The Oil Drum: Europe
DISCUSSIONS ABOUT ENERGY AND OUR FUTURE

Planning for Europe's Energy Future: My Submission to the Commission's 2010 Consultation on Energy

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Europe is finally starting to think about its longer-term energy issues, and how they affect transportation plans. To try to deal with these issues, a new European Energy Consultation was set up, specifically to look into these issues. The European Energy Consultation asked for interested individuals to provide their input.

I decided I wanted to be one of these interested individuals. Below the fold is my submission. There are two major sections to my submission:

1. A **Fossil fuel background** section which covers

- Oil supply issues
- Natural gas supply issues
- Coal supply issues
- Fossil fuels and the economy

2. **Strategies to move Europe away from fossil fuels**. These strategies are broken down into the following areas.

- Efficiency
- Electricity generation
- Freight transport
- Passenger transport

I believe an energy policy directed at fossil fuel scarcity is of first importance to Europe. In fact, its very survival and cohesion may rest on its ability to meet these challenges. It is for these reasons, I decided to make this submission.

This is a crosspost from the European Tribune.

Address to the Commission's 2010 Consultation on Energy

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1 Introduction

This document is a response to the Energy Consultation launched by the European Commission in the first half of 2010. This consultation is part of a process that shall take the Commission to a new Energy Policy Programme a few years from now.

After 6 years with energy prices much above the low levels that were the norm during the previous two decades, the European Union is finally taking into due consideration this crucial sector. It is now contemplating an economy highly dependent on foreign energy, together with meagre and dwindling traditional sources of indigenous energy. As it stands, the socioeconomic model the European Union is built on simply doesn't seem able to remain in existence using traditional sources of energy, especially fossil fuels. This has lead to the Programme known as 20-20-20, that among other things, aims at increasing energy production from renewable energy sources and efficiency. This Programme is rather limited in many areas, and in others it contradicts itself or is contradicted by other Communitarian policies.

It is more than time for a new, serious and all-encompassing Energy Policy for Europe. Otherwise the survival of Europe itself is at stake; and not only the European Construction project, but states themselves may disintegrate if they are not willing or capable of tackling the transition due ahead. Simply put, there's no Economy without accessible and secure Energy, and without an Economy there's no Social State.

This document is divided into two sections, one outlining the Background, where Europe is situated in today's world energy market, and a second presenting a possible Policy, congruent with the given panorama, establishing goals and pointing out possible means.

Some deeper issues that are either closely related to, or at the root of, today's energy problems are not addressed in this document; two obvious ones are Population and the Monetary System. Essentially, the Policy presented assumes implicitly that Economic Growth is viable in the future. The aim of this document is to present practical options that can be easily grasped by lawmakers and stakeholders in general, leaving outside more complex concerns, that though important, should be discussed in a different context.

2 Background

This section tries to explain why in recent years, energy keeps coming back as a public concern and why stakeholders have been dedicated to it more than usual. Each fossil fuel is briefly analysed separately, with a few observations regarding the expected evolution of its availability. Finally, some reflections are made on the consequences to Europe's Economy.

2.1 Oil

Oil prices began to march upward in 2004, a pattern that would last for almost 4 years, slowly breaking all previous records. Even in the wake of the hardest Economic recession of the last 30 years, oil prices are today about four times what they where a decade ago. These continuing high prices have lent credibility to those who for many years have warned about impeding difficulties in continuing the growth in world oil production that has existed for the past two decades. Notable among those giving warning are Colin Campbell and Jean Laherrére [1], Richard Duncan and Walter Youngquist [2] and Kenneth Deffeyes [3] for their oil production forecasts and Ali Bakhtiari [4] for his price predictions.

The constraints to oil production growth have today been acknowledge by most, even by the Industry itself [5], as shown by Figure 1. Also notable have been the implicit warnings issued by the IEA, that despite publishing production scenarios that each year match demand, have been vocal in other contexts explaining how unlikely it is that the scenarios presented will actually happen. Its Chief-Economist, Fatih Birol [6], has been particularly outspoken in this regard.

