing efforts for products and services which are congruent with (post materialistic) values. In order to discuss as to how this might be done it would be useful to apply insights from Maio et al. and Torelli et al. in order to promote value-congruent behaviour.

In Maio's case this would entail the explicit inclusion of reasons for holding certain values dear – instead of the values themselves – in products, services and the marketing thereof in order to appeal to values which consumers hold dear. E.g. 'Buy this solar-PV panel because it promotes equal chances for everybody' instead of 'Buy this solar-PV panel because it promotes equality'.

In Torelli's case this would entail methods for changing the consumer's mind-set before offering value-laden products and services to such a consumer. This is already being applied in concrete practice by – for example – energy companies who ask potential clients to think about our common future (in order to provoke an abstract mind-set - before offering a contract for acquirement of green energy).

This practice should be considered explicitly for those producers which desire to harness values as a driver for concrete decisions by consumers.

5.6 DECIDE UPON DESIGN AND MARKETING OR FRAMING ALTERNATIVES

After establishment of a user (base) in the Schwartz value model on the one side, and the artefactual and social contextual properties of products and services on the other, it is time to deliberate concrete actions to take for producers of products and services.

Firstly, I have postulated a relationship between:

- values, the artefactual perspective and design efforts.
and
- values, the social-contextual perspective and marketing/framing efforts.

Although not a strictly theoretical separation, both approaches have particular costs for producers of products and services. Such costs could be defined in terms of time, financial investments, and risk.

Given that each product or service is different, it is hard to establish a concrete set of actions which is *always* applicable for producers of products and services who explicitly focus on the value-congruence of their products.

Therefore I would argue that producers of products and services, primarily use the costs necessary for increasing the value congruence of their products and services in order to determine an answer to the concrete question of which action to take.

If, for example, such a producer is unwilling to change the design of their products due to time constraints or financial costs, they could focus on Pfaffenbergers' approach and use marketing and framing techniques in order to enable target user bases to re-evaluate the artefacts which such producers have to offer. This could for example entail launching an advertisement campaign in order to re-position solar-PV panels as items which – indirectly – improve aesthetic qualities of the natural environment, at the costs of lowering the aesthetic qualities of the built environment.

In a different case, such a producer might be in the position that the products' design is already what is at question – for example for a new product – and hence decides to spend additional attention on the products' features instead of launching a marketing campaign.

In practice, probably both approaches – design and marketing/framing – are to be applied in order to address both the artefactual as well as the social contextual perspective in order to let the product appeal on different levels to the intended user base.

5.7 CONCLUSION

In chapter five I have presented a relationship between value models on the one hand, and two perspectives on products and services on the other hand, which could be appropriated to create products and services which are value congruent up to a particular extent.

In the artefactual perspective, artefacts constraints are being presented as a method with which to assess those effects of artefacts which leave them to have a certain congruence with particular values. Afterwards I shortly discussed how such artefactual constrains might be designed explicitly for specific values by using a set of examples.

In the social-context perspective, I have applied Pfaffenbergers' technological drama concept, and in particular the strategies available for stakeholders surrounding particular value-laden artefacts, in order to show how particular strategies could be applied in order to change and artefacts' social context into a particular direction. After presentation of these examples I shortly theorized as to how marketing and framing initiatives could be used in order to enable stakeholders surrounding artefacts to steer artefacts into a certain social context, which have them in a position to be congruent with particular values.

Furthermore, I discussed the implicit assumption that consumers are rational agents which base their decisions on their values alone, and provided two strategies for dealing with the fact that often consumers tend to take decisions which are incongruent with their values.

Finally I shortly discussed the way in which producers of products and services are able to decide for which concrete actions they should take, given that their capacities to take action are limited on different accounts.

CHAPTER SIX: CONCLUSION AND FURTHER RESEARCH

Now I answer my main research question:

“How could renewable energy generation technologies be designed and marketed in such a way that they fit optimally with post materialist values in consumers?”

Firstly, I have established that technology is in principle not ‘the’ limiting factor for realising a switch towards a fully sustainable method of energy generation. A combination of saving initiatives and technologies which deliver energy at the same rate at which they extract it from the sun is feasible from a technological perspective. Furthermore, specific design philosophies and knowledge about the scale of the problem of moving towards ‘true’ sustainability contributes towards increasing the sense of urgency. This stimulates the developments of concrete methods and technological ways with which to foster sustainable solutions for electricity generation.

Different reasons exist which lead renewables to have a slow take-off, of which one of the most important is the fact that fossil fuel powered methods of energy generation have drawbacks, such as resource depletion and causing climate change, for which presently nobody pays. Sustainable energy generation technologies possess less or no environmentally harmful characteristics, however because of the fact that they have had to sacrifice certain technologically desirable characteristics in order to become so, they are uncompetitive when only viewed from an economic perspective.

Therefore, I studied what things are of value to people, and used Schwartz’ value model for assessing this. This model, combined with empirical research from Inglehart, shows that people’s values have changed from those which are considered as materialistic, towards those which are post materialistic.

