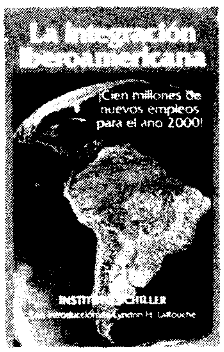
EIR Operation Juárez

The next 30 years of investment in energy

Part 20
Ibero-American integration

Infrastructure is not an industry that produces wealth directly, but it "produces" something more important: productivity. To become an economic superpower, Ibero-America will need 200,000 kilometers of new railroads, as well as ports, canals, hydraulic projects, nuclear energy, and a second inter-oceanic canal.



This installment continues Chapter 6 of our exclusive English-language serialization of the Schiller Institute's book, *Ibero-American Integration: 100 Million New Jobs by the Year 2000!* The book was published last September in Spanish. It was prepared by an international team of experts elaborating Lyndon LaRouche's proposal to free the continent of economic dependency and spark a worldwide economic recovery, "Operation Juárez."

Numbering of the figures, tables, and maps follows that of the book.

It is in the area of energy that Ibero-America has accomplished the most over the past 15 years, and has carried out certain truly great projects, including Argentina's mastery of the full nuclear cycle, the Itaipú dam in Brazil and Paraguay, and the development of Mexico's oil industry. Yet, in this same area, Ibero-America has appeared unable to integrate its efforts so essential to confronting the medium- and long-term energy requirements of the continent.

For today's economy, Ibero-America is an energy-rich continent: There is ample petroleum in Mexico and Venezuela; hydroelectric potential in virtually all of South America; natural gas deposits in Mexico, Argentina, and other countries; coal in Colombia and Brazil; and significant deposits of uranium and thorium in Brazil, Mexico, Colombia, and Argentina. Yet, when Ibero-America begins to grow at the rates specified in Chapter 5, the continent will find that, by the year 2015, it will severely tax the available energy resources, and will face a crisis that could strangle the potential for continued growth in the 21st century. Simply put, we will have reached the limits to significant growth of thermal and hydroelectric sources by then.

Some "experts," including those of the nefarious Club of Rome, have used this evident fact to argue that we must therefore limit economic growth so as to not finish off our limited energy resources. But a more scientific approach is to guarantee that, when hydropower and fossil fuel sources have been exhausted, we have sufficient nuclear energy capabilities on line to maintain energy growth and economic development generally. Unfortunately, only Argentina has given the proper emphasis to nuclear, thanks largely to Pe-

Argentina's Atucha II nuclear plant under construction in 1982. Only Argentina has given nuclear energy the importance it deserves, thanks to the foresight of leader Juan Domingo Perón in the 1950s.

rón's visionary approach in the 1950s.

Worse, certain political factions in various countries, perhaps led by Brazil's banker strata, including former minister Delfim Netto, have proposed to "solve" their energy problems by turning backward technologically from the nuclear frontier to the most primitive sources of energy for man: wood and vegetable matter, using the one for charcoal, the other for alcohol. The move to utilize "biomass" has been encouraged by the World Bank and the international environmentalist movement. In fact, Brazil has become these agencies' pilot project because Brazil's shortage of domestic petroleum makes it susceptible, in the face of budgetary cutbacks demanded by the International Monetary Fund (IMF), to the promise of becoming "energy self-sufficient"—in reality, sheer suicide.

At the present time, significant deforestation of irreplaceable Amazon forest takes place every year in Brazil, mainly to supply fuel needs. It is already likely that the negative changes in weather that have afflicted Argentina (floods in two of the last four years) and Brazil (a very serious drought in the south and floods in the Northeast this year) are related to shifts in the Amazon High caused by the reductions that have taken place in Amazon jungle area.

Biomass versus nuclear

More needs to be said about how to scientifically select among different energy sources. **Table 6-9** shows the relative energy-flux densities of alternate sources of energy. The energy-flux density of a process is the rate of throughput of energy through a given area cross-section of the process, and it is the best known measure of the intensity and efficiency of energy supply, correlating closely with historic rates of technological advance.

As shown, the energy-flux densities of first-generation nuclear reactors are at least seven times those of fossil fuel generation plants; today's nuclear plants are more often 10-15 times greater. Already, second-generation high-temperature gas-cooled reactors have recorded much improved thermal efficiencies, reaching 42%. And the energy-flux densities of second-generation fusion reactors will be hundreds of times greater still. Only by continuing to develop nuclear energy will continued advances be possible in this crucial parameter.

