Moving the water to where it is needed

Part 19
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.

One of Ibero-America's greatest resources is its water. Inhabited by 8% of the world population, Ibero-America has 15% of the planet's total land area and a similar percentage of the total cultivatable land. But the availability of water is relatively much greater than in any other region of the world, since 28% of the world's annual water run-off flows through Ibero-America's rivers. The relative abundance of water per hectare is close to twice the world average, and three-and-a-half times greater than the world per capita average (see **Table 6-6**).

However, the vast majority of this water is presently unusable, as it flows uselessly to the sea through the Amazon River system, or drains unutilized through the Paraná River system into the Río de la Plata. Thus, the total irrigated land area in Ibero-America is a relatively low 7% of the world total.

Despite the overall presence of water, severe shortages are experienced in many parts of Ibero-America, while too much water affects other parts of the continent, such as major portions of northern Argentina, the northern Magdalena basin in Colombia, southeast Mexico, and parts of Brazil.

The problem, in a word, is that Ibero-America's plentiful water is poorly distributed. Where it is needed, it is lacking; where it is not, it is plentiful. The job, therefore, is to move the water to where it is needed, and that defines the major tasks of water management over the coming 30 years. It will be necessary to control the rivers with dams to harness electricity, prevent floods, and facilitate transport; we will drain swamps and construct canals for irrigation and transport; and we will provide ample quantities of water to the cities, both

TABLE 6-6

Availability of land and water regions of the world 1982

	Ibero-America	Western Europe	United States	World total	% Ibero-America
Population (millions)	382	375	232	4,591	8.3
Population density (inhabitants per sq. km)	18.2	100.5	25.3	35.1	
Total area (millions of hectares)	2,020	373	936	13,077	15.4
Potential agricultural area (crop and pasture land, millions of hectares)	720	166	428	4,640	
Irrigated area					
Millions of hectares	14.4	10.2	20.6	212.9	6.8
% of potential agricultural area	2.0	6.2	4.8	4.6	
Average annual rainfall (mm)	1,560	830	625	830	
Average annual runoff in rivers (km^2)	11,000	1,710	1,630	38,830	28.3
Average runoff per capita (m^3)	28,826	4,562	7,026	8,458	

Sources: FAO and ONERN

for direct consumption as well as for industrial uses. In fact, in developed economies the industrial uses of water far outweigh other applications. For example, in the United States in 1980, industrial uses constituted 57% of all water uses; irrigation took up 33%; and public water utilities consumed only 8%.

In all of this, a fully integrated approach to water management is called for, such as that pioneered 50 years ago by the Tennessee Valley Authority (TVA) in the United States. The TVA not only dammed the Tennessee River for hydropower to feed local industry, but it also built a large number of smaller dams to control flooding, and established a series of experimental agricultural stations which today stand as leaders in research in fertilizers and high-yield agriculture.

With this approach in mind, we turn to examine five exemplary projects for Ibero-America that are in varying stages of design and construction:

1) the PLHINO and PLHIGON water transport projects in Mexico;

2) the complex of projects for utilizing the entire Río de la Plata River basin;

3) two canal projects linking rivers in Brazil with the Atlantic coast;

4) the trans-Andean water pumping projects in Peru; and

5) the opening up of the Llanos area of Colombia and Venezuela by appropriate water works.

While by no means a complete list, these projects exemplify the types of projects needed (**Map 6-6**).

1) Mexico: PLHINO and PLHIGON

The PLHINO (Hydraulic Plan of the Northeast) and the PLHIGON (Hydraulic Plan of the Northeast Gulf) are already well thought-out and planned projects to move considerable quantities of water from the rivers that run off a large volume of unused water, to the arid but highly fertile areas on the northeast and northwest coasts of Mexico.