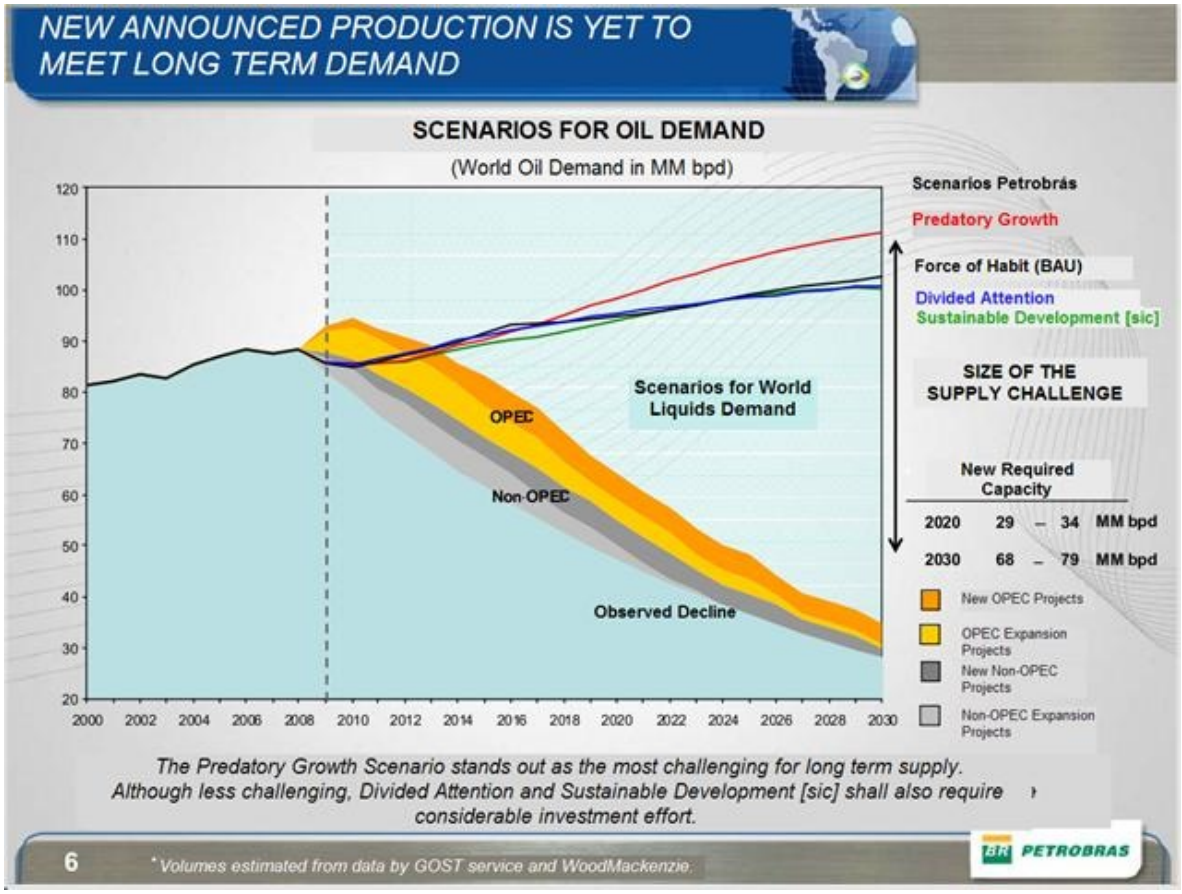

Figure 1: Future World Oil production and Demand forecasts according to Petrobras.

Peak Oil, as it was named by Colin Campbell, is a pretty palpable reality at this stage, but for Europe reality is bit more complex. Only one of its states is a net oil exporter, with most meeting their needs fully with imports. Figure 2 presents the volumes of oil made available at the international market every year by all the relevant exporters and a forecast of how this will change in the future. International oil trade peaked in 2005 and has entered a permanent decline; moreover, this decline will likely accelerate during the next decade, by 2020 removing between 1/3 or 1/4 of the volume of oil available in the market in 2005. This has been the main reason behind the high price environment of the past 6 years.

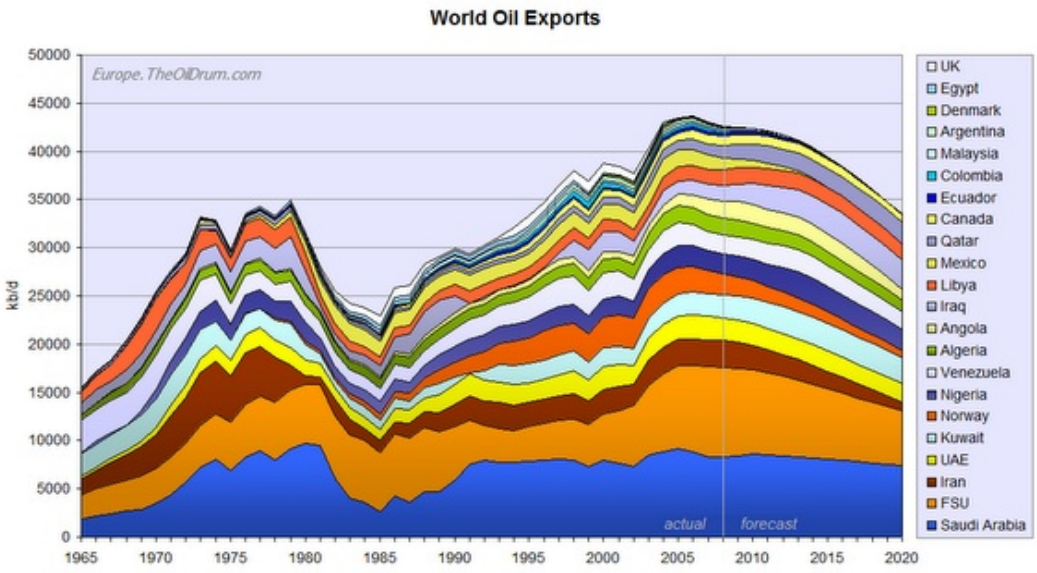

Figure 2: World Oil Exports, past and projected.

But Europe's woes can be expected to deepen further, as its most important suppliers, Norway and Russia (which supply Europe almost exclusively) are themselves entering terminal production decline. Within a decade Norway's oil exports can be expected to be a small fraction of what they are today; Russia's exports are likely to be cut in half in the same period.

It is hard to envision how Europe will fare in this race for the dwindling international oil market. One thing is for certain: Europe, with its heavy foreign dependence and its now very small internal production, is the Economic block with the most to lose.

