A New World Energy Model

An Energy Guide to the 21st Century

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This article presents a new energy model which significantly enhances knowledge of the today's global energy situation. It "mirrors," reflects, the real world of energy.

Table 1 summarizes P&FC's new energy model. This table accounts for regional energy production, trade, and consumption data. Eleven energy regions were used for regional energy analysis.

The table shows regional energy production, trade, and consumption share data, in percentages, for the entire world.

The bold-faced column gives the *user's cost of energy for each of the eleven regions*. It shows that the world's energy consumers paid $2.6 trillion U.S. dollars for the 362 quadrillion Btus they consumed in 1999. This fueled a world economy of $34 trillion GNP and 6 billion people.

No other energy model in the world accounts for the cost of energy to the consumer.

The last three columns in this table show the regional shares of Population, GNP, and Land Area.

Figure 1 is P&FC's "Mirror" Energy Model, reflecting the real energy world. The world consumer energy bill shown in Figure 1 was calculated by accounting for the cost centers for each of the 11 regions.

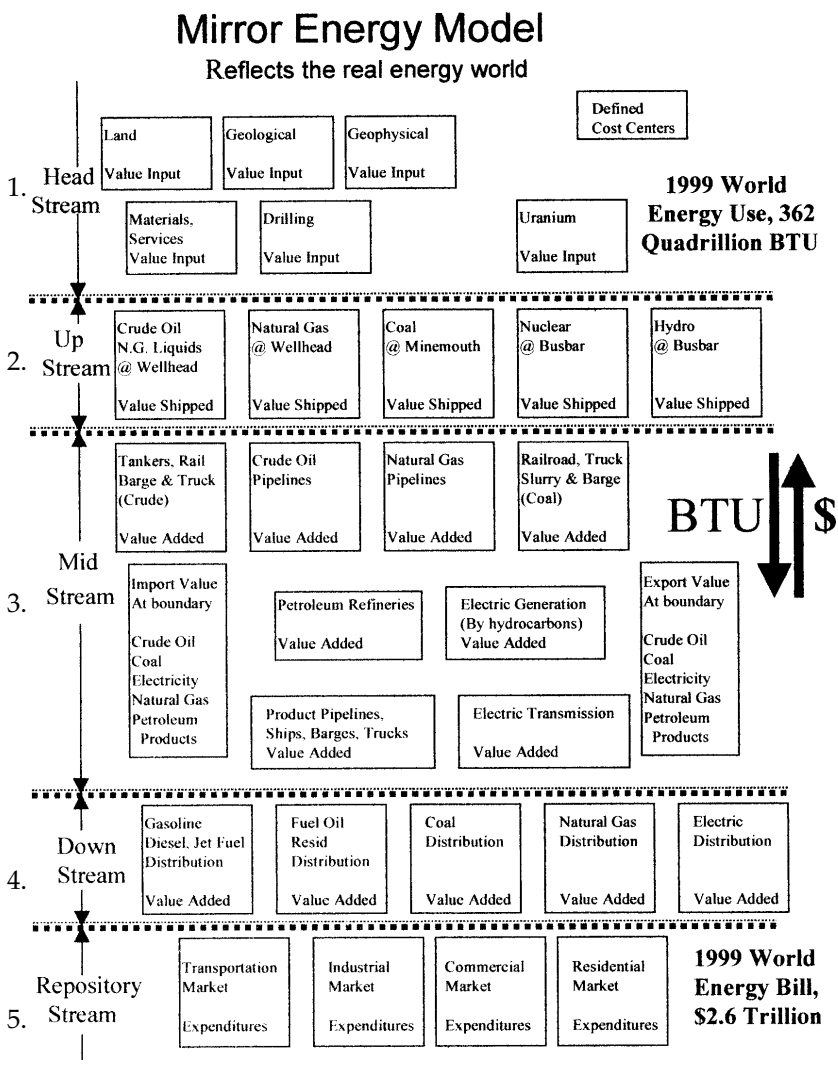
This "Mirror" Energy Model applies to individual countries, regions, and the world.

Here's how it works: The ultimate energy consumer is shown at the bottom of Figure 1, column 5, "Repository Stream." The ultimate consumer's dollars ($) flow upward as energy (Btu) flows downward to the consumer. The tracking of *dollars for services* to move and upgrade energy Btus make this energy model much more representative of the real energy world and provides greater economic transparency.