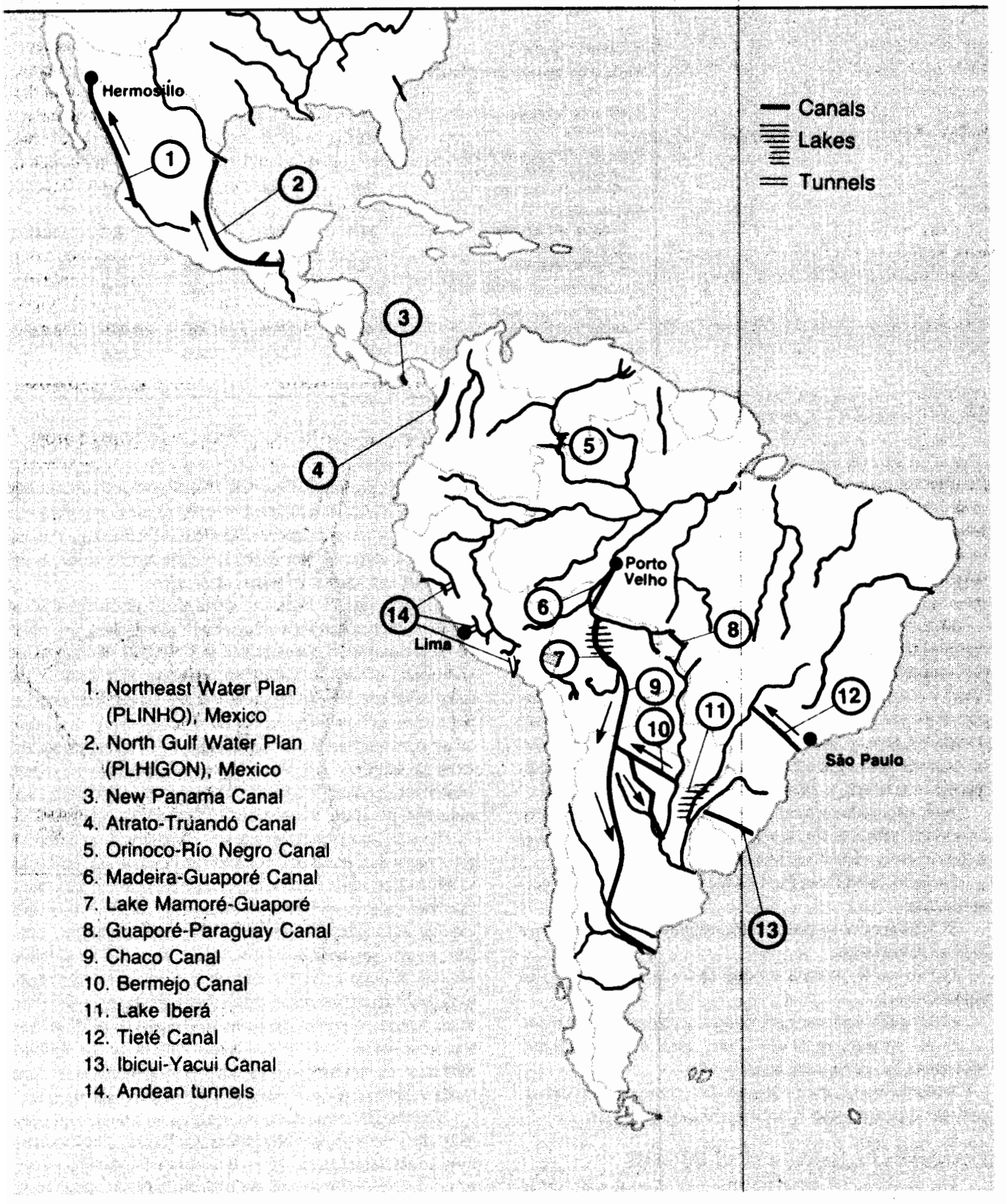
Mexico suffers from the same skewed distribution of water resources that the continent as a whole does, with 80% of its annual runoff concentrated in 33% of its territory in the southeast, while the Valley of Mexico, with 20% of the population and 50% of the industry, has severe shortages, as does the entire northern part of the country, which has many areas with rich soils but inadequate water, and where the existing aquifers are being dangerously depleted today. Moreover, to meet the needs of our overall agricultural and industrial program, water use will have to rise significantly.

To solve this problem requires a nationwide program of construction of dams and reservoirs to maximally utilize up to 390 billion cubic meters of water which annually discharge into the ocean from Mexico's rivers. The PLHIGON would capture a considerable portion of the runoff from the southeast rivers, to transfer vast volumes of water to northern Mexico through a coastal canal of 1,400 kilometers length, to be built along the shore of the Gulf of Mexico. With this there would be water adequate to irrigate some 5 million hectares, but the bulk of this area would be in the northern plateau area, requiring significant pumping works to raise the water 1,500 meters and channel it to the areas that need it.

