

Future air transportation faced to the coming lack of cheap oil: A socio-anthropological point of view

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Abstract

We are now facing the consequences of the choice of fossil energy to fuel the thermic motor. This was a not only a technical but also a cultural, choice of civilization. There is no doubt that we are now entering the Hubbert Peak, which is not an abrupt peak but a flat section of the curve before the decline of oil production. ! We have no solution for airplane by using new fuel. Thus the only solution would be to change the whole macro-technical system of transportation and political leaders should recognize that the world's oil supply and demand balance is at a critical juncture — and they must act soon taking practical steps to constrain demand growth.

Keywords

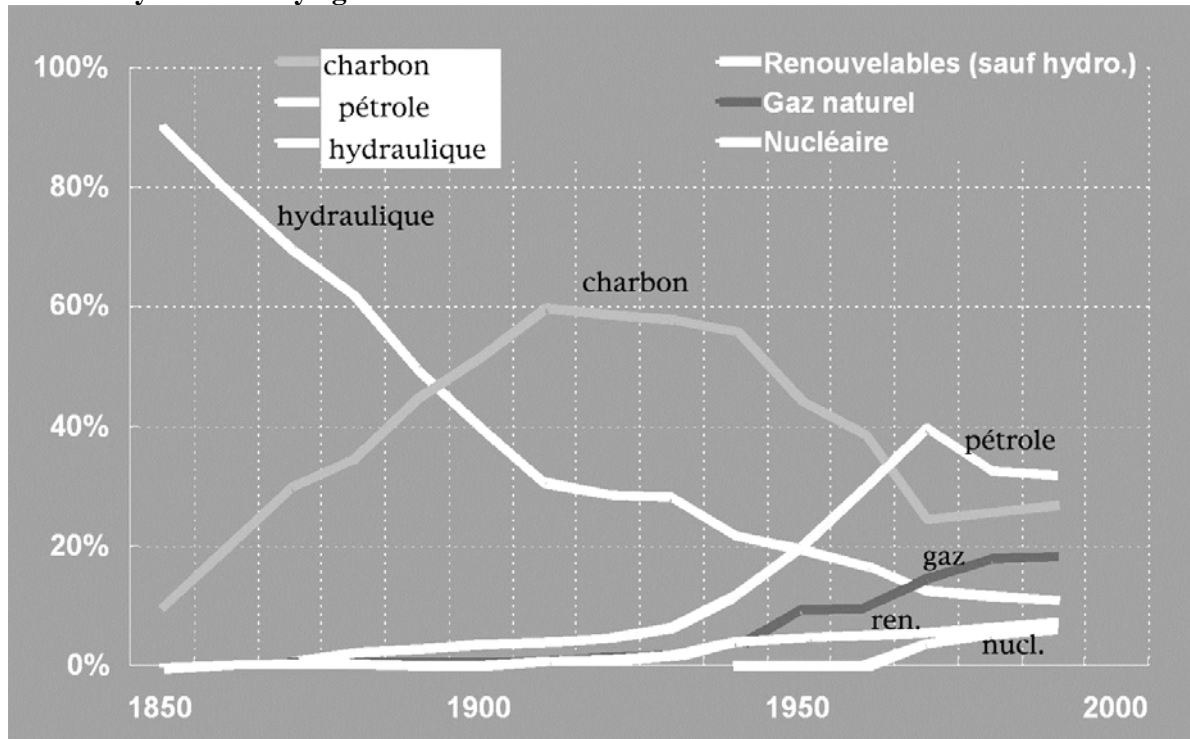
energy, fuel, oil peak, gaz, hydrogen, motor, macro-technical system, transportation, ecology globalisation, efficiency. sociology, anthropology, network

Aibus-380 was very successful when flying over Toulouse on the 29th of April 2005. But surprisingly enough, during the various interviews of the pilots, managers and other people from Airbus, nobody asked them the question that everybody knows as being the most important for the future of civil aviation « what will happen if oil prices skyrocket or simply that petrol begins lacking? ».

We are now facing the consequences of the choice of fossil energy to fuel the thermic motor. This was a not only a technical but also a cultural, choice of civilization therefore modern society could be called « thermo-industrial » , not only industrial and certainly not « post-industrial ».

