As early as the 1980s the Federation of Swiss Protestant Churches concerned itself intensly with energy policy and perspectives on energy. The studies and position papers produced at that time demonstrated that the question of energy is an important one, since consumption of energy is connected with lifestyle and social values. Since then, the signs of an unavoidable reorientation on energy policy have increased. With the «Energy Ethics» study, published in 2008, the FSPC offers its member-churches an extensive basis for discussions and opinion-forming on energy, and also climate, policy. This short version in English is meant to facilitate exchanges on this theme with our sister churches in the ecumene and with international partners.

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FSPC Study 1

Energy Ethics

Towards a New Energy Age – Sustainable Perspectives for Post-Oil Times

Summary

Federation of Swiss Protestant Churches FSPC

Publisher	Federation of Swiss Protestant Churches FSPC
Author	Otto Schäfer
Series	FSPC Studies
Translation	Maria Helena Nyberg
Proofreading	Natasha Pittet
Cover	istockphoto.com
Layout	Büro + Webdesign GmbH, Berne
Printed by	Roth Druck AG, Uetendorf
Internet	www.sek.ch
Email	info@sek.ch

«Energy Ethics» in its full version was adopted by the Council of the Federation of Swiss Protestant Churches FSPC on 31 October 2007.

ISBN 978-3-7229-0003-2

FSCP Studies Series

1 Energy Ethics - Towards a New Energy Age – Sustainable Perspectives for Post-Oil Times, Summary, 2009, 32 pp., CHF 6.-.

Download of the full version of the Study paper «Energy Ethics» Study (179 pp):

French: http://www.sek-feps.ch (under: Thèmes A-Z, Energie)
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German: http://www.sek-feps.ch (under: Themen A-Z, Energieehtik)
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1. Energy Crisis and a New Energy Age

The signs of a global energy crisis are clearly visible:

- Climate change is caused by human activity and is 80 % the result of burning fossil fuels;
- The discovery of oil deposits is dropping and the extraction maximum will soon be exceeded; also the reserves of natural gas, coal and uranium are decreasing;
- Wars are waged for oil, corrupt dictatorships are supported, and terrorist acts occur.

But the following is also obvious:

- Renewable energies are booming, they are an export hit and the order books are full;
- Energy efficiency is not just a catchword – although the kilowatt consumption decreases unnoticeably and too slowly, yet heat pumps are installed and buildings insulated.

How can signs of renewal match signs of threat?

Many things point to the fact that an epochal change is taking place; an old energy age comes to an end and a new one begins. We find equivalencies in the past. Civilizations are based on technical and social energy systems. But energy systems reach their limits through internal developments and external constraints, they break apart (in the same manner as during the centralisation of the late Roman antiquity) and something new develops.

Such a transition is structurally demanding and bears risks. In addition, it also provokes feelings of insecurity and is mentally exhausting, as not only structures are concerned, but also attitudes to life and expectations for the future.

What will "the new" consist of? How fast and how radical will be – and has been – the transition to a new energy system? How do we have to assess the individual elements of this energy system – energy sources,

technical possibilities of conversion, distribution and application of energy, political perspectives, and steering tools?

To undertake such a comparative assessment is a matter of ethics in which the ethical argumentation is based on convictions of "good life" and morally correct action. These convictions are phrased as "basic values" in a very much generalizing, fundamental form. Five basic values seem to be particularly important and appropriate to the issue of energy: Freedom, sustainability, justice, participation, peace. More precise guidelines, going into more detail, are based on these basic values. Following Arthur Rich we call them maxims.

This level-headed way of looking at things using reasoned arguments allows the working out of ethical positions, which are comprehensible – this is essential. Yet this way of looking at things can also suggest that our desires and fears, our inner contradictions, our sluggishness and interests are willingly subordinating themselves to the clarity of the argument. And this would be naive.

Therefore, we need two different methods to penetrate problems. On the one hand, there is the rational deduction of ethical judgements from general basic values and their confrontation with a description of the problem as comprehensively as possible. On the other hand, human beings are taken seriously in the complexity and inconsistency of their existence, considering the fact that our decisions have always been based on our life experiences and on the stories that mark and support us. This existential and spiritual view tries to discover and to communicate what burdens us and what helps us to continue in view of the imminent change, which is the global energy crisis. When we have to deal with crises, in other word, when we realize the finite nature of being, it may be inspiring to resort back to the Christian faith and Bible.

2. Basic Values and Maxims of the Ethics of Energy

To determine basic values is something of a pragmatic procedure. The determination is temporary and open to discussion, appealing to intuitive evidence that is required in all basic ethical judgments. Out of ten basic values that the ITE of the FSPS compiled and characterized, five are particularly relevant for energy ethics: freedom, sustainability, justice, participation, peace. In the following maxims, these five are clearly defined and differentiated from each other. The list of maxims, despite all efforts to come up with a representative selection, makes no claim to be complete.

2.1. "Freedom"

Freedom is not only a precondition for creativity and innovation, it is also fundamental to the way we see ourselves as human beings. To understand freedom as autonomy relates back to the tradition of the Enlightenment. Freedom opposes all forms of constraint, but not an organisational structure that conveys meaning and direction, inasmuch as the Other and faithfulness to ourselves are the limits of our individual freedom. Institutionalised freedom uses a developed and arranged setting to protect itself against despotism and power.

Maxim 1: Putting Incentives before Coercive Measures

Measures that create incentives must be preferred to coercive measures. Freedom of initiative and exchange must be promoted. Both initiatives of one's own and free exchange have their own value and must be respected accordingly. The smaller the room for manoeuvre the more the risk of violence increases. If the essential goals of energy ethics cannot be reached by using incentives, coercive steering tools are indispensable.