The PLHINO canal, on the western seaboard, will similarly carry water 1,100 kilometers northward on the western litoral just inland from the Pacific coast. In addition to carrying the needed water to the arid agricultural areas in the

MAP 6-6

Great water projects in Ibero-America



north, the canals will permit barge transport, and will also facilitate drainage of several large salt-water marshes, and their flooding by fresh water brought in the canals, to clean the soils so they may be devoted to agriculture.

In this region, a little more than a million hectares of land would be opened to irrigation. In addition, the canals will be employed to replenish the aquifers on which the entire region now depends.

2) The Río de la Plata basin projects

While the water drained by the Paraná-Río de la Plata basin in the Southern Cone is far less than that carried by the Amazon, there is a significant quantity of water of this vast waterway which can be taken advantage of in the next 30 years even more readily than can that of the Amazon, given that its bordering lands enjoy a climate favorable to agriculture and to habitation. The full development of the potential of the region, spanning the five countries of Argentina, Brazil, Uruguay, Paraguay, and Bolivia, will entail opening tens of millions of hectares of new land to intensive agriculture, while the waterways and rail lines become the lifeline of a string of industrial cities along their length.

This project entails:

- a series of major dams to control the water, prevent flooding, drain marshes, and provide hydropower;
- several canals to bring water to semi-arid but rich soils along the skirt of the Andes and in the Gran Chaco region;
- other canals and locks to open up barge transport almost 3,000 kilometers into the interior;
- pumping of water from the Paraná to increase water availability to the semi-arid regions (**Map 6-7**).

The Itaipú dam in Brazil has already been built, and the Yacyretá project in Argentina, which will provide less power but which requires even more earthmoving, is finally under way. However, interminable delays have prevented the Yacyretá project from being completed, and several other projects from being started. The plans call for a series of dams along the lower Paraná between Itaipú and the Río de la Plata, including Chapeton (3,000 MW), Corpus (4,000 MW), and Pati (3,300 MW). One important purpose of the dams is to control the flooding which twice in four years has inundated large portions of Argentina lying along the river, with tremendous economic and human losses.

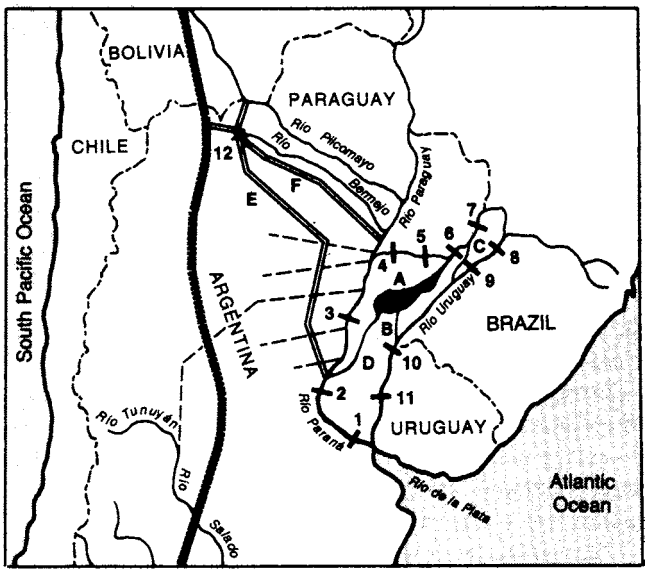
In addition to the dams, there is a large depression in Corrientes province of Argentina, the Laguna Ibera, which can readily be turned into a large lake. The problem with flood control on the Paraná is that the water flow during the flood season is so great that no dam-created lake can possibly retain more than a small fraction of it, so that no matter how many dams are constructed, most of the excess water will still flood. If the Laguna Ibera is largely drained during the dry season, water can be diverted to it during the flood season and provide vastly more storage capacity than can the dams by themselves. Further, small diversion canals can carry excess water to the Uruguay river, which doesn't flood. Several other dams will be constructed on the Uruguay river portion of the basin, Garabi (2,200 MW), Roncador (2,800 MW), and San Pedro (745 MW). Associated drainage projects will recover at least one million hectares of good land for agriculture.

The downstream flood control and hydropower generation projects affect the eastern half of the basin, leaving the semi-arid western half, which extends all the way from the Gran Chaco region of southeastern Bolivia and northern Paraguay down to the middle of Argentina, unaffected. The problem is a very sharp rainfall gradient, in which this region receives too little water for intensive cultivation. Several plans exist to remedy this defect.