By contrast, returning to wood and vegetable matter is completely retrograde. The energy-flux density of wood-burning is only one-fifth that of coal or oil. Even more devastating for the economy is that an enormous investment in labor, infrastructure, and land is required to provide this biomass in Brazil, which is only considered "economical" because the labor is very cheap, no cost is put on the mis-use of land and infrastructure, and what costs there are do not involve foreign exchange, unlike oil.

Table 6-9 also ranks various energy sources by "periods of energy repayment," that is, the years of generation required to produce as much energy as is consumed in the construction of the installations. It is striking that the lowest energy-flux density sources are also the ones with the longest period of repayment. Solar cells, for example, another energy source much promoted by the Club of Rome, has a repayment time of over eight years, 20 times that of nuclear sources.

TABLE 6-9

Comparison of electricity sources, by energy flux density and efficiency

	Energy flux density (KW/m²)	Capital investment (dollars per KW)	Replacement period (years)*	Net cycle efficiency (%)†
Solar collectors	0.2	20,000	8.3	2.6
Biomass	3,200			
Fossil fuels	10,000	850	0.2	30.0
Light-water nuclear reactors	70,000	1,300	0.4	30.0
High-temperature gas reactors	70,000	1,300	0.4	42.0
Fast-breeder nuclear reactors	70,000	1,600	0.4	35.0
Nuclear fusion‡	70,000	n.d.	0.4	25.0

* Years of generation needed to produce energy equal to that consumed in construction of the installation.
†Thermal efficiency (useful electrical energy as percentage of total energy consumed in the conversion process).
‡First prototypes; later models will have greater energy flux density.
Source: *Mechanical Engineering*, June 1976.

Table 6-10 shows the percentage of total energy consumed as biomass, largely as trees, in Ibero-America in 1982. Outside of Central America, Brazil led the list, followed by Peru and Colombia. As a result of deforestation in the latter two countries, recently constructed hydropower dams are already silting up and erosion losses are very serious off the steep hillsides which are being denuded to provide low-efficiency fuel.

Figure 6-3 shows the growth from 1970 to 1984 of total, hydro, thermal, and nuclear-installed electrical capacity. Capacity is estimated to have grown another 8% in 1985 to 123,900 megawatts (MW), bringing the 15-year growth to more than three and one-fourth times larger, or an average annual growth rate of 8.3%. Generated electrical power grew at an annual 8.5% rate, to 478 million MwH. Both growth rates were well above average rates of industrial or GNP growth during the same period.

The composition of the energy sources has shifted steadily toward hydropower, which now accounts for 53.5% of installed capacity, and 63.5% of total output, reflecting the correct decision to utilize the abundant hydropower resources instead of fossil fuels.

TABLE 6-10

Burning of biomass in Ibero-America 1982

(tons of oil equivalent)

	Total energy	Biomass	% of total energy
Argentina	26,274	1,579	6.0
Brazil	84,951	30,615	36.0
Colombia	14,659	3,673	25.1
Chile	7,695	1,760	22.9
Mexico	72,925	13,771	18.9
Peru	9,990	3,248	32.5
Venezuela	21,929	3	0.0
Central America	10,909	6,367	58.4
Ibero-America	**269,585**	**68,661**	**25.5**

Source: OLADE

Energy needs in 2015

While it is difficult to precisely anticipate rates of energy or electricity use that will be required in the future, it is nonetheless possible to specify general parameters that permit competent planning. The energy targets presented in Chapter 5 (see *EIR*, Vol. 13, Nos. 46-49, Nov. 2—Dec. 12, 1986) call for a total output of electricity in 2015 of 7.8 trillion MwH, which dictates a very specific course of action.

The difficulty in estimating electrical consumption for Ibero-America in the year 2015 stems from the fact that energy/production parameters will change dramatically in the next 30 years due to the introduction of new technologies. Although it has been historically true that electricity has grown more rapidly than GNP as a whole (in Ibero-America over the past 15 years, it grew twice as fast), it is also the case that new technologies will imply tremendous energy efficiency as well as energy intensity. (A good example of this is the fact that the more modern Japanese steel industry uses only half as much energy per ton of output as the relatively backward U.S. steel industry.)