This also includes the freedom to err and to correct mistakes. If one is forced into infallibility because of the danger of irreversible damages, then freedom is contradicted; if however mistakes and errors are tolerated, then freedom is promoted.

Maxime 2: Tolerating Mistakes

The energy supply must be organised in such a way that wrong decisions, mishaps, incidents, and negative effects happen seldom and do not have far-reaching consequences, as well as that risk-bearing facilities and systems can be reviewed, corrected, and improved.

Freedom is open to the future. A future that is determined on a long-term basis and, even more, a future that is permanently troubled, restricts spheres of freedom in an unreasonable way. We need to claim and to promote liberal procedures of shaping the future, instead of technocratic and bureaucratic planning. "We need not to predict our future but to decide" (Denis de Rougemont). The freedom of future generations requires framework that are aligned along free market lines and that prevent ecologically destructive developments (such as strict standards). Such steering mechanisms are quite liberal in their essence, when seen as a challenge to innovation and as a safeguard of future freedom.

Maxim 3: Protecting the Freedom of Future Generations

Energy scenarios with strong control mechanisms correspond to a liberal understanding of politics, whenever they suceed in translating ecological conditions into economic conditions and thus protect the freedom of future generations and promote the creativity of current projects for the future.

2.2. "Sustainability"

Basically, sustainability consists in a utilization of natural productivity, which uses the interest without affecting the capital. In the ideal case of "profound sustainability", the reproduction ability and the potential for development of natural systems remain untouched, and it is only possible to a limited extent to replace them with non-natural resources.

Sustainability is an ethical basic value in two respects:

- The respect for the living conditions and the right to self-determination of future generations;
- The respect for nature's intrinsic value and for the diversity of living things.

If referring to future generations, there are less arguments with which to counteract, as it corresponds to the classic way of justifying ethical standards by using reciprocity and generalization. "What would we expect from today's humanity if we lived in 300 years from now?" – this mental exercise of swapping roles sounds very convincing: we do not want to inherit a looted planet.

Respecting the intrinsic value of nature and the diversity of living things cannot be necessarily deduced in the same way, yet it belongs in many traditions to the heart of ethical action (this is also true for Christianity and other religions). The challenge of nature's intrinsic value conveys a specific character to the basic value of sustainability.

Is it possible to measure sustainability? As a first approximation it is possible – with a "synthetic sustainability indicator". Here, the best known is the "ecological footprint", corresponding to the total area (constructed with a lot of simplifying assumptions) that a society needs for its economy and lifestyle. In rich countries, the actually existing area, with its "biocapacity", lies far below the "ecological footprint". In other words: external biocapacity is absorbed, foreign areas are occupied. Metaphorically speaking, one could say that such countries live "on too big feet".

Maxim 4: Respecting Sustainability Indicators (ecological footprint)

All consumption of resources and the neutralization of pollutants by nature must respect the criterion of sustainability. Here, the comparison between an ecological footprint and biocapacity could serve as an approximate but useful synthetic indicator. In the field of energy (as in other special fields), specific indicators are to be preferred.

2.3. "Justice"

Justice is a complex collective word. There are different approaches to, and forms of, justice. They are in a relationship of tension to each other, but still do not exclude each other. The justice of performance claims a fair proportion of performance and a performance in return; in other words, the more difficult, larger and better performance deserves a higher equivalent (for example, a higher salary). Yet in comparison, social justice pleads for the recognition of basic human rights and basic needs independent from economic performance or performance in general.

The extent of a just settlement of things can be different. However, the guiding principle of the modern understanding of justice consists in the overcoming of discriminations. Simply to exclude parts of humanity from justice would be equivalent to despotism. This is why "global justice" includes all people living today (**intra**generational justice). It cannot either be tolerated that future generations be deprived of their rights to exist and to choose by those who live now (this is where **inter**-generational justice comes into play).

In the energy sector, three aspects of justice are essential.

The basic rights and basic needs of the weakest and poorest members of the society must be guaranteed. This includes a minimum of energy supplies, which cannot be refused to those who cannot pay.

Maxim 5: Protect Basic Social Rights

In the supply of energy, the basic social rights of the poorest must be respected.

The historical development of the energy supply and individual car mobility was also geared to build cohesion between the different layers of society. Switzerland is an impressive example of how peripheral and disadvantaged regions were treated with justice, thus strengthening national unity. This principle is still valid today – but with a different perspective, as now Switzerland is looking beyond state to strive towards European integration and a globalisation that keeps human justice in mind.

Maxim 6: Supranational Spaces of Solidarity

Today, positive historic experiences serve as the foundation shaping our living space using the principle of solidarity and extending the distribution of energy resources across supranational spaces of solidarity.

If justice is to be maintained in distribution, we will face numerous problems in practical and fundamental implementation. How much inequality can be tolerated, or, putting it positively: can we accept inequality as it triggers a dynamic development with better living conditions also for the disadvantaged? Fairness is not equal to levelling down. But there are limits to inequality. In view of the elementary basis of life on this planet, every human being has the same rights and obligation.

Maxim 7: Equal Entitlements for All

Under the fundamental global conditions for human life, justice has the meaning of allocating to every human being the same proportion of the rights of use and responsibility (*"equal entitlement approach"*). In the field of energy, this maxim must be applied to the management of resources and pollutants (emissions, waste).