F.1

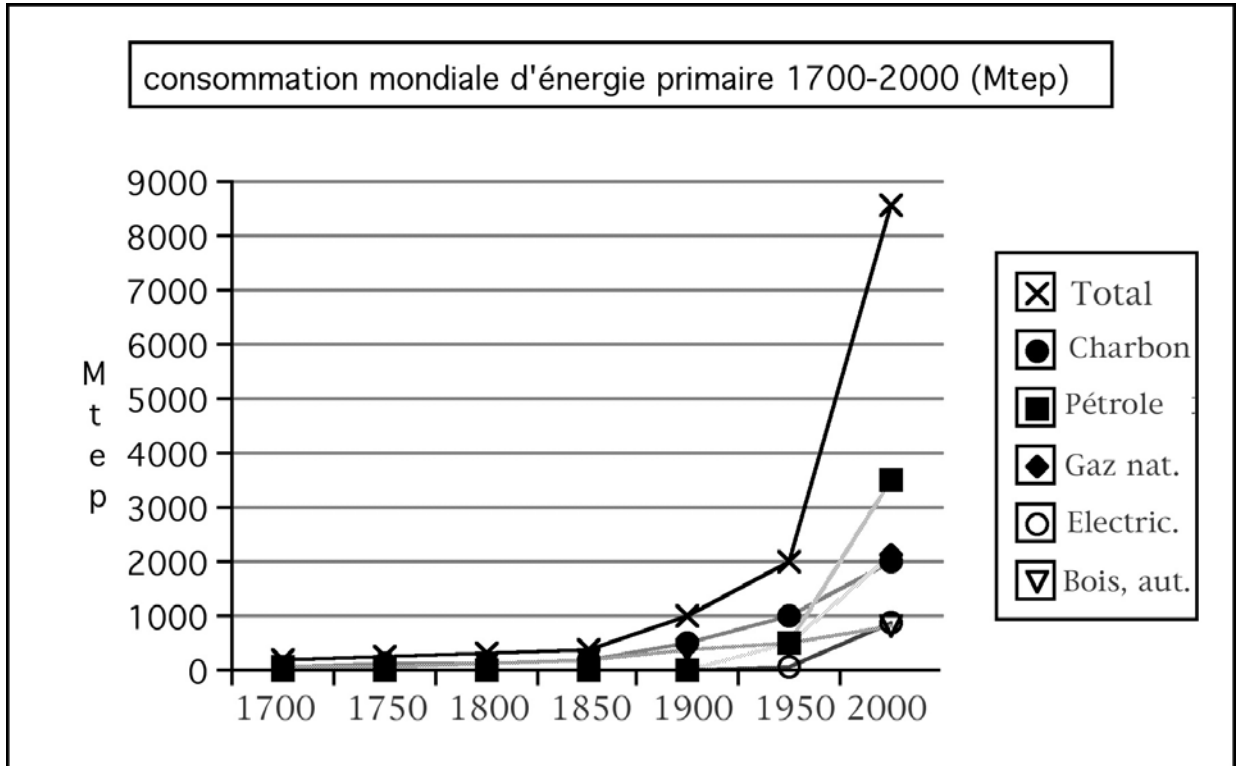
Thermo-industrial civilisation was born recently : it grew quickly during the second part of the XIXth century but became predominant only at the eve of the XXth century, that is only one century ago .



Source : Alain Gras, *Fragilité de la puissance*, Fayard, Paris 2003

F.2

Development of the use of fire has been fascinating, as well as our use of fossil energy and notice how recently industrial civilisation has chosen the path of oil technology.