Thus, in terms of rising energy intensity, we have consid-

A gas producing unit utilizing "biomass"—a very low energy flux-density source—to turn farm products into fuel. In Brazil, vast amounts of food crops are wasted to produce such "self-sufficient" fuel, under the pressures of IMF financial policies.

ered the following factors:

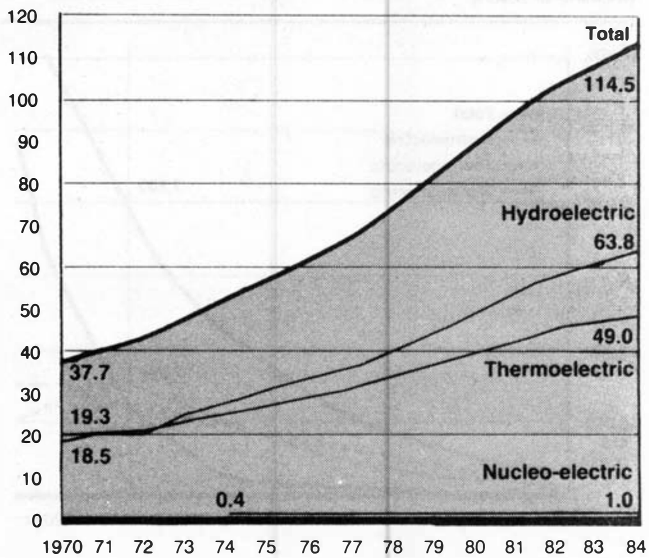
- Industrial processes in general will shift toward the use of electrical power in place of direct thermal energy from fossil fuels. This will accelerate as the new generation of plasma technologies develop.
- Electricity will itself be used to generate fuels, such as hydrogen, which will begin to replace the use of gasoline and other hydrocarbons by early in the next century.
- Transportation will increasingly employ electricity, for intra-urban subways, inter-urban electrified trains, and for electrified railroad freight cargo.

However, the next 30 years will also see an explosion of new technologies that will lower the requirements for electricity per unit of product, i.e., increase energy efficiency. Already, very significant savings in electricity consumption for industry have been realized in recent years. And in the future lie such things as frictionless transmission, supercooled applications of electricity, and a host of other technologies.

Considering these various factors, our projection is that the electrical industry through the year 2015 will have to grow an average of 10% per annum.

This projection agrees with an extrapolation based on per-industrial-worker use of electricity in industry. Taking the goal for electricity generation that we have proposed for the year 2015, of 7.8 trillion megawatt-hours (MwH), we are brought to the current level of European industrial consumption of 20,000 kilowatt-hours per industrial worker, which correlates as well with the industrial productivity levels that

FIGURE 6-3
Installed electrical capacity, by source 1970-1984
(thousands of megawatts)



have been fixed as an objective for that year.

This leads to a projection of 1,550,000 MW of installed capacity required by 2015, about an 11-fold increase over the present (if the total planned capacity of Itaipú and Guri are counted as already constructed), or an 8.3% annual growth rate. This, interestingly, is nothing more than a continuation of the historical rate of increase of the past 15 years.

Assessment of sources of fuel

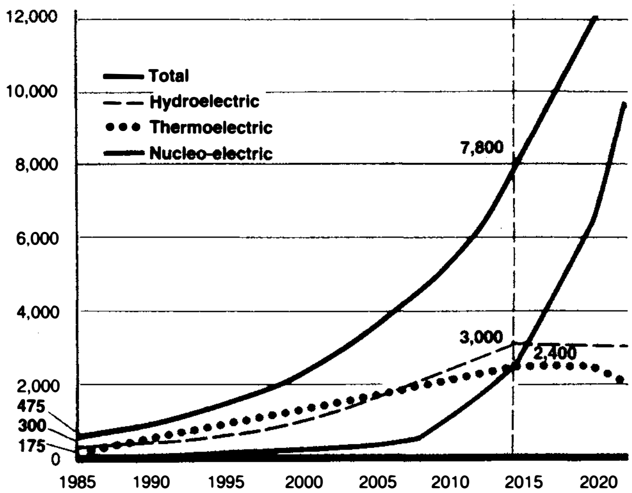
There are three fundamental parameters that must be examined in planning the next 30 years of electricity investment: the sources and availability of fuel sources, the production and installation of the needed capital goods, and the availability of properly trained and skilled manpower to install and operate the power plants.

Figure 6-4 shows our estimated projection of total energy required, and a reasonable estimation of its likely composition by source of fuel. Best estimates are that the continent has slightly over 600,000 MW of economically exploitable hydropower potential, which, at a load factor of 5,000 hours, gives us our 2015 target of 3.0 trillion MwH/year, as indicated. However, this exhausts this source, so the graph shows a linear continuation of this level of hydropower past 2015.