2.4. "Participation"

Energy confers power. Due to the necessity to share and use power in such a way that those who are concerned can co-determine, participation is an essential basic value in the debates about energy. Wherever participation and co-determination in the collective decision-making processes are not given, people are declared incapable. They are turned into strangers in their own world.

The principle of subsidiarity is a century-old traditional principle of participatory expression of the people's will in Swiss politics on all levels of society. The lower level of each structure has the autonomy to decide on all questions that this level is able to solve within the scope of its responsibilities and authority; the upper level only takes on the decision when it must intervene as a conciliatory mediator or when the scale and complexity of the problem makes it necessary to interfere.

Yet, today's form and understanding of subsidiarity is contradictory. On the one hand, there are numerous innovative procedures of participation and co-determination; on the other hand, polls show that people at large feel politically powerless; they feel not able to really participate and share their opinion, they have the impression of not being asked or heard.

It is problematic to mix participation and "promoting acceptance ", as then there is the danger of treating one's citizens not really as the sovereign voting public, but as clients of a strategy of political feasibility.

Maxim 8: Participation of Citizens (Subsidiarity)

The participation of citizens must be defined and implemented in the political frame work of subsidiarity. The autonomy of the lower levels needs to be respected, but also protected from abuse (incentives or strong pressure).

The liberalisation of the energy markets offers new opportunities to customers – also in view of preferences in energy policies (eg. "ecopower"). Thus, one cannot speak of a real co-determination in the decision-making processes of energy supply companies. The demand to "democratise the economy" (André Biéler) remains a hot issue.

Maxim 9: Democratising the Energy Industry

As in politics, the energy industry needs participatory structures, as much in production as in distribution and consumption. The options that are offered to the customer aim in the right direction, yet they remain below the level of the desirable "democratising of the economy".

2.5. "Peace"

As a basic ethical value, "peace" is more than a subjective experience; it is all about an objectively arranged structure of relationships preventing and limiting violence, resolving conflicts non-violently, and aiding in overcoming destructive conflicts. Peace is based on a established legal system.

What peace means becomes clear when comparing the terms peace and security. Peace entails security. But security policy is no peace policy – if it is only geared to protect one's own interests against others (with violence if need be). Then, security is the opposite of peace. True peace guarantees the interests of life and development of all the stakeholders in an balanced way. True peace is just and sustainable.

"Supply security" is an important aspect of energy politics. It belongs to the constitutional task of energy supply companies. Supply security and economy essentially contribute to economic wellbeing and to social peace. However, while pursuing national or particular interests, they must still be compatible with a global peace policy. A system of energy supply that is connected to, and has even been paid for with, many international conflicts must be seriously questioned.

Maxim 10: Integrating the Economy into Peace Keeping

A safe and profitable energy supply contributes to social and economic peace. But as a criterion of the good management of energy resources, the economy must be subordinated to peace in a comprehensive way. An energy system that creates violent conflicts cannot be profitable in the long run.

How can a peace-promoting energy policy be defined? To start with, the unilateral dependence on limited and heavily disputed resources must be reduced (eg. oil and natural gas). It remains a move of security politics to keep options open between several fuel producing countries, and cannot be called a matter of peace politics. The excessive energy consumption of rich countries must be reduced and levels of consumption must be brought in line with each other globally. Energy-related environmental damages (emissions, pollutants) are not to be exported to the disadvantage of others. Improved technology transfers induce up-to-date technical progress by leaping over ecologically and economically outdated stages of technology *(leap frogging)*; state-of-the-art technology becomes common-place. The risks of nuclear proliferation command a reluctant procedure when planning new nuclear power stations, at least in geopolitically critical regions.

Maxim 11: Avoiding Energy-related Threats to Peace

Peace is threatened and violated by:

1) extreme energy-political dependencies;
2) unfair trade between producing and importing countries;
3) excessive (non-sustainable) and unequally distributed consumption of finite resources;
4) race in industrial development including every destructive intermediate step;
5) uncontrollable interplay between the civilian and military sectors.

This maxim is worded in a negative way. Thus, the maxim points out once again the new situation in energy politics, which can no longer be supported. We face difficult changes, both painful and promising.

3. The Energy Crisis as a Spiritual Experience: Farewell and Renewal

Sorrow is a basic human experience. By going through sorrow, we renew ourselves in view of an unwanted change and a loss that has hit us in our inner self. Sorrow is a burden and a liberation at the same time, because it leads to new confidence. We overcome what was earlier called a "trial"; life is again ahead of us.

3.1. The Energy Crisis: a Collective "Trial" made of Sorrow and Renewal

The energy perspectives of today's Western societies can be compared to a collective "trial"; we are insecure, because the seemingly self-evident is no longer a support, and now the question is to go through sorrow to find again the confidence to live. Yet, at first we try to evade this sorrow. In the same way as individual sorrow – letting go one's own life or a partnership, as much as losing a dear person –, collective sorrow also knows *denial* and *reluctance*. No, we need not worry, there will be oil for a long time and with our ingenuity we will always be able to discover new deposits, be it in the depths of the oceans, or in tar sands above ground ... No, climate change is not that bad, there has always been something like that, and we will adapt ourselves marvellously. Or just as much: Well, let us then liquify natural gas and coal and produce oil that way! And let us collect the carbon dioxide and then separate it, making it harmless and store it! All these technologies are neither meaningless nor bad as such. But the extreme confidence in them point to the fact that a whole civilisation refuses sorrow. Even though we should know that denial and revolt are already stages of sorrow, we are already in mourning and simply do not want to admit it to ourselves.

