Financial Crisis, Energy and Sustainability in Brazil

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An immediate consequence of the financial crisis that shook the large majority of countries is the reduction of economic activity and increased unemployment. Since economic activity is closely linked to energy consumption, it is expected that the quantity of energy consumed will also decrease. At first glance this seems to be good news: with lower demand, prices should fall, as occurs when stores offer sales.

The strong drop in oil prices, for example, is probably due to this fact and to the decreased credit that reduces speculation in this sector. In the past, oil had been sold directly by producers to the companies that refined it and which then sold it to distributors. In recent years, however, oil entered the category of commodities – products sold on exchanges. This sharply increased the number of intermediaries between producers and final consumers. The commercial and financial operations increased in volume and sophistication. There was speculation on the price of oil as there was speculation on real estate debt. The results are now well known. It was usual, until recently, to have 15- 20 intermediaries in the transaction between oil producers and distributors. The same took place with natural gas, whose supply chain is intimately linked to oil. The limited number of oil and gas suppliers facilitates this process. This does not occur with coal, another important energy source. Its cost has varied little because there are abundant resources with broader geographic distribution. There is a larger number of suppliers and not much opportunity for speculation.

In 2006, fossil fuels (coal, oil, and gas) accounted for 81% of global energy consumption. Oil alone was responsible for 34%. It can be asked what will happen when the economies of large countries return to normal and energy demand rises again, above all in China.

The response is that the current crisis also represents an opportunity for reorganizing the energy system on more solid and sustainable foundations. The bases for this reorganization are efficiency, greater participation of renewable energy sources and the decentralization of energy production.

First, in the industrialized countries where per capita consumption is quite high, there is great waste of energy and room for rationalization

of the system. This can lead to significant savings without harming the quality of the energy. In the developed OECD countries, from 1973 – 2005, global gains in energy efficiency reached 0.8% per year (IEA, 2007b). In California, per capita electricity consumption has not increased since the 1970's, while in the United States as a whole it increased 50% (Figure 1). This was achieved by laws that established maximum consumption limits for equipment that use electricity – refrigerators, air conditioners, industrial and commercial motors and many others. Manufacturers were required to produce more efficient equipment (Bois, 2006).

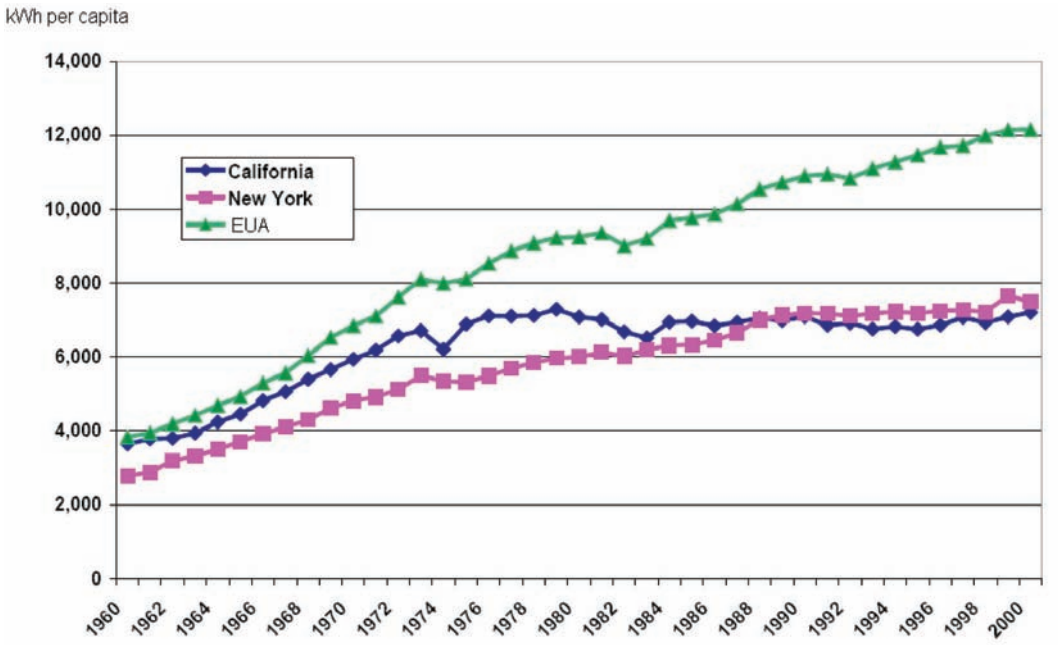

Figure 1 – Per capita electricity consumption in the United States and in California and New York states (Rosenfeld, 2004).

In developing countries, where per capita consumption is relatively small, energy efficiency alone will not resolve the problem, because in many cases the final energy services (lighting, heating, cooking etc.) are still insufficiently available. Thus, global production and consumption of energy must increase to fulfill this repressed demand.