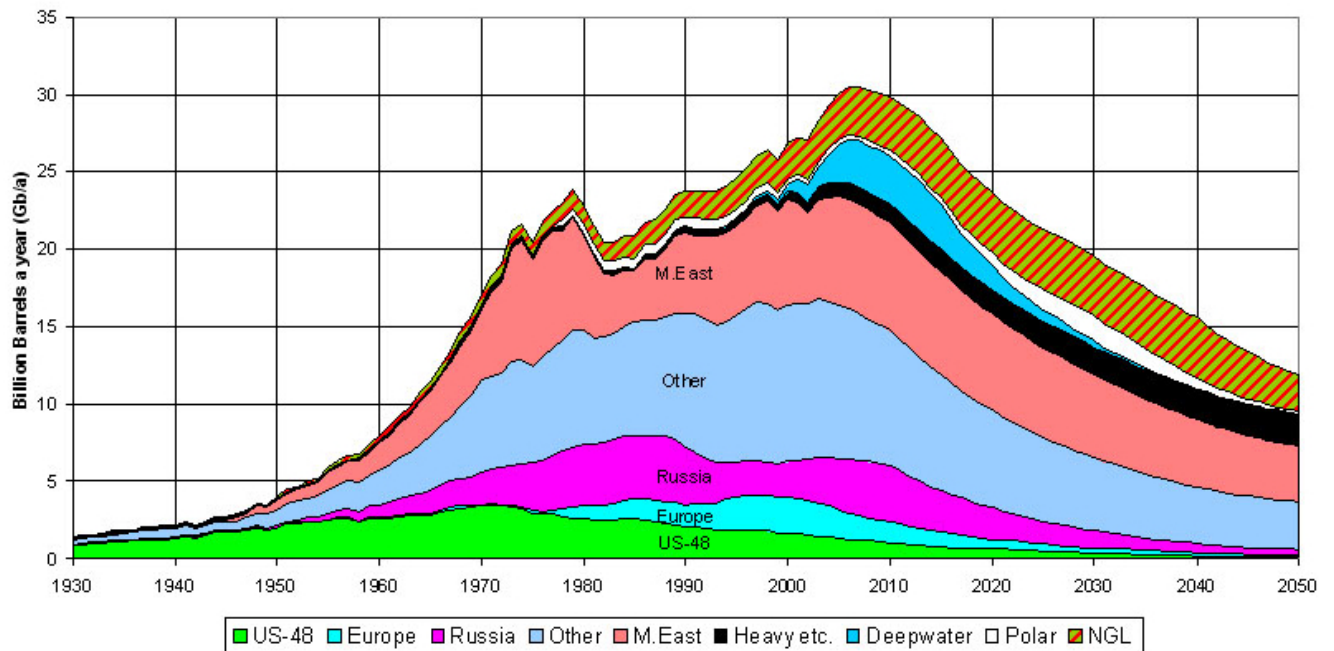
Source : Alain Gras, *Fragilité de la puissance*, Fayard, Paris 2003

There is no doubt that we are now entering the Hubbert Peak, which is not an abrupt peak but a flat section of the curve before the decline of oil production. How long will we stay on this section, this is an open question but we have to be conscious of the change for the future of the macro-technical civil aviation system.

F.3