2.2 Gas

A Peak of world Natural Gas production is not something to expect in the short term. Although some have pointed to such possibility, even independent researchers usually position the peak some decades away. Today, with the development of unconventional reserves in North America, terminal decline in that region at least has been postponed for some years.

But Gas is not a fungible commodity like Oil. Its trade is mostly regional, reliant on pipeline deliveries. Europe's access to this energy source must be viewed considering this geographical restriction. Imports equate to about 60% of consumption. This gas is supplied by three neighbouring blocks: Russia, Norway and the Magreb (North Africa). Norway is now reaching its production peak for gas, and a marked reduction in exports can be expected in the next decade. Russia is not yet near such a decline. It is likely that Russia can maintain present production levels during the next fifteen to twenty years; the question regarding Russia is its internal demand, which has been slowly eroding export capacity. A best case scenario for Russia would seem to be the maintenance of present gas exports to Europe at current levels. The only export capacity growth that is expected is from the Magreb, though not in sufficient volumes to fill the gap created by the other two neighbouring suppliers.

Compounding the problem with imports is declining internal production. Since its peak in 2001 during the golden days of the North Sea, gas production in Europe has been slowly declining, and this decline can be expected to accelerate into the future. A huge gap will open between production and a relentless demand that up to 2008 had been growing 2% annually. Euan Mearns [8] produced an analysis of the European Gas Market in 2007 that detailed these issues. A summary is presented in Figure 3.

The only way to match an annual demand growth of 2% would be by importing all the Natural

Gas traded in the world by ship in liquid state. The likelihood of that is very slim, especially in the face of competition from emerging economies.

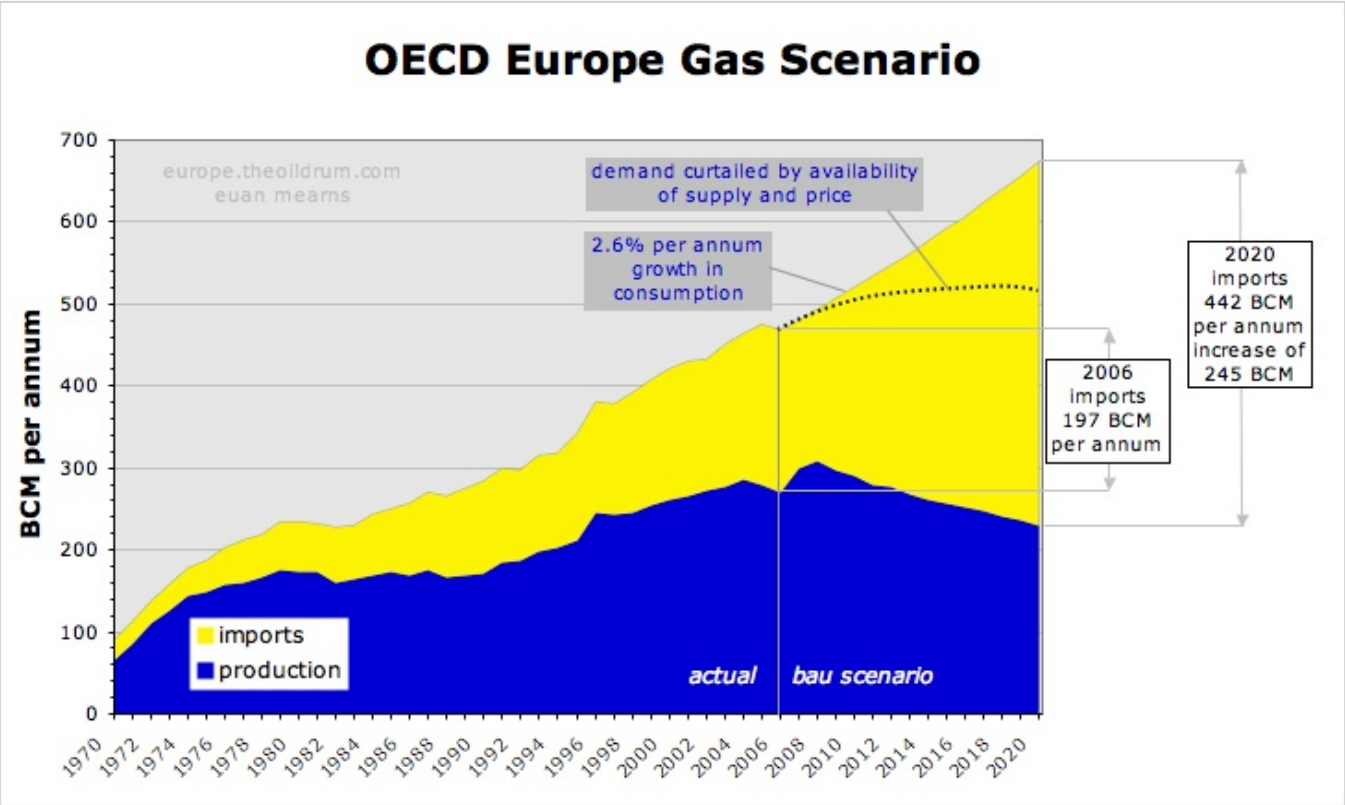

Figure 3: Gas scenarios for OECD Europe summarising the indigenous supply forecasts and demand forecasts.