In this field, the renewable energies (such as wind, solar, biomass and small scale hydropower) will have a major role to play. Not only are these energy sources less polluting, but by their nature, are produced in small units. The decentralization of energy production leads to increased supply security and the creation of jobs. This occurs particularly in the production of ethanol from sugar cane in Brazil. The production of ethanol generates

14 – 21 times as many jobs as those needed to the produce the equivalent amount of energy from oil (Goldemberg, 2004). The opportunities for bioenergy are extremely promising not only with the currently dominant biofuels (bioethanol and biodiesel for vehicles, bagasse for electricity, wood from reforestation for vegetable charcoal for iron foundries and others) but also with the so-called second generation biofuels (in the case of ethanol from cellulose, which could be produced anywhere in the world, even from coniferous trees in cold climates). By 2030, biomass could supply from 31 – 87 EJ of energy per year. As a comparison, annual global energy consumption is now 420 EJ (IPCC, 2008).

For the same quantity of electricity, the number of jobs generated with wind energy is nearly 100 times greater than that generated by nuclear . The 120 GW of installed capacity in wind turbines throughout the world produce 260 TWh of electricity and avoid the emission of 158 million tons per year of CO2, which would occur if this energy was produced from fossil fuels. This is a market of about US$ 48 billion, which creates some 400,000 jobs. The United States surpassed Germany in wind capacity and 48% of all its new electrical energy generation comes from this renewable source of energy (GWEC, 2009)

In addition to wind and biomass, the use of solar energy – with thermal panels or photovoltaic cells – have local characteristics that frequently avoid the long distance transportation of energy. The decentralization of energy generation decreases the vulnerabilities suffered for example by the oil produced in the Middle East and transported to the United States and Japan. Energy security is a critical issue for other countries as well. Western Europe depends on natural gas from Russia that must cross the Ukraine. Chile depends on gas from Argentina, which needs to import it from Bolivia, which has difficult relations with Chile. China is vulnerable because all of the oil it imports must pass through the Straits of Malaga (near Singapore). Recent developments in solar energy make it possible to generate electricity on the roofs of buildings and either use it immediately or feed any surplus into the electrical grid. Completing the energy integration, future perspectives include electrical vehicles and those moved by hydrogen cells.

The use of geothermal potential is still incipient, but one-kilometer below the earth's surface are temperatures of 40 degrees Celsius. The potential is immense, although there has been little research. It is estimated that geothermal sources could produce 140 EJ of energy per year worldwide (IPCC, 2008).

Thus, the current crisis presents opportunities to rebuild the global energy system on a new more solid and less polluting basis. An efficient system based on renewable sources would allow reversing the trends in increased emission of greenhouse gases, for which the use of fossil fuels are the principal causes.

Although they now have lower participation in the global matrix (approximately 13% in 2006), renewable energies are not and should not be considered "alternatives". In the United States, President Obama has already defined the following course: invest heavily in new technologies, generate local jobs, decentralize sources and reduce energy dependency and increase efficient energy use (especially in vehicles) and the participation of renewable fuels. His motives are many and include not only the financial crisis, but also the global environmental crisis (from which the United States had maintained a distance) and the regional geopolitical and economic influence of oil producing countries such as Iran and Venezuela.

In Europe, greater energy efficiency and renewable energy sources have long been identified with long term environmental, social and economic sustainability. Germany already has wind generating capacity that exceeds that of the Brazilian Itaipu dam. The UK is the world's largest financiers of Clean Development Mechanism projects under the Kyoto Protocol. Denmark has state of art technology to install large offshore wind turbines and has the world's largest energy farm of this kind. Sweden produces biofuels locally and imports environmentally certified ethanol from Brazil for their vehicles.

Developing countries have adopted various routes. China, aware of its energy needs, built the world's largest hydropower dam and has a vigorous solar energy program. India utilizes large quantities of organic wastes, a cheap and efficient way to produce energy. For many years, Brazil has been considered a global leader in renewable energies, thanks to bioethanol and to its hydropower supply. Other countries such as Nigeria, Venezuela, Boliva and recently Angola still prefer to rely on their fossil fuel resources. Others like Haiti, Congo and Zimbabwe still depend on wood from deforestation and imported oil products.

Russia stands out as a leading source of energy and is now especially supported by its exports of oil and natural gas. The country has great potential to become one of the world's largest producers of bioenergy, when the fuels produced from cellulose become commercially competitive.