Then we haggle and *negotiate* – we live through this stage of sorrow as well. The time of renewable energies approaches, we do not deny it, but we postpone its arrival. Certainly. the ecological footprint of Switzerland is three times bigger than its biocapacity; only the so-called "2000-Watt-Society " meets reasonable requirements of sustainable development and just distribution for the present and future generations. We do not deny this, we only change one digit: we do not want to be there by 2050, but only by 2150! There is another typical stage of sorrow, namely depression. There is nothing to be done, says a gloomy fatalism. It takes the end of a certain world and time, and turns it into the end of the whole world and of all times. Forerunners of an all-inclusive destruction of the inhabited earth are the islands in the Pacific that have become uninhabitable due to the rising sea level. Disasters beat against us whatever we try to save. Humanity is lost, there is no hope. Therefore, we need not bother – concludes this depressive fatalism.

Liberating sorrow becomes apparent whenever we leave behind what we do not want to realise, defiance, negotiation, and depression. Then, we can take the road to an open future. As soon as we have such an attitude, there will be room for a composed, ethical contemplation.

3.2. Comparable Experiences in the History of Science

Whoever is interested in the history of science will see that the understanding of energy has gone through the experience of finiteness time and again. One had to say good-bye to illusions and to open oneself to new perspectives, by living through something like an intellectual sorrow. These experiences of crises in the history of understanding energy are also theologically and spiritually important.

A well-known example is the dream of the perpetuum mobile. Already in the ancient world, people tried to construct machines that would run eternally and could in addition perform work. But it never functioned. A finite and earthly creature was not capable of doing it. Only the creator himself seemed to constantly create energy from nothing, as the mechanics of the sky, earth, and sea showed that life is in constant movement. The waves and the winds and constant self-renewal – are they not the perpetuum mobile of nature in the hands of the creator? Only in 1842 was it proven that even in nature energy is only always transformed but never newly created (principle of conservation of energy or the first law of thermodynamics). The physicist Mayer and Joule,

who independently from each other had discovered this principle, saw it as a consolidated understanding of finiteness (for both of them, the discovery not only represented a scientific law, but was also a deep spiritual experience).

Very soon, the first law of thermodynamics was followed by the second: the transformation of energy is not reversible at will, as heat is collected, a degraded form of energy. This can also be expressed by saying that a closed system becomes more and more "chaotic"; it pursues a growing disorder (entropy) (this is why we use the term "law of entropy"). Is this also true for the universe? Some people thought so and predicted that the universe would die of the "heat death" – after many hundreds of millions of years. At the end of the 19th century, people considered this perspective to be a depressing experience of finiteness.

Paradoxically, in this connection, the miracle of life became more and more clear from the point of view of energy. Individual living organisms, as well as everything living, as a whole develop against the natural "gradient" of increasing disorder (entropy). Life extracts energy from its environment and spontaneously creates specific orders pushed by an inner dynamic force (so-called "theory for dissipative systems"). In the course of evolution, living things increase in their complexity, yet they are mortal. Life is a constant confrontation with death and finiteness. We human beings are conscious of it. Is it our "calling", to make it through this dispute, to limit chaos, to minimise violence? And to give sense to the quantitative limitedness of our life and of all life, that consists of quality and intensity?

Is the adventure of life a "trial", a process of sorrow and renewal, by which we have to learn how to leave behind the past and that which dies away, how to "discharge ballast ", to get new swing and buoyancy? In this figurative language of the balloonist, Bertrand Piccard describes the transition into a new energy age. In 1999, he managed to fly around earth in a balloon – without a stopover. At this time, he is intensively involved in his "Solar Impulse" project. He intends to circle the earth again – maybe in 2011–, of this time with a solar airplane. He understands this stimulus of a new energy age as a technical challenge, as a scientific project, and as a human, emotional adventure of self-discipline and will-power: his project wants to communicate courage to go towards new goals. One needs to know that Bertrand Piccard's main profession is Psychiatry. In his thesis of 1996, he dealt with the trial – in French the "épreuve" –, the ordeal of a misfortune, an accident or an illness. The new forces that are generated from such a "trial" are his message, also in the case of his newest project that wants to symbolically show what we need to fulfill as a global community in times of change: the farewell to the waste of non-renewable energies and the transition into a post-fossil age.

4. Constraints and Chances on the Brink of a New Energy Age

Ecologically there are two developments that mark the limits of our present fossil-energy age – partially with dramatic urgency: climate change and diminishing oil-reserves *("peak oil")*.

4.1. Climate Change

Climate change shows that the atmosphere's capacity to absorb the fuel product of carbon dioxide (CO_2) has been exhausted. Carbon dioxide is not the strongest, but the most important, greenhouse gas when it comes to quantities. Man-made carbon dioxide emissions contribute approx. 80 % of the global warming of the atmosphere. Fossil fuels, oil, natural gas and coal, are the main reasons for climate change – even more evidently when we add the clearcutting of forests as an indirect consequence of the use of fossil fuels. Since the 4th climate report of the UN-group of experts IPCC in spring 2007, it now seems to be scientifically highly probable that climate change is a fact and that it is man-made. Hence, politics must act urgently, in particular, because the predictions for the second half of the 21st century are quite alarming, despite all its differentiations (a rise in temperature of 4 to 6 °C is possible – with an increase in desertification in areas that are already dry, an increase in floods and salinization of flat coastal areas, lack of drinking water and with other consequences that are threatening the economy globally). As the climatic effects of CO_2-emissions will materialise with a delay of several decades, we must determine the course of limiting and finally reducing carbon dioxide emissions in the next ten years. Until 2050, the global halving of emissions is required; in the early-industrialised countries of Western Europe a reduction of 80 to 90 % will be needed.