In Europe, but especially in the United States, Natural Gas has been used as a campaign flag by some politicians, promoting it as a benign or beneficial energy source, in some cases even suggesting the idea of a non-fossil origin [9]. This has created the false impression that Gas may be the answer to most, if not all, of the world's energy problems. The United Kingdom, for instance, is expecting to be generating two thirds of its electricity from Natural Gas a few years from now; how that will be possible is uncertain.

2.3 Coal

As with Gas, a peak in world Coal production is not expected in the short term. And unlike the two previous fossil fuels, reserves and future production profile estimates have yet to converge. Predictions exist for a world Coal Peak between 2025 and 2060, leaving unanswered the question of whether it can ever surpass today's energy flow from Oil.

In the short term, Coal presents different challenges, stemming from the relatively small size of its international market; most of the Coal mined in the world is consumed within the borders of the countries producing it. Coal consumption in the EU has decreased dramatically in the wake of the economic crisis (down 17% since 2008), but it still is the main source of baseload electricity in most states, with 45% of it being imported. Conversely, the emerging economies are consuming a great deal more coal. In 2010, India alone is expected to consume more Coal than the EU for the first time in history. As for China, it consumes almost half of all the Coal mined in the world, almost six times what the EU consumes and this amount is growing at close to 10% per annum.

So far China has remained Coal self-sufficient, despite some sporadic periods when it had to temporarily purchase supplies from the international market. One of these periods took place in

the Spring of 2007, at a time when prices in Europe were around 45 $/tonne. China became a net importer of Coal for a few months and even after closing the gap later that year, faced a harsh winter in the early weeks of 2008, that compromised mining and transport, prompting shortages in most of the country. By this time Coal was being traded at the Amsterdam port for more than 140 $/tonne [10]. It took less than 12 months for Coal prices to rise by as large a percentages as Oil prices had risen in four years.

Coal Consumption in Asia is growing so quickly that episodes like the 2007/2008 crunch may become permanent. The IEA expects China and India together will generate demand of over 110 Mtoe in the international market by 2015 [6]; this figure is very close to what the EU imported in total in 2009. Can the international market cope with such a demand surge? Of all international fossil fuel markets, Coal may well be the one yielding the greatest surprises for the next decade.

2.4 Fossil Fuels and the Economy

High energy prices had been the omens of Economic Recession during the XX century, once it became clear in 2004 that OPEC was unable to rein in oil prices, many were those announcing an imminent crisis. The shock did not come until 2008, when high energy prices coupled with rising interest rates dried up household spending and triggered credit defaults throughout much of the OECD. This crisis revealed serious fragility in the financial system with over indebtedness by households, companies and states.

In Europe, this recession had different impacts on different states, but immediately threatened liquidity all across the bloc. This was dealt at the time with state guarantees on private bank credit, but with economic activity nearly stalled, it evolved into a crisis of confidence ins state solvency. This confidence crisis affected only some states, particularly those in the Eurogroup with large budget deficits, though they are indebted mostly to other EU states. But it is important to note that those states that are today in the most financial trouble are exactly those most reliant on Oil as their primary energy source [11], as Figure 4 shows.

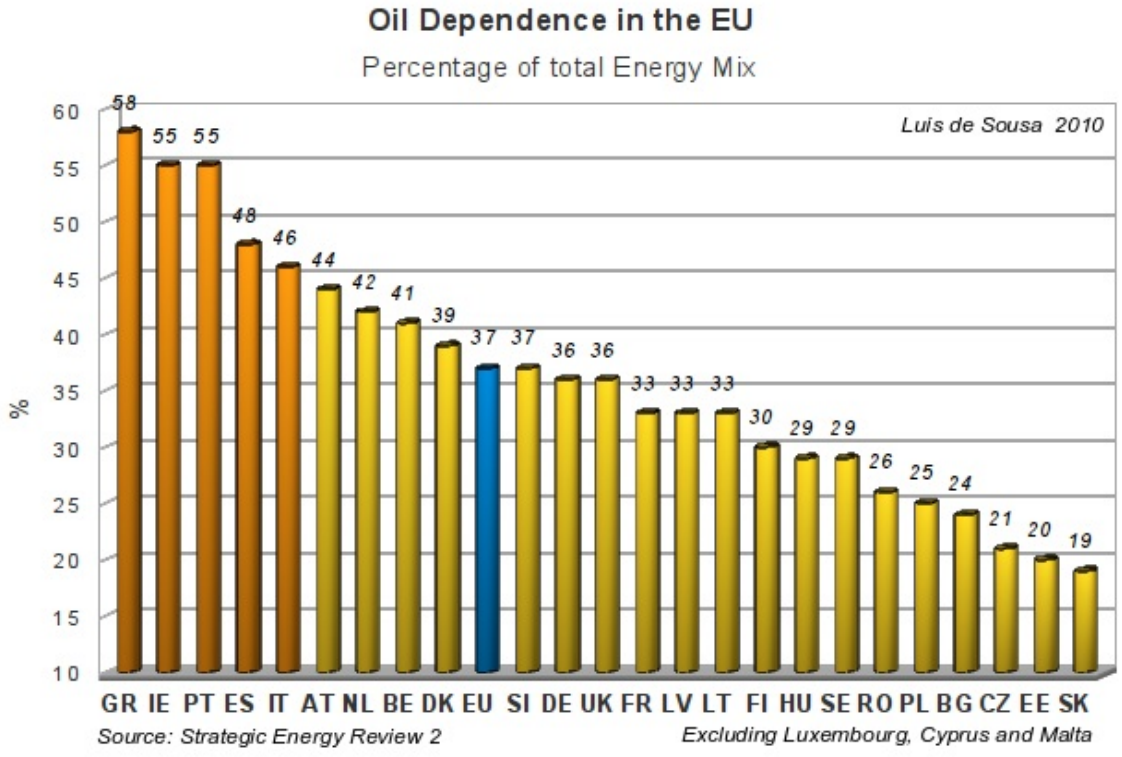

Figure 4: Oil dependence by state in the EU.