Thermal power must take up the slack to meet total energy needs until at least the year 2000, at which point nuclear power will have to come on line in a major way to meet the vast majority of new energy needs. By 2015, all new power added to the system will have to come from nuclear.

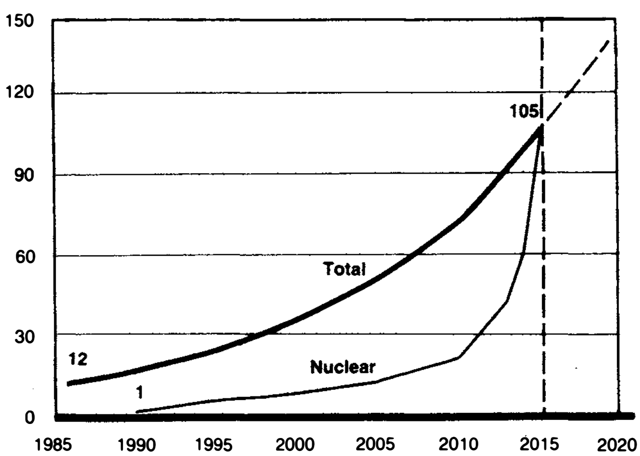
This projection highlights the absolute necessity for cre-

FIGURE 6-4
Projections of annual hydroelectric, thermoelectric and nucleo-electric production 1985-2025
(millions of MwH)



ating a massive nuclear program in Ibero-America as the centerpiece of energy policy for the next 30 years, and beyond. **Figure 6-5** shows the necessary trajectory of nuclear energy capacity. Because the continent is still so underdeveloped in this area, we assumed that no more than 4,000 MW can be installed annually by 1995, 6,000 MW by 2000, and 12,000 MW by 2005. Since the rate of production must rise to 105,000 MW by 2015, this can only be accomplished by the full implementation of mass production methods, such as those described below.

FIGURE 6-5
Projection of electrical, nuclear, and total capacity 1985-2015
(thousands of MW)



The indicated level of nuclear power generation by the year 2015 also raises the question of availability of nuclear reactor fuel. The identified uranium resources of the continent, primarily in Brazil, Argentina, Colombia, and Mexico, are significant but not large in comparison with the United States and Australia. Even if export restrictions from these countries are eased, the world's future needs for uranium may still exhaust known resources. So, the continent must not only fully develop its present reserves, but must also initiate a large-scale uranium prospecting project. It is also recommended that Brazil's massive thorium deposits (44% of the world's estimated reserves) be explored and exploited, and that thorium-fueled reactors be built.

However, advancing technologies in the nuclear field make the fuel question simple to resolve. First, there is the known process of reprocessing spent uranium fuel, which doubles the life of the original uranium. Second, one of the prime reactor designs for near-term deployment is a simple model of breeder which, once loaded with a starting charge of fuel, breeds its own continuing needs for the life of the reactor. Liquid-metal fast-breeder reactors, such as the French SuperPhenix, breeds not only enough fuel for its own use, but fuel for another reactor as well. More advanced designs of breeder reactors will breed fuel even more rapidly.

But most important, by 2005-2010, which is when our projection of nuclear generation first starts growing rapidly and when the first real shortage of uranium might otherwise appear, the fission-fusion hybrid reactor will be available. The first generation fission-fusion breeders may not produce energy from fusion with much reliability, but they will be operated purely as fuel breeders. Using fusion reactions to generate neutrons to turn non-fertile fuels into fertile nuclear fuels can occur before the fusion reaction is fully harnessed to producing net energy. One fission-fusion hybrid will be able to produce fuel for anywhere from 10 to 25 reactors. This technology not only solves completely the fuel availability problem for nuclear energy, it also guarantees that nuclear fuel will continue to cost a tiny fraction of the alternative fossil fuels.

Finally, by the year 2015 if not before, first generation fusion power will be fully commercialized. Fusion power, which uses the hydrogen of sea water as its fuel, will become the only acceptable choice for new plants sometime after 2015. The advent of fusion energy makes available not only an inexhaustible source of electric energy, but cheap, very high temperature direct heat for industrial processes. At the point it is exploited on a vast scale, the use of fossil fuels either for electricity generation or for direct industrial consumption can rapidly be phased out. The 21st century will be the fusion age, and Ibero-America must begin to prepare for it today.