The best studied is the Bermejo canal project. A canal would be constructed parallel to the Bermejo river from southern Bolivia to the junction with the Paraná, to provide efficient water transportation from Bolivia to the south Atlantic Ocean, and to permit irrigation of the land on either side

Map 6-7

Great water projects in the river plata basin



I Dams
– – Aqueducts and canals proposed by Adolf Mochkofsky
Grand Chaco Canal
Canals of Bermejo River

A Lake Iberá
B Mirinay River
C Aguapey River
D Corrientes River
E Santiago del Estero Canal
F Lateral canal

1 Guazú
2 Paraná Medio Chapetón
3 Paraná Medio Patí
4 Itatí
5 Yacyretá Compensador
6 Yacyretá
7 Corpus
8 Roncador
9 Garabí
10 San Pedro
11 Salto Grande
12 Zanja del Tigre

of the canal. The intrinsic limitation of the canal by itself is that it will carry insufficient water to irrigate more than about one million hectares along either side of the canal. Furthermore, other plans call for extending a series of canals to the south from the Bermejo to bring water to the very dry regions from Salta to Neuquén in Argentina. It has been shown feasible to pump water from the Paraná via retrocanals westward into a major north-south canal extending south from the Bermejo canal, to provide adequate water. The water that could be so pumped is limited only by the quantity of hydropower electricity that is devoted to this purpose.

It appears, however, that a different project might represent an even better solution. The junction point of the Majore and Guapore rivers near Gajara Mirim opens up the prospect of constructing a dam where a large quantity of water will be elevated to nearly the height of the divide between the two rivers. Then, water would have to be pumped only a small remaining height up the Río Grande, past Santa Cruz, where the water would then flow south by gravity in a canal into the Bermejo and on into the southward canal. Should it prove feasible, this project, shown on Map 6-6, would provide ample water to this semi-arid region at relatively low pumping costs.

Finally, a lock canal must be built to bypass Itaipú and a second upstream dam to free the Paraná for barge traffic, making the Paraná navigable for 2,700 kilometers.

3) The Brazilian canals

Two canals in Brazil, the Paraná-Tiete and the Ibicui-Yacui will improve the transport grid of the population and industry-dense southern coastal region of Brazil. the Paraná-Tiete project will extend navigation on the Tiete 120 kilometers further upriver, ending at a multimodal terminal near the city of São Paulo. Once finished, the 689 kilometer-long Tiete River waterway will serve the most highly developed industrial area of Brazil, connecting the industries of São Paulo with the rich raw material-producing areas of that section of the country. The Brazilian government has calculated that by 1990, if completed, the canal will be carrying 7,700 million ton-kilometers of cargo.

The Ibicui-Jacui canal will link the Ibicui river, which flows into the Uruguay river, to the Jacui river, which flows into the Lago Dos Patos at Porto Alegre. To connect the rivers, a 213 kilometer canal will have to be built with a 100 meter difference in height. When finished, the canal will form a 780 kilometer navigable waterway that will be fully capable of handling boats of up to 2.5 meters draft. This project will provide both transportation and irrigation to one of the most promising agro-industrial areas of the continent, and will permit the economic exploitation of the large coal deposits nearby.

4) The Trans-Andean water tunnels

From Ecuador to southern Chile stretches a narrow coastal strip of land separating the shore from the steep escarpments of the Andes mountains. Along this narrow strip lives most of the Peruvian population and practically the entire Chilean population. There is very little rainfall on this latoral, and its rivers are of necessity quite short, falling from the height of the Andes in no more than 100 km or less. The result for Peru is a small and very uncertain supply of irrigation and drinking water for the majority of its population. Yet, just over the crest of the mountains there is plentiful water in the headwaters of the rivers that flow east into the Amazon River system. As shown in **Table 6-7,** barely 2% of the total river runoff in Peru flows through the rivers on the Pacific side of the Andes, while 98% of all the water drains east into the Amazon River.

The solution, proposed already in 1801 by Alexander von Humboldt, is to transport water from the eastern slope of the Andes to the western slope, using tunnels and pumping. Several such projects have been planned (see Map 6-6), and one is presently under construction. The most important project involves damming the Mantaro River, pumping the water over the continental divide and channeling it via tunnels into the headwaters of the Rimac River, whence it flows to Lima. It not only will provide water desperately needed in Lima, where the largest concentration of population and industry in the country is located, and which is presently suffering a very acute water shortage, but it will also produce substantial hydroelectricity en route. Although eminently feasible, the World Bank withdrew from the project in 1982, causing all work to stop at that time, even though the bank offered no alternative method to bring water to Lima. Although work has since been resumed, it must be completed immediately, since no further industries can be built in Lima until there is enough water for personal and industrial use.