There may be several reasons for this coincidence, but it clearly shows that fossil fuel dependence is having a determining role in the present crisis. Moreover, it also indicates that a Pan-European scope is indispensable for an effective Energy Policy.

The Economic Crisis has now continued for almost two years. GDP numbers may have grown occasionally, but unemployment figures are still high and in some cases still growing. At the same time, oil prices remain about 2.5 times what they where back in 2004. An economy based on fossil fuels will always have little room to grow while supplies of these energy sources remain constrained. This low growth, high unemployment environment can be expected to continue for as long as Europe keeps its dependence on foreign supplies of fossil fuels.

In fact, this crisis is facilitating an important shift of fossil fuel usage from the OECD to emerging economies [12] as Figure 5 portraits. These economies function on much lower energy per capita requirements. As a result, they seem to be more resilient to the present constraints in the international market. An unsustainable economic paradigm is coming to an end. If economic recession is the only way for Europe and the OECD to reduce its reliance on fossil fuels, then economic recession is what it will be.

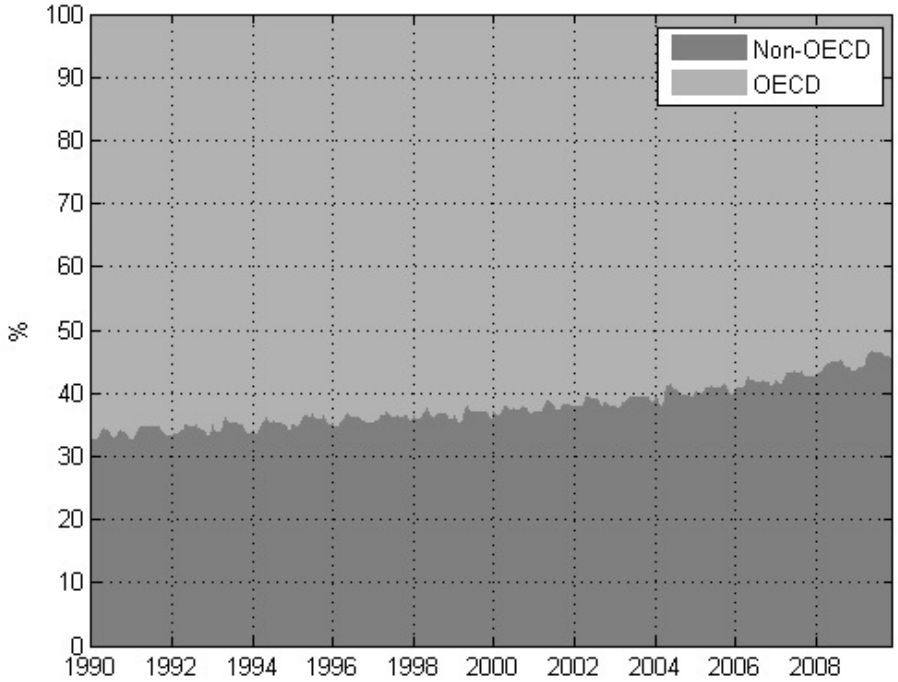

Figure 5: OECD and Non-OECD shares of the world total liquids consumption (EIA data).

Already under strain, the socio-economic model under which Europe is built on will eventually cease to be viable under this fossil fuel paradigm; the Europe Project is likewise at stake. The European goals of Harmony, Solidarity, Equality and Freedom cannot be defended using the present, defunct, energy paradigm.

3 The Policy

The Energy Policy elements presented are here outlined using the Business Motivation Model (BMM) framework [13]. This framework is structured to organize business plans in a way to make them easy to understand, follow and maintain[1]. It is composed of three essential elements:

- **Ends** - the future state the business hopes to reach;
- **Means** - the methods that will be employed to reach those ends;
- **Influences** - things that impact or constrain the business;

In this analysis, only Ends and Means are considered; an assessment of Influences is outside the scope of this document. "Ends" breakdown into three types of ever more detailed categories:

- **Vision** - a single sentence summarizing the hoped-for business state;
- **Goals** - conditions that must be satisfied on a continuing basis for the business to attain the Vision;
- **Objectives** - specific, measurable and time-framed targets that the business must achieve to fulfill its Goals;

Means breakdown in a similar hierarchy:

- **Mission** - a single sentence defining the business operation that can make the Vision a reality;
- **Strategy** - macroscopic course of action that takes the business to its Goals;
- **Tactic** - specific activity that implements a strategy;

Translating this framework to an Economic or Policy Programme, Vision and Mission can be seen as the digest of its grand objective, a direct way to make its purpose explicit. Goals and Strategies define the next level, Ends that are either collectively perceived as relevant or imposed by circumstances; they stem from, and exist, mostly in a technical plane, largely disconnected from political philosophies. Objectives and Tactics comprise the bottom level of Policy application, corresponding to executive targets and initiatives. It is at this level of implementation that political orientation has the larger role.