4.2. "Peak Oil"

In the past decades, drilling for oil saw a steady increase. Production and consumption of oil have reached unprecedented heights. However, many things show that "peak oil" will be reached soon, and even exceeded. Since 1965, reserves added annually are on the decrease; since 1980, annual consumption has always been higher than the amount of new explorations. Despite the fact that the oil-price increase of the recent past depends on many factors, a range of experts still consider this increase to be structurally caused: shortage is looming and will certainly become acute. Will we experience a new "Cold War" for oil and other non-renewable resources (in the case of fossil fuels particularly also gas)? Competition will become more aggressive – between the industrialised countries of the Western world and the big threshold countries such as China and India. Not only a "Cold War" will take place – in many violent conflicts around the world it is all about oil: the wars in the Persian Gulf (Kuwait, Iraq), the military conflicts in the Caucasus (eg. Chechnya) and in Afghanistan (both regions play a role as strategic corridors for transporting oil from Central Asia), the wars in Darfur (in the background also a war for oil resources between China and France). And the Islamist terrorist attacks have to be seen as a result of the oil crisis – even if one applies the much needed reluctance to only accept monocausal explanations.

For the reasons mentioned, fossil energies are only a very limited and finite option for the future. There will be natural gas on the market for a bit longer and for reasonable prices, but even there, shortage will be felt in the coming decades. In case of hard coal, the timeframe maybe much longer (measured in centuries) – however, it has the most unfavourable CO_2-balance (the worst fuel value in relation to the emissions). Technical solutions may defuse the problems slightly (gas and coal can be transformed into oil – with a relatively low yield; carbon dioxide can be partially collected and stored underground – but this procedure is not yet tried and tested). We must look for other valuable options somewhere else.

Two areas in particular correspond to the "Chances" mentioned in the subtitle: Energy efficiency (the saving of energy) and renewable energy sources.

4.3. Energy Efficiency

The increase of energy efficiency is undisputedly the key to future energy policies, because no change on the side of production will be able to solve the problems, if we do not exhaust all improvement potentials on the side of consumption. And it has been proven several times since the 1980ies and 1990ies that this potential is huge – using popular key words such as "Factor 4" (v. Weizsäcker, Lovins and Lovins) and "Factor 10" (Schmidt-Bleek). Here, we need to distinguish two levels – in the flow of energy from the raw material to the service:

- The transformation of primary energy into final energy;
- The use of final energy.

An instructive and essential example of efficient transformation is the combined-cycle gas turbine station. When burning natural gas, energy is produced by a generator. In an old-fashioned power station, the waste heat is lost. In the combined-cycle gas turbine station, this waste heat is used to produce a steam flow driving a second turbine and a second generator. The power yield is thus much higher. Still, there is residual heat, but it is used as heat. The efficiency is again improved – by a differentiated use of the generated energy forms.

There are further procedures: the fuel cell (much discussed in the framework of a possible long-term realisable "hydrogen system") and the heat pump, which can be understood (physically not entirely correctly but pragmatically) as an increase in efficiency (by a factor of 3) in heat production with electrical power. At the same time, cold is being produced – which can also be used in the most efficient case.

Pumped-storage power stations are used ro adjust production to time oscillations of consumption; despite several transformation losses (which in an ideal case could be avoided), they contribute to efficiency.

The use of final energy holds a huge unexhausted potential in energy efficiency. 40 % of final energy is not used, corresponding to a total of 10 billion Swiss Francs a year. Official estimates (Swiss Federal Office of Energy SFOE/BFE) assume that in the building sector 50 to 70 % of energy could be saved by implementing technical improvements. Yet, here we are faced with the difficulty that the renewal cycle of the building sector amounts to decades. In the case of vehicles, or household and trade appliances, technical improvements can be implemented much faster, as their life cycle is not calculated in decades but in years. Imports must be considered as well in these efforts, as the implicit or hidden energy of goods that are imported ("grey energy") increases the actual energy needs by 20 to 25 % of the domestic primary energy consumption.

Looking at energy services (and this is what really matters), one can compare saved energy with particularly intelligent energy production. Here, the American energy expert Amory Lovins has coined the nice term of *"Negawatts"*. Negawatts have no competition and are economical and environmentally-friendly.

4.4. Renewable Energies

In the case of renewable energies, only water power is relevant as to its quantities – at least in Switzerland: here, almost 60 % of total power production is covered by water power (large power stations). Very high rates of increase, however, are conspicuous in the use of other renewable energies. This is for example true for wind power, with less convenient conditions in Switzerland than elsewhere, but in view of a European combine still being of great interest (the power supply in Denmark is already covered by 20 %, in Spain by 30 % with wind power). Equally, the natural heat of the earth will probably be much developed in the future – serious problems in the case of pioneering projects, such as *"deep heat mining"* (Basel) should not make one forget the fact that there are a lot of small and medium-sized applications that are tried, tested, and safe. Solar energy has been strongly developed in countries that have pushed a forward-looking energy production policy (Germany, Austria), even in

minor areas such as hot water generation, and increasingly in power generation (photovoltaic conversion). It is striking to see how the social profile of the promoters has changed in this field. In the past, we saw "alternative" pioneers installing such plants, however today, we witness innovative forces in all walks of life including the economic world.