Table 1. World Energy Model for the 21st Century

Region (No. of Countries)	Percent of Energy Production	Percent of Energy Consumption	Percent of World Energy Bill	Percent Net Exports (Net Imports)	Percent of Population	Percent of GNP	Percent of Land Area
1. Africa (47)	6.9	3.2	**2.9**	3.7	13.1	1.9	22.5
2. C. & S. America (27)	6.1	4.8	**5.9**	1.3	6.6	8.5	14.1
3. China (1)	9.9	10.2	**9.6**	(-0.3)	21.1	3.1	7.4
4. Japan (1)	0.1	5.6	**6.4**	(-5.5)	2.1	12.5	0.3
5. Mexico & Canada (2)	6.9	4.8	**4.9**	2.1	2.1	3.4	9.2
6. Middle East (13)	13.3	4.1	**3.1**	9.2	2.6	2.1	4.1
7. Russia and FSU (25)	15.6	13.5	**16.2**	2.1	6.7	2.6	17.8
8. SE Asia and Oceanic (15)	6.5	7.4	**6.4**	(-0.9)	11.5	5.8	9.8
9. South Asia (7)	2.6	3.4	**2.9**	(-0.8)	21.5	1.8	3.9
10. United States (1)	19.1	24.3	**20.1**	(-5.2)	4.5	23.9	7.3
11. Western Europe (21)	11.5	18.1	**21.1**	(-6.6)	8.1	34.2	3.6
1999 World Totals	362 Quad Btu		**$2.6 Trillion**		6 Billion	$34 Trillion	

Figure 1



FIVE ENERGY COST GROUPINGS

There are five general cost groupings in the "Mirror Energy Model":

1. **Head Stream**: Includes the land, geological, geophysical, drilling, equipment service costs. These costs have little to do with the cost of energy in the short term. This is because much of the petroleum

produced today is from fields that were found several decades ago, Saudi, Iran, etc.

2. **Up Stream**: Accounts for the cost of the primary energy at the source. The model calculates the value shipped for each by multiplying the unit volumes by the unit price at the wellhead, minemouth and the bus bar for nuclear and hydro. This tallies the value shipped.

3. **Mid Stream:** The top row (a) deals with the cost of transporting raw energy, crude oil, natural gas, coal. The cost of transporting is a value added. It is calculated by multiplying the volume transported times the unit cost of transportation.

   The second row in the Mid Stream (b) deals with the cost of upgrading or converting raw energy to refined energy, electricity and refined products. The cost of upgrading energy is another "value added." This cost is calculated by multiplying the volume upgraded by the unit cost for upgrading.

   The third row in the Mid Stream (c) deals with the cost of transporting refined energy: electricity and refined petroleum products. This cost is also a value added. This cost is calculated by multiplying the volume transported times the cost per unit to transport.

   The two side boxes in the Mid Stream classification represent energy imports and energy exports for the region. Again this is simply volume times unit cost.

4. **Down Stream**: Accounts for the cost to distribute energy. This is for electric and natural gas distribution, along with gasoline, heating oil and coal. This is also a value added to the overall cost of energy. Of the cost levels, the down stream, i.e., distribution cost is generally the largest.

5. **Repository Stream**: What the individuals and companies pay for the energy they consume. This is for transportation fuel, (gasoline, diesel, jet fuel) industrial energy, electricity and natural gas delivered to the residential and commercial sectors. The overall consumer's expenditures for energy must reconcile with the overall cost.

Energy is seldom found where it is needed, consumed and generally not in the proper form necessary for end use consumption. Therefore raw energy must be transported to conversion centers and then refined energy must be transported to distribution systems. All cost additional money.

The World Energy Model data are maintained on an Excel spreadsheet, which makes for a great analysis tool. The model can be graphically displayed with the use of PowerPoint. Each cost center is color coded and sized proportionally to the value added. This allows for visual regional and country comparisons.

The model allows for insight to where economic rents are collected, both on the production and consumption side.

Another new World Energy Model has recently been published by Ecole Du Petrole. It is in common use and represents conventional energy wisdom. A schematic of this energy model (too complex to reprint in this article) is shown in the World Energy Council's recent report "Energy for Tomorrow's World—Acting Now." Most of this data (1998 figures) can also be found in BP's Annual Statistical Energy Report, the *Oil and Gas Journal* data base, the EIA in Washington, or the IEA in Paris.

Further information on the P&FC Energy Model is available from the author.

ABOUT THE AUTHOR

Dale W. Steffes, P.E., founder of Planning and Forecasting Consultants, Houston, Texas, is a gifted observer of the international energy scene. He specializes in independent analyses of market opportunities for major energy producers and users. Mr. Steffes' freedom from the strictures which often cause corporate and industry errors in judgment have made his evaluations especially valuable to those executives who understand the merits of a professional outside viewpoint.

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