This document focuses mainly on the higher-level of Goals and Strategies; no Targets are presented and only a limited number of Tactics are discussed. The intention is to simply show stereotyped courses of action, without diving into political or philosophical considerations.

At the Tactical level considerations on taxes may be made, such as "reflect the consumer electronics labeling framework into the taxing scheme". These references are always made in abstract, leaving open implementation options; for the example above, labeling could translate into a VAT rebate, a VAT increase or both. The taxing scheme can as well comprise individual or collective income taxes, all depending on each Executive's philosophy.

The proposed Policy is presented in the following subsections: firstly Vision, Mission and Goals are presented as a first macro-view with introducing texts outlining the overall aims. Then a number of Strategies are put forward and discussed for each Goal, with some tactics put forward in an informal way.

Each policy element is an index with a character reflecting its type and a sequential number reflecting hierarchy, e.g. the first goal is indexed as G1 and is supported by strategies S1.1 and S1.2.

3.1 Vision

A United, Solidarian and Egalitarian Europe beyond fossil fuels.

3.2 Mission

Move Europe and its Socio-Economic model to a non fossil fuel reliant paradigm.

3.3 Goals

G1. Efficiency - do more with less.

Former Energy Commissioner Andris Piebalgs once wrote that his favourite energy source was Efficiency, that could as well be turned into an Energy Policy motto. Efficiency measures are those that have greater impacts on the shorter time-frame, they dispense technological development and usually are not politically sensitive. Measures in this field must always have an important role in Energy Policy for an Economy like Europe's, given its reliance abroad. Unfortunately, some of the present policies included in the 20-20-20 package aim at exactly the opposite direction.

G2. Electricity Generation - on fully indigenous energy sources.

Electricity will become an even more important energy vector, as Europe shifts away from fossil fuels. Especially as Transport trades liquid vectors for electricity, generation needs shall increase by significant amounts. If electricity continues to be generated with fossil fuels (mainly Gas and Coal) the effect of this shift could even be negative. It is thus essential for Europe to move towards a fully renewable electricity market or at least fully reliant on indigenous energy sources.

G3. Freight Transport - out of the roads.

Well over half of the oil consumed in the EU is used for Transport. During the few months of 2008, when oil prices remained over 100 $/barrel, it became apparent that the road infrastructure isn't viable in such environment, with strikes erupting all across the continent. Changing the transport of goods and commodities can represent an important reduction of Europe's oil dependence while having little impact on every day life. It is seamless to either the manufacturer or the client if some merchandise moves on rail or by ship, instead of the road. Moreover, much of the infrastructure to make such shift already exists, perhaps simply needing maintenance. Implementation could be made progressively, first on inter-state transport, then on inter-city and so on.

G4. Passenger Transport - a new concept of individual travel.

Today individual travel is performed mainly on two modes of transport: by road car (inter-city) or by air-plane (inter-state). Both of them are now highly reliant on oil, with aviation being 100% reliant on jet-fuel and no serious prospects for an alternative. Substituting these two modes present two different challenges: the airplane's speed (travelling at 900 Km/h) and the individual car's flexibility (being simultaneously a commuter, a small freighter and a mid-range vehicle). Overcoming these two challenges shall require a new concepts of what travelling to another state or to another city may mean, but it is imperative that it takes place.

Humans cherish the concept of the individual vehicle for the perception of control it provides them, ready to travel long distances, to take loads to whatever location is desired, whenever an individual chooses. This versatility is a product of the low volumetric density of oil products. But in reality cars are confined to roads, constrained by its driver availability and being repetitively used as a simple commuters. Travelers will have to make similar concessions to the ones they do when traveling by airplane: being subject to a pre-determined schedule and route, travelling with strangers and using other modes closer to destination, but at closer ranges that the traditional interstate flight.

Like modern cars, airplanes are a bi-product of oil's volumetric density, allowing a heavy chunk of metal to rapidly cross the skies. Aviation does not seem to have any substitute for jet-fuel, because its fuel follows such tight specifications. In time, flying will likely become unaffordable to the majority of the population, something which, without mitigation, can have profound social and cultural impacts for Europe. Travelers will have to expect longer hours of inter-state travel, but if

these coincide with regular leisure or resting periods, their impact on daily life can be reduced close to zero.

3.4 Strategies

G1. Efficiency - Do more with less

S1.1. Abandon CCS targets

Carbon Capture and Sequestration (CCS) has no place in a fossil fuel constrained world, where the extra 30% to 40% extra primary energy needed to run such systems isn't available. The implementation of the existing CCS programme can be expected to have tragic consequences for Europe. Any targets on this matter must be scrapped immediately.

S1.2. Abandon agro-fuel targets

One of the 20-20-20 targets is a replacement of 10% of the transportation fuels used today in Europe with agro-fuels. To achieve that an area at least the size of Germany would have to be covered with dedicated crops [14]. This target will likely have to be met with imports, though of a more expensive and in much lower supply commodity than oil. There is no logic to justify such target, immediate scrapping is imperative.