Given this situation, Brazil could take a number of different pathways. The most evident appears to be inertia, or that is, to use its already explored hydropower dams, let bioenergy (particularly ethanol) expand, conclude the Angra 3 nuclear reactor that has been halted for decades and most of all continue depending on oil. There could also be a vigorous increase in oil production from the offshore, pre-salt layer, but there are still many doubts concerning how and when this will be explored. Natural gas can also gain an increased share, due to exploration of gas fields on the continental shelf. The reliability of the Bolivian gas supply to the country is still problematic.

Concerning electricity production, the "new" renewable sources (biomass, wind, small hydro plants) are still considered expensive, given the price of energy at the purchase auctions promoted by the federal government.

Energy from the Santo Antonio and Jirau hydropower plants on the Madeira River were bid below R$ 80/MWh, while that from biomass power plants were contracted for a fixed price of R$ 156/MWh. Electricity from wind generators costs more than R$ 200/MWh. According to this model, the bids are won by the proponents who offer energy at the lowest cost when the plant begins operating, regardless of the quality. This system seems to be good because it favors consumers but has the perverse result that favors plants that can be built quickly, even if they are polluting. This is a perfect recipe for purchasing the worst.

As a rule, the new technologies cost more but only remain more expensive while they ascend the mandatory steps on their "learning curves". Investments in these technologies can be compared with those for oil, gas, coal and nuclear energy. The national oil company will invest R$ 174 billion, or nearly US$ 80 billion, from 2009-2013. Of this, US$ 28 billion is for pre-salt oil deposits, and US$ 2.8 billion for biofuels (Petrobras, 2008). Subsidies for the production of Brazilian ethanol, estimated at US$30 billion from 1975 and 2000, reduced the product cost by a factor of three, making ethanol competitive with gasoline in 2004, without subsidies.

Official projections in the Ten Year Energy Plan – PDE 2008-2017 (MME, 2008) did not consider any increased efficiency that represents an additional effort in the campaigns underway. Examples of inefficiency are seen everywhere: electric showers that use 8.000 Watts of power, the widespread use of incandescent lighting, heavy vehicles that consume large quantities of fuel (poor quality diesel fuel with high sulfur content that causes considerable health problems in large cities), priority for road transport for both cargo and individual passengers.

According to the president of Empresa de Pesquisas Energéticas [Energy Studies Company, the national energy planning entity], "too much emphasis is given to sustainability of the physical environment, in detriment to the other two pillars of sustainable development: social desirability and economic viability" (Tolmasquim, 2009). The increased participation of fossil fuelled thermal plants in electricity generation is seen as a punishment for environmentalists who "opposed" large hydro projects in the Amazon Region. Environmental licensing is presented as another villian: fossil fuel plants are easily licensed (including polluting coal plants) but not the hydros.

Meanwhile, it is seen as impractical for Brazil to achieve per capita consumption of 2.380 kWh *by 2020* as called for by a WWF study (2006) on electrical efficiency. It is true that this would be a low level of consumption compared to the average in developing countries, but it should be remembered that most OECD populations are in cold climate regions, which require more energy. The relatively "low" consumption does not mean that gains in efficiency are impossible. For example, in 2005 per capita electrical use in Sâo Paulo was 2.600 kWh (SSE-SP, 2006) and there is clearly

unexplored room for improvements that would not compromise quality of life. In terms of energy intensity, measured in energy consumption per unit of GNP, Brazil was the only country to regress (that is, to maintain its rate above the level of 100%) from 1990-2005 (Figure 2).

The argument that Brazil suffers from poverty and exclusion should not be used to avoid the adoption of broad – and possible – efficiency measures. According to the International Energy Agency (IEA, 2007b) each ton of steel produced in Brazil releases 0.48 Mt of CO2 (compared with only 0.15 MtCO2/ t per ton of steel in Europe, 0.14 in the United States and 0.07 in Japan). The cement sector is relatively efficient, but can reduce its current 3.6 GJ per ton of clinker to 3 GJ/t. The Brazilian petrochemical and chemical industries could realistically undergo 20% energy efficiency gains (IEA, 2007b). Brazilian fossil-fuel power plants have an average efficiency of 36.0%,while the OECD average is 38.6%. Countries such as Austria have an average of 44% at their plants (IEA, 2007a).