The Hubbert Peak

OIL AND GAS LIQUIDS 2004 Scenario



Source : Campbell/Bauquis/Laherrère/ASPO

Thus the question comes down to this: is there any substitute for fossil oil ?

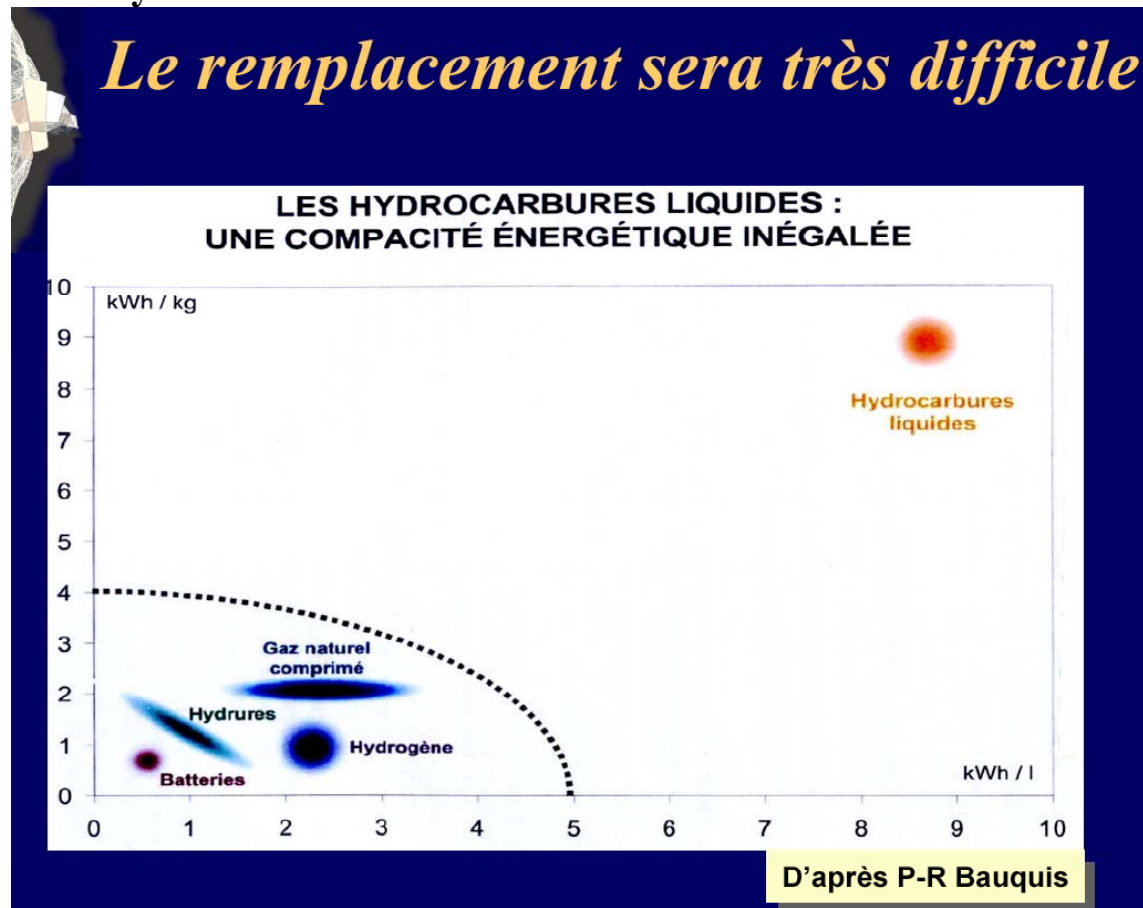
Technically yes : petrol transformed from gaz with Fischer-Tropf process but the Return on Energetic Investment is only 40 % (it seems unrealistic to use coal instead of gaz because of the pollution). I will soon return to this question.