S1.3. Re-penalise fossil fuels

In recent years a number of fossil-fuel based energy vectors have been promoted accross the EU, including Liquefied Petroleum Gas (LPG), Compressed Natural Gas (CNG) and jet-fuel. These vectors have benefited from tax breaks when used as transport fuels, something that makes little sense from a Energy Policy perspective. Fuel duties have played an important role in avoiding the higher energy per capita figures of other OECD members (e.g. USA, Canada), hence avoiding over-reliance on foreign energy. Moreover, these market biases have prompted owners to spend thousands of euros retrofitting their vehicles to use these vectors, a relevant investment that brings no efficiency improvement. There's no reason to differentiate between fossil fuel based vectors; all must be brought into the same tax framework.

S1.4. Use Thermal Waste Heat

Fossil fuels are primary energy sources that are transformed into motion or electricity by means of combustion. This is a rather inefficient process, where between 50% and 70% of the input energy is lost as heat. While recently combined cycle power plants have became the norm, targets must be set for an all round efficiency increase in electrical generation, including older power plants. Other tactics may combine to boost this strategy, such as the spreading of district heating systems, especially in northern states.

S1.5. Use urban waste

A process already in motion in some parts of the EU, that should also be turned into a European wide practice. Waste contains many different forms of matter that can be used as energy source, either by outright combustion or by processing it into useful vectors such as bio-diesel. This strategy can be seen as part of a larger Environmental goal of closing Society's matter cycle.

S1.6. Promote efficient consumer goods

Part of the Commission's present Energy Policy implementation is already a much wider Labeling

framework now extending to a great number of consumer goods. This initiative should be progressively extended to all goods that use energy or otherwise have a relevant impact on energy efficiency (e.g. car tyres). More than that, the Labeling scheme should also be reflected in the taxing scheme of these products, thus providing a market bias in favour of efficiency. To work, a Labeling Framework will likely need a supporting institution responsible for testing goods and keeping efficiency rankings up-to-date.

G2. Electricity Generation - on fully indigenous energy sources.

S2.1. Support Renewable Energy

Some states have already shifted a relevant fraction of its electricity generation to indigenous renewable energies that go beyond the traditional hydro-electric. This has been achieved in great measure due to the introduction of feed-in tariffs, fixed rates by which grid operators must buy the generated electricity. Though more expensive than fossil fuels, feed-in tariffs are nonetheless considerably below present final prices at the consumer (e.g. in Portugal and Spain Wind feed-in tariffs are circa 7.5 euro cents/kWh, whereas consumers pay 12 euro cents/kWh).

This approach seems sharp in two ways: it facilitates investment (which for renewables is mostly before start-up) and can impose a benchmark to separate between lower and higher EROEI [2] energy sources. In the current market, where many different forms of renewable energy are promoted by different agents, a single fixed feed-in tariff for every one will stave off immature or low EROEI sources from entering the market. Additionally, a higher tariff limited to a certain generation capacity (say 10 Mw) could be employed for development projects.

S2.2. Promote Energy Storage

Feed-in tariffs for electricity generation as just part of a larger process to shift from fossil fuels to renewable. Being mostly intermittent in nature, renewables pose some challenges to grid management, many times not matching the instantaneous demand on the grid. So far this has been mitigated with the use of the hydro-electric park for storage, augmenting the hydrological potential for load-balance generation. In time, with an increased intermittent supply to the grid, hidro-electric storage may not be enough; new forms of energy storage must be promoted side by side with renewable energies.

This strategy can also be implemented with special tariffs for energy storage. It can take many forms, simply as fixed figures for intake and feed-in, or more complex schemes contemplating the daily variations of the demand/supply balance.

S2.3. Develop an European Nuclear Programme

Now patent from the experience by the states with higher penetration rates, renewable energies are having impact chiefly on load balance generation (in great measure due to its coupling with hydro-electric as explained above). Base-load generation will feel the impact later and likely only after larger scale storage systems are in place. Objectively, the only ready, scalable, indigenous alternative to fossil-fuels for base-load is Nuclear energy. It is thus time for the EU to assume this fact and take this energy source seriously.

A real European Nuclear Programme should not be seen simply as an expansion project but rather as a maintenance, assessment and long term road-map for this energy source. An important part of this programme would have to be information, explaining to the EU citizen what Nuclear energy is, why is it needed, what are the potential hazards, how they are mitigated, what is the EU planning for it long term. After that a thorough assessment of each state' base-load needs should take place, especially for those that do not have relevant Coal resources and do not

use Nuclear. And on this assessment the Nuclear Park could be properly dimensioned and its hypothetical decommissioning planned for the long term.

G3. Freight Transport - out of the roads.

S3.1. Limit inter-state road freight

Tackling freight transport should start by the long distance, where empty haulage has the worst impact (finding back-trip loads is harder). This can be implemented in several ways, with special tolls on inter-state highways for hauliers, creating an inter-state circulation tax scheme for trucks, adjusting the taxing scheme on goods transported by road, etc.

The lion share of implementing this strategy would be recycling the jobs lost in the hauling industry. Workers in this sector would primarily be lead to the alternative industries: rail-roads, water-ways and maritime shipping; other options may exist in the logistic sector aggregated to these industries.

S3.2. Limit inter-city road freight

Similar to the previous strategy, this one would came at a later phase, with inter-state road transport already greatly reduced. The tactics discussed above largely apply here and would translate into an European-wide cost hike for road hauling. Only for short distances, where rail or waterways are impracticable, road freight could be left as is.