Biomass of all kinds can be considered a renewable energy, when we can talk of a raw material that is actually "growing back" – i.e. renewable primary products. The best example here is the sustainably managed forest. Wood from such a production is an important renewable energy with interesting opportunities of transformation (gassing, carbonisation). The situation of directly or indirectly agriculturally generated bio-fuels is more complex. There are clear reasons why they are increasingly propagated as "Agro-heat-fuels " und "Agro-fuels". Of course one can use the argument that they are climate-neutral: the carbon dioxide, generated by the burning procedure, is absorbed by the plants growing back. But the argument is only partially valid, because intensive farming consumes fossil energy. On other continents (South America, Africa), huge forest areas are clearcut for bioethanol and palm oil production. Also, chemical fertilizers are neither climate-neutral (nitrous oxide), nor sustainable. The competition between food production and energy production – even using the same plants at times – turns out to be very problematic in North-South relations. This is one reason for the dramatic rise in food prices since 2007.

Energetical recycling of waste is a borderline case of renewable energy – often it makes very much sense in the real given system of economy and consumption, but if one checks it against the criterion of sustainability, then for example biogas only comes close to, and waste incineration corresponds partially to, the requirements of sustainability.

Nevertheless, the increasing use of energy from biomass has a potential in overall terms and in comparison with fossil energy. Positive technical developments are foreseeable, as for example the use of the entire plant mass (bioenergy of the 2nd generation) instead of only one tiny

part that is energetically of particular interest (rape seed oil; bioenergy of the 1st generation).

4.5. Nuclear Energy

At present, nuclear power makes a quantitatively relevant contribution to Swiss power production (approx. 40 %). In real terms, nuclear power stations are steam turbines (with an efficiency potential that has been so far neglected), the heat generation of which is based on the decay of a radioactive element. The second possibility, namely generating a thermic reaction through nuclear fusion, has been investigated for many years (in the European area with the ITER project); yet, if and when this technology will be ready to be applied is uncertain.

The nuclear power stations in use today are those of the 3rd generation. Their fuel element is a rare form of uranium, the nuclide U235. The shortage of this energy raw material is foreseeable (the reserves will last for another 30 to 70 years, maybe longer, depending on the number of nuclear power stations of this type, that are built all over the world). This is why the development of nuclear power stations of the 4th generation is pushed; here, the fuel element is thorium or plutonium. Due to the dangerous character of plutonium, these "fast breeders" are extremely controversial. Their advantage consists in the fact that there is no possibility of a nuclear chain reaction.

There is no experience with the disposal of radioactive elements yet. Here, we mention a technically complex project which is burdened with a lot of unpredictabilities. We expect useful information from subterranean lab examinations, yet the extremely long storage duration (half-lives of up to several million years) exceeds every politically reliable planning for the future by orders of magnitude. Another serious worry is the increased risk of terrorist activities – here, a nuclear power station could represent a highly sensitive object with a huge damage potential.

What speaks in favour of the civil use of nuclear power is the fact that it only generates small amounts of carbon dioxide (nothing at all in

the process of nuclear reaction; merely the operational context of uranium mining involves emissions). The high energy density of nuclear fuel and the fact that electricity is produced, that is, a versatile "noble" form of secondary energy, can also be mentioned as being in favour of nuclear energy.

Apart from various aspects of security, its huge system inertia is also another argument against nuclear power. This is a disadvantage in times of transition during which short-term adjustments are useful. Simply stated, the operation of nuclear power stations are not very flexible in this respect – every turning off and on again is expensive. Planning and building nuclear power stations take a long time (15 to 20 years), equally, the dismantling after the end of the operating period is a time-consuming procedure. We already mentioned the extremely long periods that need to be considered when storing highly radioactive waste. Finally, this energy technology is situated in a scientific-technical-institutional environment that is relatively closed; it has to live up to a high demand for specific competences, which so far has not been too accessible to diversification as a condition of flexible reorientation. In recent times, economists have voiced their scepticism; they doubt that private investors are to be found in a liberalised energy market who would find a nuclear power plant project interesting despite its risks.

The contribution of nuclear power to the global energy supply has been quite modest so far (2,5 % of overall primary energy, 7,5 % of commercial primary energy). Due to the already mentioned long planning phase, it is hardly possible to imagine a short-term pushing of nuclear power by using climate-political reasons, and such a procedure would not meet any targets. The overall assessments of nuclear power are not uniform, the polarisation of opinions is very large with all the inherent unproductiveness of a ritualised conflict.

It is decisive that the energy debate should not be limited to nuclear power only.

5. Towards a New Energy Age: Ethical Assessment of Swiss Energy Scenarios

The interplay of energy supply and energy consumption with the respective social data, such as population development and societal and economic forms, as well as value systems, forms a technical and social energy system, as we saw in the definition of the energy age. This synthetic view is also used in political consultations – by means of developing energy scenarios. Scenarios are not to be confused with "forecasting" the future, but are deductive analyses with conditional statements ("if – then"). Scenarios make determined basic assumptions (they establish framework) and try to show with the help of models what the results of these assumptions are. Scenarios are there to support decision-making processes. Either they show what happens if certain measures are taken (measure-oriented scenarios) or – in a reverse way – which measures must be taken in order to reach certain goals (target-oriented scenarios). Scenarios are always connected to specific values: political measures and goals are decisions based upon certain value systems. They disclose normative ideas. This is why scenarios can also be compared in ethical respects.