Ethanol or Methanol : the energy coming from agriculture represents only a small part of the energy invested, the price of the ethanol for exemple here in Brasil is low because of government backing. Actually, energy drawn from biomass is only worth for the peasant and his machines, just as Mr Diesel thought in the 1890ties. As it is known his idea was to create an engine working thanks to energy coming from liseed oil produced by the farmer and used for farm work .

In a way the use of fossil oil, petrol, doesn't fit the normal evolution of technoloy, its energetic power related to his mass would have been quasi inconceivable for a man of the pre-industrial era. And this compacity makes it extremely adapted to aeronautics, but maybe too much because in its development aeronautic technology has never been open to the use of other energy (with few exceptions such as ethanol and hydrogen). Thus the technoloigcal trajectory of aeronautics is now up a blind alley, a situation of blockade and « path dependency ». Civil aviation is a mega-machine which could die in the future by starvation !

F.4

The energy powerness of oil is fantastic compared to other carbohydrates

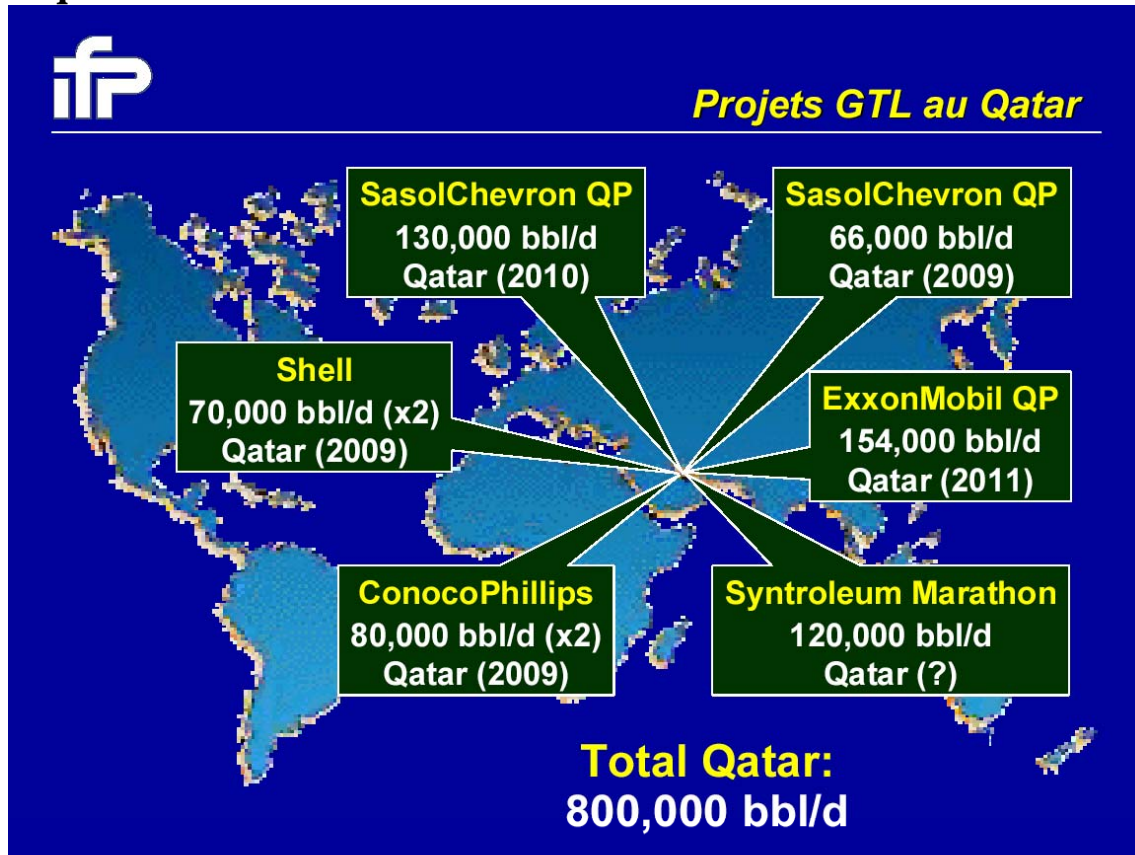


There is little hope for deep sea exploration, because deep water non-conventional oil would represent only five per cent of world supply by 2020. Ultimately it would produce only about 5 Gb. The world is currently consuming a billion barrels of oil every twelve days. The cost is « fifty to sixty million per rig and there is little guaranteed return. »

Pierre-Rene Bauquis, Vice President of the French Energy Institute, associate IFP professor and former special advisor to the president of TotalFinaElf, « commercial production of hydrogen is two to five times the cost of the fossil fuels used to make it. » Thus transportation is impossible. It is twice as costly to transport hydrogen as it is to transport electricity. The storage costs for hydrogen are one hundred times the cost of liquid petroleum products.

He was equally unforgiving when it came to ethanol. "To replace forty per cent of the oil in use you would need three times the currently available farmland just for feedstock."

As I said earlier, the Fisher-Tropf process for transforming gaz into kerosen doesn't change the problem because the resources of gaz are also limited. Of course, Qatar, where the US has located its Central Command headquarters, has more natural gas than North and South America combined and Qatar has decided to build a big industry based on Fisher-Tropf transformation . But the problem with the gaz will be the same like for the petrol : the prices will of course follow the rate of the oil and the depletion of gaz will be greatly accelerated (see Jean Bresson's paper for the economic dimension).



Thus the final answer is no ! We have no solution for the moment by using new fuel.

In other words the only solution would be to change the whole macro-technical system of transportation. Let the air-borne transportation be made by train on railways using much less energy and let the ships use other fuels, maybe coal (and capturing CO₂) or even wind in the sails. As a matter of fact the two main means of transportation, symbolic pillars of our way of life, car and airplane are terribly unefficient compared to other means !

Moreover the choice of long range heavy bodies is an absurdity from an ecological point of view : most of the kerosen is used in the first place to transport itself, the passengers are only a subordinate weight ! The most efficient mean for air transportation is, according to the experts, a small plane and a range of 4000 kilometers, solution exactly opposite to the current choices.

Energy efficiency by mean of transportation

Car	25 to 50 gross ton miles/gallon (10-20 tkt/liter)
Airliner	60 to 65 gross ton miles/gallon (25-30 tkt/liter)
Bus	110 to 120 gross ton miles/gallon (ca 50 tkt/liter)
Truck/18 wheeler	120 to 200 gross ton miles/gallon (50-85 tkt/liter)
Train	750 gross ton miles/gallon (320 tkt/liter)

The larger the number, the greater the energy efficiency. For comparison, a two ton car would have to get 375 miles per gallon to equal the energy efficiency of a train.