S3.3. European Rail Freight Network

In parallel to the phase-out of road hauling a programme to create an European-wide standard freight rail network would be necessary. A first stage could correspond to a network connecting every state capital, composed by slow lines (maximum speeds circa 100 Km/h). In time this would expand to all cities above a certain threshold size.

Underpinning this network an information system would be needed to allow a hauling operator to easily contract its container trip between any two nodes of the network.

S3.4. European Shipping Network

Also part of the alternative to road freight, maritime shipping, though reliant on fossil fuels, presents several advantages, a much reduced fuel usage per tonne-kilometre and relatively low infrastructure requirements. A programme would be needed to facilitate navigation all around the EU's coasts, to provide proper logistic infrastructure at ports and facilitate the movement of goods through customs (scrapping any barriers of this sort to inter-state shipping).

As before, a proper information system is indispensable for the management and tracking of freight ships, plus the useful instruments for easy contracting.

G4. Passenger Transport - a new concept of individual travel.

S4.1. Promote Aerodynamics

Somewhere after the Second World War the car industry simply forgot about Aerodynamics (or may have passed it to the back seat). Charismatic cars like the Volkswagen (later christened as beetle) or the Citroën DS, where built with much higher concerns on this field than those available today. Air is the largest obstacle to the movement of a car on a tarmac road, and the only one in flat road at constant speeds. The other obstacle is mass, entering the equation whenever there is

acceleration. The car industry seems to be slowly tackling the mass component with energy recovery systems on braking (something associated with the popular concept of "hybrid-car"). Though indirectly penalized by fuel duties, movement through Air has so far been left unmitigated.

Implementation could be achieved with progressive industry standards for minimum frontal area / shape ratios or by adjustments to the taxing scheme. Aerodynamic vehicles will likely steal away some of the flexibility embodied in today's cars. Vehicles to transport large loads or large numbers of passengers would become less attractive. Overcoming this difficulty is something the industry can possibly deal with by itself, e.g. by recurring to concepts such as modularity.

An Aerodynamic bias on the car market may also have another important function by facilitating the penetration of alternative vector vehicles. These vectors are invariably less denser than oil products, thus providing less travel distance for the same tank size; better Aerodynamics shall increase these vehicle's range, improving their usefulness.

S4.2. Substitute inter-state Air travel for High Speed Rail

Using quasi-straight lines passing over major cities, a path between Athens and Brussels is about 2000 Km long; between Tallinn and Brussless it is about 1900 Km and between Lisbon and Brussels a little less. At an average speed of 200 Km/h these distances are covered in 10 hours or less. At face value, such a long time inside a train may not be that appealing. But instead of idealizing it as a regular plane trip with the passenger stranded in a seat, it can imagined in a different way. A passenger takes the Trans-Europa-Express at 8 pm in Athens and moves to the restaurant car for dinner. Somewhat later the passenger enters a small, but comfortable, cabin where some hours are spent reading, watching a picture or blogging, before going to bed. At 7 am the next day the passenger is up, goes for breakfast and at 8 am leaves the train at the destination city, where a cab or bus shall complete the journey to a starting business or vacation day.

There is certainly more to it than this simple story, children, luggage, etc, but for many occasions this could become a reality. A programme to substitute inter-state air travel by rail would not only require an high-speed network connecting at least every state capital, it would also need to make night travel affordable. Taking advantage of economies of scale, architecting new train cars, improving modal integration, a new long-distance passenger travel system must become a reality in Europe.

S4.3. Penalize jet-fuel

Complementing the introduction of an European high speed rail network is the simple measure of introducing fuel duties on jet-fuel. Though referenced before, it is important to stress that jet-fuel is subject to no duty at all throughout the EU. It's introduction is sensitive, since without a proper alternative long distance passenger travel could become unaffordable; on the other hand it would work as an important incentive to the introduction of a high speed rail network. It could be implemented progressively, firstly impacting only domestic flights below a certain distance, then spreading to all internal flights and later to all jet-fuel marketed in the EU.

4 Summary

Europe faces enormous challenges in the years, and possibly decades, ahead due to its reliance on foreign imports of fossil energy. By different factors, outright scarcity, geographic constraints or demand growth from competing importers, Oil, Gas and Coal are all set to become harder to afford for Europe. If no other way is provided for the reduction of their usage, then economic

hardship shall take care of such task.

An Energy Policy directed at fossil fuel scarcity is today paramount for Europe, and may rest on it the survival of its Socio-Economic paradigm. Even the EU's cohesion itself may come at stake without a path to an Economy based on indigenous energy.

This document proposes an Energy Policy from a macroscopic stance, founded on four pillars: Efficiency - continuously improve the way Europe uses energy; Electricity generation - substitute foreign fossil fuel imports for indigenous renewables and Nuclear if needed; Freight Transport - substituting road hauling for rail, water-ways and maritime shipping; Passenger Transport - changing the way Europeans think of passenger transport, with new concepts of individual/family vehicles and long distance travel.

May our leaders have the courage and science to tackle this challenge.

Footnotes

(1) A more detailed and direct description of BMM can be found at this webpage: http://www.selectbs.com/adt/analysis-and-design/what-is-business-motivation-modeling-bmm

(2) EROEI - Energy Return On Energy Invested; it is a measure of how much useful energy is delivered to society by an energy source, after excluding build-up, operation and other energy inputs.

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