Other major tunnels include those from the Pilpichaca River to Ica, from the Maranon to the Viru River, and from the Apurimac to the Colca.

These tunnels will provide a large amount of water for the comprehensive irrigation plan laid out during the government of General Juan Velasco Alvarado, in the late 1960s and early 1970s.

TABLE 6-7

Peru: availability of water

(billions of m^3)

Watershed	Runoff	Volume captured for use
Pacific	35	3.3
% of total	1.7	66.0
Atlantic (Amazon)	1,999	1.7
% of total	98.3	33.0
Total	**2,033**	**5.0**

Source: ONERN

TABLE 6-8
Peru: principal irrigation projects

	Land brought under cultivation (thousands of hectares)	Improved land (thousands of hectares)	Hydroelectric potential (MW)	Total cost (millions of 1981 dollars)
Irrigation works in progress:				
Jequetepeque-Zaña	16.4	49.6	83.0	189
Majes-Siguas	57.0	3.0	656.0	1,637
Tinajones	30.0	70.0	38.6	252
Chira-Piura	41.5	115.0	92.0	494
Other programs	72.5	14.5		
Irrigation works under study:				
Puyango-Tumbes	58.0	11.0	100.0	503
Chao-Viru	31.4	85.4	64.4	427
Olmos	88.0	24.0	624.0	1,200
Total	**394.8**	**372.5**	**1,658.0**	**4,702**

The plan sought to recover 250,000 hectares of soil that had been destroyed by salinization and improper drainage. Specific irrigation and drainage projects (**Table 6-8**) have been started, and if all the major proposed ones are completed, which is quite feasible, 394,800 new hectares of irrigated land will be cultivated, and 372,500 hectares of existing land will be improved with irrigation. Thus a total of 767,300 hectares of fertile land will be added under intensive cultivation at a total cost of only 4,702 million 1981 dollars. Although this does not seem like a large area, it would nearly double the irrigated farmland in Peru, and also provide 1,658 megawatts of electricity to parts of Peru that are presently very backward.

5) The Llanos of Colombia and Venezuela

The Llanos of Colombia and Venezuela comprise an area of over 200,000 square kilometers, where the topography is fairly level, and the primary vegetation is grasses. Located along the valleys of the Meta and Orinoco rivers, this region represents one of the greatest areas for agricultural expansion in Ibero-America.

Presently, the area is extremely underutilized, being used mostly for cattle raising, due primarily to the region's isolation and to its unfavorable climate. In the rainy season, usually four months a year, there is a large amount of rain and water from the Andes mountains which causes extensive flooding, with the lower lands converted into swamps for several months. In the dry season, it barely rains and the Llanos become very hot and dry.

The key to the agricultural development of the region is the construction of irrigation canals and reservoirs to provide water all year round, and to prevent the yearly flooding of the most fertile areas. The already discussed construction of a railroad along the piedmont of the Andes, and the use of the Meta and Orinoco for navigation, will allow the area's products to be delivered to the population centers.

A series of dams will be required in the Andes and its foothills to capture a major portion of the water that now floods the plains during the rainy season, and use it for hydrogeneration and for supplying water needs during the dry season. The Colombian government has conducted surveys which indicate that the total potential for the rivers that drain into the valley of the Meta and the Llanos is 12,098 megawatts, with the possibility of constructing 54 dams. On the Orinoco river, 6,933 MW could be obtained with the construction of only three dams between Puerto Carreno and Mondaupo, a short distance away. Thus, a total of 19,031 MW of electric generating capacity could be readily achieved in the Llanos. The enormous potential for industrialization this represents could be seen by the fact that Colombia in 1985 had a total installed capacity of only 5,462 MW for hydroelectric plants, and 2,000 MW for thermoelectric plants, less than 40% of what the Llanos rivers alone could generate.

The damming of the major rivers, such as the Meta, Arauca, and Orinoco, will also create extensive navigable waterways that will provide cheap, bulk transportation for the region's products, either within the region, or to deep water ports such as Ciudad Bolívar, Ciudad Guayana, where they can be loaded onto ocean-going vessels. This will open up the impressive mineral resources of the region, now inaccessible for the most part, which include important oil and gas deposits in the region of the Arauca, coal in Colombia, bauxite deposits in Venezuela, and gold and platinum deposits in the Guayana highlands of Venezuela.