The fact that consumers in western-style economies have a different set of values – in general – compared to a few decades ago provides room for the producers of sustainable products and services to substitute the economic disadvantage of renewables for increases in value congruence.

In order to explore how they could do this I presented two perspectives on products and services, namely an artefactual view as well as a social contextual view.

The artefactual view links artefactual constraints with certain effects, effects which are value congruent with particular parts of Schwartz’ value system. By clarifying what constraints artefacts are able to bring about, and how they are related to values, designers of such artefacts are better able to assess what design features of their artefact are important if they desire to create artefacts which link-up well with particular values in Schwartz’ value model.

On the other hand, artefact constraints are insufficient as an explanation for the position which artefacts hold in their social context. In order to provide an approach for assessing the social context factors of an artefact – taken broadly as product or service – I have applied Pfaffenberger’s technological drama approach on the way in which stakeholders are able to deal with the presence of certain products or services. Three strategies, countersignification, counterappropriation and counterdelegation all have a particular way for dealing with the presence of products and services, and provide concrete departure points for developing marketing and framing strategies by producers in order to let their products and services link-up with particular values.

FURTHER RESEARCH

At its present level of development this thesis and the conclusions it draws are quite theoretical and limited. The economic competitiveness of renewables, the degree to which values are applicable as motivators for economically-oriented consumers and the relationship between value-congruent lives and levels of subjective well-being have not been researched into detail.

These are limiting factors for the development of a full-fledged practical methodology for business to design or market their products in a value-congruent fashion these questions should be researched further, in order to become more specific in a method design.

It has for example been argued that eventually renewables will *always* become cheaper to use compared with fossil fuels, because fossil fuels rely on a fixed amount of to-be-consumed fuel which at some point will be more expensive to extract than to deal with the disadvantages of renewables. The exact point in time at which this 'grid parity' is reached is subject of fierce discussions among scholars and economists (Sinke, 2009), however it is important to establish this point in time in order to further assess whether a value-approach might be useful before 'classic' economic arguments are sufficient for switching towards renewables.

Furthermore, a practical approach with which values could be applied as behavioural motivators for consumers has yet to be developed. Maio et al. and Torelli et al. have presented empirically supported views upon the relationship between values and behaviour, however their conclusions have not led to the explicit development of a concrete, hands-on strategy for letting people act in congruence with their values. This is worth further investigation, because it is important in order to let a values-based approach towards the introduction of renewables become successful.

Finally, after analysing several waves of the WVS, Inglehart has concluded that people who live more value-congruent lives tend to have a higher level of subjective well-being (Inglehart et al., 2008). The exact nature as to this relationship is however largely unexplored, and specifics as to the 'why' this causal relation seems to exist is of particular relevance. Especially if we take into account empirical research into material wealth which suggests that such material wealth only contributes to increases in subjective well-being up-until a certain extent, it seems valuable to discern whether value-congruence is perhaps the next 'thing to strive for' by people who already possess sufficient material wealth for optimization of their subjective well-being.

On a more theoretical approach, this thesis supposes a concrete relationship exists directly between people's values and their concrete behaviour. This could be considered as an Achilles heel for this thesis because it has been argued by critics that such an approach is theoretically unsound because it 'rationalizes' the mind, and as such presupposes that values and concrete behaviour are directly linked to each other. Instead authors such as Rokeach use attitudes as a much more directly linked construct related towards concrete behaviour (Rokeach, 1979).

However, values are attractive for use as a long-term anchor for which to focus design and marketing efforts upon because they are less volatile than attitudes, they tend to be more long-term and persistent over time which makes them attractive. Research which develops and constructs concrete methods or experiments in order to deepen insights between values and behaviours is scarce, however it is my opinion that more research would be of particular value in this field.

This is due to the fact that Schwartz and Inglehart provide empirically based research on the general values which people in western-style societies hold in high regard. Still, often this exact same people take decisions which are clearly incongruent with their own values. Given the fact that it is reasonable to hold the position that people who live lives which are value-congruent experience higher levels of subjective well-being, it seems clearly worth the effort to further research methods with which people could be persuaded or even 'nudged' to display more value congruent behaviour.

In short, it is not the values which people hold which explain why renewables have a relatively slow uptake, it is the relationship *between values and behaviour* which provides much more interesting insights into what people claim they want to do, and what they actually do instead.

Furthermore, it seems to be the case that philosophical ideas such as political consumerism are more theoretical than reality is able to handle. Often people are unaware of the ethical impacts which their daily decisions have on their environment. Especially if such effects have a large separation between cause and effect, both in space and time, it is very difficult to argue for the relevance or acuteness of such issues. Still it can be argued that it is in the interest of our species to explicitly deal with the long-term – or far away – effects of day-to-day decisions.

That is why it would be valuable to invest research into the question as to how people relate to their environment, and specific attention could be spent on the differences between those items which we are directly able to sense, and those which we are only able to sense indirectly through mediation of technological artefacts.

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