5.1. Four Major Energy Scenarios

At the beginning of 2007, the Swiss Federal Office of Energy (SFOE) presented the results of a three-year study of energy perspectives for a time horizon of 2035. A two-stage approach is applied. The most comprehensible and important element is the ideal representation of four possible basic patterns of future energy policies. These scenarios I to IV are characterised by slogans:

- Scenario I: "No change of procedures";
- Scenario II: "Strengthened cooperation";
- Scenario III: "New priorities";
- Scenario IV: "On track to the 2000-Watt-Society".

In a second stage, the four basic patterns are varied as to technology and structure – depending on the kind of provided or propagated electricity supply. A to G represent the following "variations in offer": A = nuclear; B = nuclear and fossil-centralized; C = fossil-centralized; D = fossil-decentralized; E = renewable energies; F = changed time of operation (of nuclear power stations); G = import (electricity imports). The variations in demand are only mentioned in passing.

The four energy scenarios can be divided into two groups. Scenarios I and II are *measure-driven*, scenarios III and IV are *target-driven.* The four scenarios are now to be characterised and assessed in comparison to each other.

Scenario I "No change of procedures" is a so-called *reference-scenario* based on today's valid energy policies and considers an increase of energy efficiency through technical progress and growing price pressure due to energy shortages.

Scenario II "Strengthened cooperation" is based on a more intensive process of reaching agreements in politics and the economy, and thus depends on the voluntary nature of actions. Rules and regulations are only made more rigorous in a moderate way, CO_2-charges on fuel will be introduced (that has become the reality in the meantime) and promoting instruments are clearly strengthened. A cost-covering refunding system for feeding power from renewable energies into the mains supply is planned (this has also somewhat materialised).

Scenario III "New priorities" assumes that the political priorities will be completely changed on the national as well as international levels. Climate protection, energy efficiency, careful resource management, and promotion of marketable technologies receive a high emphasis. An essential instrument is the increase of the price of non-renewable energy and of power by introducing a steering levy (as of 2011). In order for such a scenario to be successful, goals and instruments must be harmonised to a large extent on an international level. Besides, specific energy consumption standards are required for buildings, appliances, etc. The great demands of an affluent society are not considered in this scenario, they are the same as in scenario I.

Scenario IV "On track to the 2000-Watt-Society" sets a sustainability target in advance. This target was developed by experts of the Swiss Federal Institute of Technology Zurich as a result of the Rio-summit of 1992. These experts calculated that assuming living conditions to be comparable on a global level, a permanently used power level (in other words average energy consumption) is not to exceed 2000 Watts per person. However, each inhabitant of Switzerland presently consumes 5000 Watts; and taking the imported "grey energy " into consideration – depending on the assessment – even up to 9000 Watts. The overall energy consumption therefore must be reduced by a factor of 3 – if expressed in a simplified and careful way. What makes the situation even worse is the fact that approx. 3000 Watts are made up of non-renewable energy. Here, it was assumed that from the climate-protection point of view, only 500 Watts are admissible – which means that the consumption of non-renewable energy needs to be reduced to one sixth. This is in relation to the order of magnitude, which has also been discussed since the UN-Climate report of spring 2007. For the time period under review up to 2035, we talk about a saving of 35 % in fossil energy.

The political instruments are comparable to those of scenario III, yet with even more drastic effects. In particular, the marketability of new key technologies must be improved fast and in a decisive way. Structural changes are unavoidable (work at home and other measures to reduce commuter traffic; compact building and urbanization). Renewable energies become the standard in heat generation. Compared to scenario III, efficiency regulations are tightened and implemented in an accelerated way.

5.2. Comparative Ethical Evaluation of the Swiss Energy Scenarios

If one assesses the four scenarios superficially, then *those that are target-driven are preferred from the start.* This is understandable, as the basic values of freedom, sustainability, participation, and peace, in line with their application-driven maxims, set the standards valid for the entire society. But these standards can only become effective as a political target setting. Nevertheless, such a procedure would be too simple. Previous trends with all their inertia and steadfastness must be considered. Opposition against changes must be taken seriously.

One of these serious trends is the continuous growth of energy consumption. Nevertheless, this growth has slowed since the seventies and, since 2000, it has become apparent that the peak may have been reached. Growth has clearly slowed down, but it is still there. In scenario I, it is assumed that the final energy consumption remains more or less at its current high level (-3 % up to 2035). Only in scenario IV is a considerable reduction by almost one third planned (-31 %; II: -9 %; III: -18 %). One can easily imagine that such a turnround can only be reached with truly innovative political means.

In the case of power consumption, the constant growth is even more evident. The curve almost does not level off, all scenarios assume that up to 2012 power consumption will grow further. Only by 2035 does an opposite development become apparent (scenario I: +29 %; scenario IV: -2 %). The almost invisible drop in scenario IV has to do with the shifting effects (the promotion of heat pumps and railroad traffic produces additional power consumption; in a positive sense, one can at least say that power consumption nevertheless does not grow).

Yet, in these scenarios lies an increased *gap in provision*: power demand grows more and more beyond the offer. This has to do with the fact that relevant power import contracts will phase out in 2020; at the same time, the first nuclear power stations will have reached the end of their operating period (Beznau I and II, Mühleberg). If these are not replaced, it seems that there will be a dangerous electricity gap.

The discussions on the term of an electricity gap are very controversial. Critical voices point out that Switzerland is easily capable of providing for itself on a liberalised European power market without exclusive supply contracts. It is said that an outdated ideal of national self-sufficiency must be replaced by the awareness that a European association of power companies is the solution. Then, the real problem may be the price of power, but not the lack of power. After all, the electricity gap is not the same in all the scenarios: in scenario IV, it amounts to 9 %, in scenario I, 31 % of national power generation. Political measures to lower demand will make sense at any rate. They open room for manoeuvre for future politics and appear at first glance to be liberal in a seemingly paradoxical way.