www.oilcrisis.com/transport

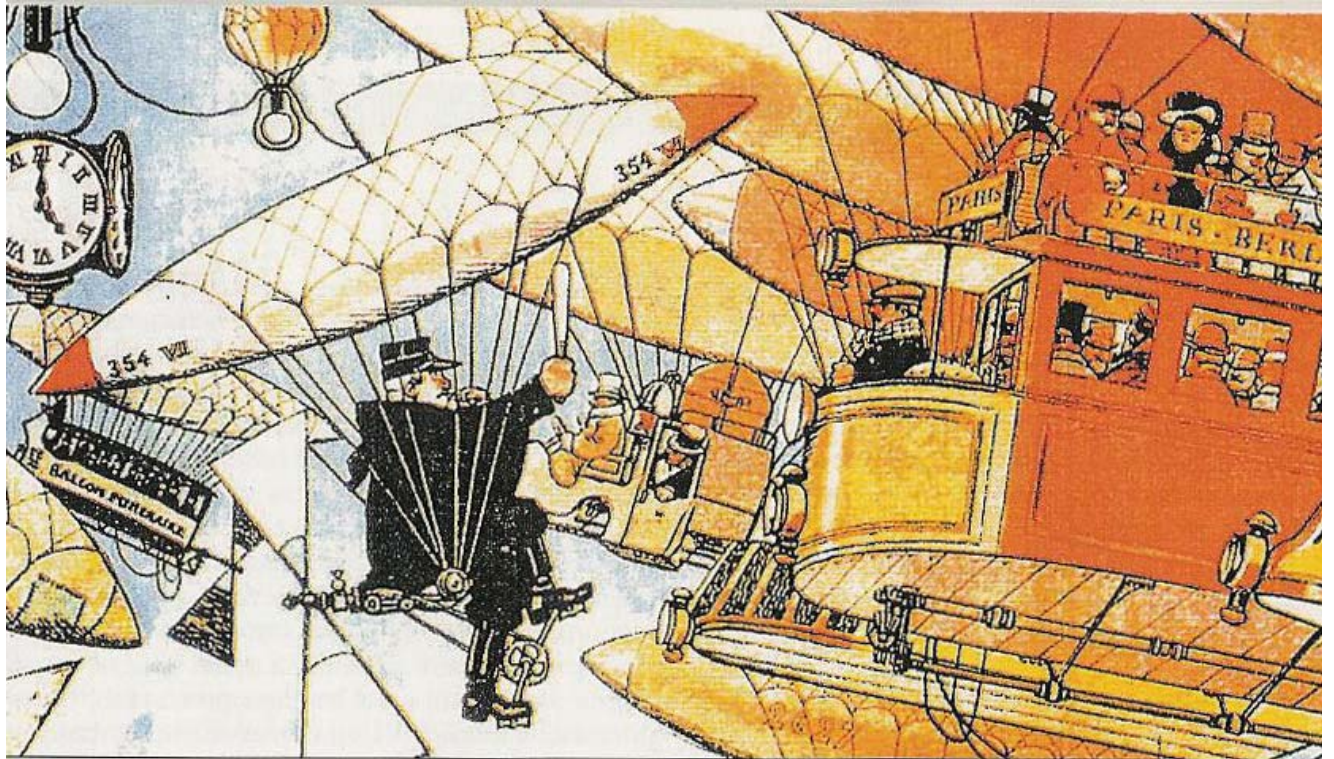
Nethertheless the liberal market is not ready to impose regulations, it should be the task of the states and international institutions to impose strict constraints upon the use of oil in order to preserve fuel for the airplane. Political leaders should recognize that the world's oil supply and demand balance is at a critical juncture — and they must act soon taking practical steps to constrain demand growth

But in this case we come out from the model of globalisation : certainly airplanes will no longer transport onions from Tasmania to Europe or mangas from Brasil. The basic nutrition for animals like soja or corn (mais) will become very expensive for the foreign market even it they are transported by ships, and so on... Delocalisation will be no longer the main result of globalisaiton.

But even in this case we could be not far from catastrophic events. Kenneth Deffeyes who wrote about the Hubbert Peak recently, believes that the cost of fertilizer production for the Third World, implying that natural gas shortages and related electrical manufacturing and transport costs might precipitate a famine of unimagined proportions. It is clear that in a context of energy shortage USA will also keep for them most of the oil production, then what will be the reaction of Europe and powerful states of the far east like China, Japan, Korea ?

In conclusion, let me suggest one solution that should be seriously considered for air transportation, a technology discovered two hundred years ago and very successful before the invention of airplane: the dirigible.

F.8



*Trafic Jam in the future air transportation as seen in **1901** by the « Assiette au Beurre »*

But I don't believe this technology is responding to the speed obsession of the modern society and in any case this futurology comes out of the scope of this congress !