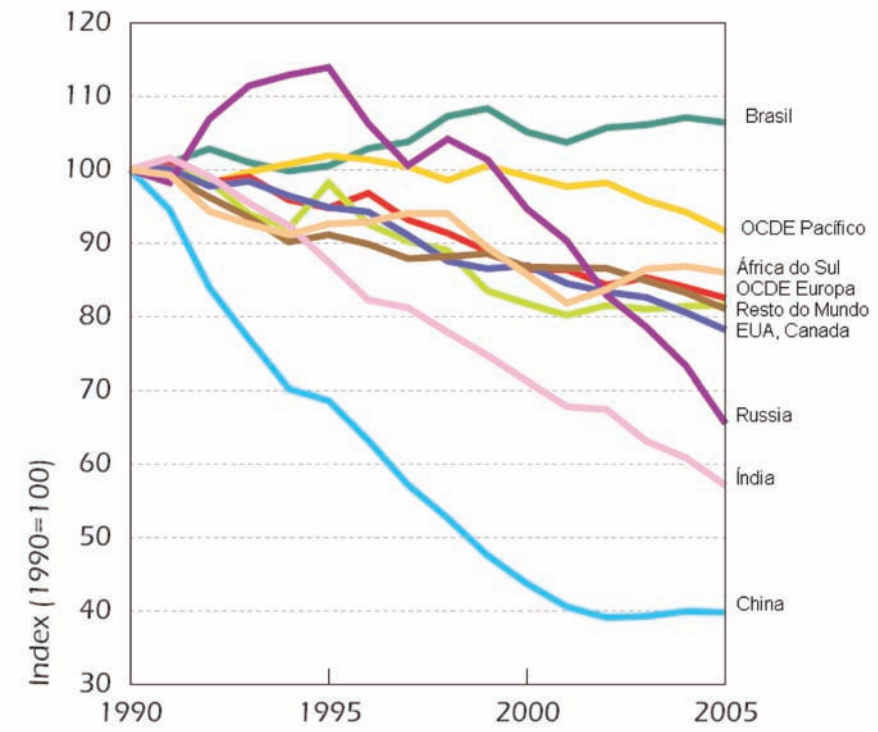

Figure 2 – Total energy consumption per unit of GNP, per country or region. 1990 = 100%

Despite the scientific consensus about the problem of global warming and despite the growing convergence of the political positions in the negotiations around the Climate Convention and the Kyoto Protocol, there is resistance in the Brazilian federal government to modify old paradigms.

Increased CO2 emissions are still seen as a natural consequence of economic development. Newspapers show the tip of this iceberg: while news of catastrophes of a climatic origin is concentrated in the "Science" sections, the Economic sections highlight increased oil production. Local disasters, such as floods and drops in agricultural production are treated as consequences without causes, or as "scientists warnings". This should not be the position of a country as dependent on climate as ours.

There are few legislative initiatives to truly prepare society to confront global warming by adapting to its impacts and mitigating the causes. Most measures focus on stimulating the so-called "carbon credits", through the Clean Development Mechanism (CDM). These initiatives are important, but far from sufficient: while CDM projects worldwide should mitigate nearly 0.8 billion tons of carbon equivalents (GtCeq) by 2012 (CDM Executive Board, 2009), total emissions must be reduced by 214 times this amount by 2050, or nearly 175 Gt Ceq (Pacala & Socolow, 2004).

Despite the general awareness that there are problems caused by emissions of greenhouse gases, especially CO2, changes in unsustainable production and consumption habits are not planned. The proposed São Paulo State Climate Change Policy law (Alesp, 2009), sent by the governor to the state Assembly, was strongly criticized in much of the media for "opening the road to urban tolls and to intermunicipal rotation of vehicle use". Although it does not call for either of these measures, no other point of the proposal was debated. One very important aspect of the project that was ignored by the media is the goals for reduced emissions, references for future laws, policies, plans and projects in the fields of energy, transportation, urban planning, land use controls and many others. The idea that the goals affect economic competitiveness is false. Japan is an example of a country that incorporated significant technological innovations needed for a low carbon intensity energy profile. By means of intelligent buildings, Japan, Germany, Britain and many other countries have significantly reduced their energy consumption and greenhouse gas emissions.

The financial crisis, at its core, is one more reflection of the crisis of sustainability presented by history. There were other crises in the past, also linked to excessive exploitation of resources, speculation, inflation and scarcity. The immediate consequences were loss of lives, war, economic deceleration and unemployment. Some societies have disappeared, such as that of Easter Island. Others never recover, like the Roman Empire. Many survive and some grow and evolve, investing in innovation and efficiency. The post war periods show us which were the good examples. Brazil is a country with abundant natural resources, but it must choose its route before it looses its comparative advantages.

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Abstract – The recent global financial crisis reduces economic activity and consequently energy consumption. This may be an important opportunity to reorganize the energy system on more solid and sustainable foundations: efficiency, higher share of renewables and decentralized energy production. Brazil and other developing countries can leapfrog the experience of developed nations in energy efficiency, complementing this with a vigorous program in renewables, particularly "modern" sources (wind, solar, biomass and small hydro plants). However, there is a concern about inertia in the Brazilian scenario, based on an increasing share of fossil fuels in the matrix, in prioritizing resources for oil and gas exploration and in the continuing unsustainable production and consumption standards.

Keywords: Financial crisis, Energy efficiency, Renewables, Sustainability, Policies, Fossil fuels.

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