The objections that are raised against the feasibility of policies that are inspired by scenario IV (and scenario III) concern social interaction, the legal authority of the federal government and international harmonisation. Here, we talk about factors that are not easily discerned, but are always connected to political intentions. Social cohesion, a living federalism in solidarity, European integration, and a contracted binding order in the global community ("global governance") are concerns that the FSPC has time and again supported and represented in public. The Swiss Federal Office of Energy states that "passing social tensions as a result of a forced policy in the direction of a careful management of resources " cannot be excluded, in particular in scenario IV. The SFOE adds: "Due to the greater dependency on energy imports and the necessity of bigger gas power stations or of nuclear power stations, scenario I is also highly susceptible to conflicts."[1] The following assessment is added: "The supply risks up to the time horizon of 2035 are less found in the limits to fossil energy resources, rather they lie within geopolitical conflicts."[2]

In the end, the motive of the *"paradigm shift"* (as mentioned in the report of the Swiss Federal Office of Energy in view of scenarios III

1 BFE, Energieszenarien 2035, I, Berne 2007, 106 and following

2 see above, 101.

and IV) or rather the challenge of a collective renewal, of a process of mourning as a precondition to enacting positive change may help in the decision-making processes that are imminent. It becomes clear that even the seemingly realistic scenarios I and II have a considerable price, although they are not strikingly forward-looking and although they isolate themselves to a large extent from global sustainability requirements, from peace (geopolitical stability), and from intragenerational and intergenerational justice.

Therefore, the political strategy that is assumed in scenario II does not correspond to the requirements, even if one has to admit that this concept would honour a well-established practice of democracy by consensus and the partnership between state authorities and social partners.

As to scenario III, one needs to say that the present development of public opinion has awarded a certain de facto plausibility to it. For the "new priorities" that it presupposes in the near future largely relate to climate protection. And here, the awareness of the existence of problems, and probably also the readiness to support certain political decisions, have clearly grown. But it must be criticised that this scenario does not yet include visible structural changes. Regional development planning, urbanization, traffic policies are all not yet consistently included in energy politics. This is a marked weakness of this particular scenario.

In the end, a comprehensive re-orientation of energy policies according to scenario IV indisputably corresponds to the ethical criteria and the necessary transition into a new energy age. One can question why the Swiss Federal Office of Energy postponed the time limit to reach the 2000-Watt-Society until 2100. Efficient climate protection (according to the criteria of the 4th IPCC-report) and climate justice put the limit at the highly demanding target year of 2050. It is rather important to really introduce the necessary re-orientation in the years to come – as these will be decisive years in terms of climate policies.

6. Courage and Means to Change

How can the 2000-Watt-Society be realised? And what can the churches contribute?

Since the 1970ies, one points to a new exemplary **lifestyle**. In particular, committed members of the reformed churches have implemented such a lifestyle, also in Switzerland (Zurich, Geneva). It is interesting to observe the recent past and to see how evangelical Christians in North America and in other countries discovered the importance of a lifestyle that is credible in the Christian sense when it comes to energy and climate policies. These Christians even defend their new lifestyle against all forms of opposition. But they also had to learn: individual initiatives by some people or groups are not enough, even if they are important. Much rather, we definitely need political framework. In the meantime, even traditionally rather "unpolitical" evangelical Christians demand an **ecological tax reform**, that taxes resources and not labour.

Apart from the earlier *fiscal instruments* (in particular the CO_2-steering levy on fuels) others must follow (CO_2-steering levy on fuels, energy tax, power tax).

The *criteria of how to tax vehicles* must be changed and switched over to fuel consumption (Bonus-Malus). This is also true for the import tax on imported cars. Here, an international harmonisation is necessary, in particular in relation to the European Union.

Another important field is **technical standards**. This discussion may not be limited to some alibi-objects. And it is not about banning symbolic objects, as one may believe at first glance (the classic light bulb, four-wheel vehicles). But consistently stricter standards are required that declare the best inventions from an energy-point of view to be the binding state of technology.

The **municipality** carries responsibilities that should not be underestimated. Approximately 75 % of carbon dioxide emissions are produced in **cities**. The award of being a real "energy-conscious city" has given several Swiss cities pride and a collective identity that rubs off on its inhabitants (eg. Lausanne, Neuchâtel, La Chaux-de-Fonds). Even a border-crossing region such as the *Regio basiliensis* obtains a share of its attractive profile from an active innovative energy policy.

This is also true for **companies**. If bp now calls itself *"beyond petroleum"* (BP, the traditional British Petroleum is only a subsidiary), it polishes the bp-image, but at the same time it is also a publicly proclaimed demand, which cannot be ignored with impunity in the long term.

It is remarkable that Switzerland has produced internationally renowned **pioneers of solar-driven vehicles** on water, in the air, and on land: the solar race car Swiss-spirit (successor of the famous "Spirit of Biel"), the solar boat Sun21 with its crossing of the Atlantic ocean, or the solar airplane project Solar Impulse of Bertrand Piccard.

It is important that **churches as well** realised their message as to energy issues in their own field. At the same time, they have a religious, spiritual job consisting of encouraging people to be ready for the required changes.

For a **church in reformation** this should not be too difficult, because the protestant churches originated from **the times of change** in which it was no longer possible for a re-orientation to be postponed. In this respect, we believe that in particular our evangelical churches can no longer deny the challenges of a post-fossil age; also, in this time of changes, they are required to contribute.