

GLOBAL ENERGY DEMAND FORECASTS

1. IIASA's predictions were influenced by several factors: 1) most of the analysis was done prior to the 1979 rise in oil prices; 2) there was an optimistic view of the growth of nuclear capacity (to some 50 to 60 percent of global generating capacity by 2030); 3) participation in the study by the Soviet Union and other centrally planned economies, who for political reasons projected very high economic and energy-use growth rates; 4) low expectations for conservation and alternative energy sources.
2. Predictions of future energy demand are based on estimates of underlying economic and demographic factors, and of the relation between overall economic and population growth and energy demand. IIASA's population and GDP growth rate projections are as follows:

Population projections by region, high and low scenarios (10⁹ people) (Finite World, p. 429)

Region	Population base		
	year 1975	Projection 2000	2030
I (NA)-North America	237	284	315
II (SU/EE)-Soviet Union/East Europe	363	436	480
III (WE/JANZ)-West Europe/Japan, Australia	560	680	767
IV (LA)-Latin America	319	575	797
V (AF/SEA)-Southern Africa& Asia	1,422	2,528	3,550
VI (ME/NAF)-Middle East/North Africa	133	247	353
VII (C/CPA)-China/Central Planned Asia	912	1,330	1,714
World	3,946	6,080	7,976

NOTES: 1975 data are midyear estimates from United Nations Monthly Bulletin of Statistics Januar~ 1978

Historical and projected growth rates of GDP, by region, high and low scenarios (percent/yr)

Region	High scenario					
	Historical			Scenario projection		
	1950-60	1960-75	1975-85	1985-2000	2000-15	2015-30
I (N A)	3.3	3.4	4.3	3.3	2.4	2.0
II (S U / E E) .	10.4	6.5	5.0	4.0	3.5	3.5
III (W E / J A N Z)	5.0	5.2	4.3	3.4	2.5	2.0
IV (L A)	5.0	6.1	6.2	4.9	3.7	3.3
V (A F / S E A) .	3.9	5.5	5.8	4.8	3.8	3.4
VI (M E / N A f)	7.0	9.8	7.2	5.9	4.2	3.8
VII (C/CPA)	8.0	6.1	5.0	4.0	3.5	3.0
World	5.0	5.0	4.7	3.8	3.0	2.7
I + III (OECD).	4.2	4.4	4.3	3.4	2.5	2.0
IV + V (Developing)	4.7	6.5	6.3	5.1	3.9	3.5

Region	Low scenario					
	Historical			Scenario projection		
	1950-60	1960-75	1975-85	1985-2000	2000-15	2015-30
I (N A)	3.3	3.4	3.1	2.0	1.1	1.0
II (SU/EE).	10.4	6.5	4.5	3.5	2.5	2.0
III (WE/JANZ).	5.0	5.2	3.2	2.1	1.5	1.2
IV (L A)	5.0	6.1	4.7	3.6	3.0	3.0
V (A F I / E A)	3.9	5.5	4.8	3.6	2.8	2.4
VI (ME/NAf)	7.0	9.8	5.6	4.6	2.7	2.1
VII (C/CPA)	8.0	6.1	3.3	3.0	2.5	2.0
World	5.0	5.0	3.6	2.7	1.9	1.7
I + III (OECD)	4.2	4.4	3.1	2.1	1.3	1.1
IV + V + VI (Developing)	4.7	6.5	5.0	3.8	2.9	2.6

SOURCE Energy in a Finite World, A Global Systems Analysis, Energy Systems Program Group/International Institute for Applied Systems Analysis (Cambridge, Mass Ballinger Publishing Co., 1981) p 433

3. In general, the IIASA study places great emphasis on the development of nuclear power, and especially on an explosive growth in fast breeders after 2000. Although a number of countries, including France, Japan, and the Soviet Union, have announced aggressive plans to install breeders over the next several decades, it should be remembered that questions still remain as to breeder reactor safety, reliability and operating costs. (See ch. 6 for a comparison of breeders and other baseload power sources.) IIASA's high expectations for breeder development are by no means universally shared.

Percent of global secondary electrical demand met by nuclear power-IIASA

	1975	2000		2030	
		Low	High	Low	High
Conventional reactors	20	271	294	19,2	22,9
B r e e d e r s	0.0	044	067	40,6	38,2
Total	20	275	303	498	611

SOURCE *Energy in a Finite World*, p 580

4. These higher estimates for the amount of coal used for synfuels depend on a number of assumptions, including the greatly increased use of nuclear power to replace coal in electricity generation.
5. The following CONAES study estimates for the U.S. should be compared with the IIASA estimates for North America (see No. 1, p. 271 for population and economic figures; assume Canadian population is approximately 10 percent of total),

Population in 2070—279 million (Bureau of Census Series I I projection, with no allowance for illegal immigration).^a
Average growth in GNP, 1980-2010—2 percent per year¹

Primary energy demand (Quads)		
CO AfAES ² [United States only - 2010]		
Low [A]	Medium [B]	High [C]
70	90	130
IIASA ⁵ (North America-Canada approximately 10 percent of total)		
	2000	2030
Low	99	131
H i g h	120	180

Direct comparisons are difficult because of the different time frames and geographical areas examined. The CONAES A projection, no growth in energy demand over the next 30 years, has no parallel in the IIASA study. The IIASA low scenario is slightly higher than the CONAES series B projections; the high scenario is approximately equal to CONAES C. Population estimates are compatible; however, CONAES' 2 percent per year average GNP growth rate is much lower than IIASA's high scenario. It is approximately equal to the low scenario forecast.

Insofar as the two studies are comparable, CONAES' estimates are somewhat lower than IIASA's, with the more radical CONAES A projection much lower. The difficulty lies in determining what this might mean on a global scale. Lower estimates for the United States may hold true for other Western industrialized areas, but cannot be extended to developed centrally planned economies or to the developing world, where growth rates are expected to be higher than in the OECD. The CONAES report itself states that: "Even if energy conservation in the United States accomplishes a great deal domestically, it will be more than offset by demand growth in countries at the 'takeoff' stage of development." Global energy consumption in 2010 is estimated to be probably three to four times what it is now, with electrical consumption rising at even faster rates.^b

6. The Case Western Reserve and World Energy Conference estimates for future energy and electricity use are as follows:

^aEnergy in Transition, 1985-2010 (Washington, D C , National Academy of Sciences, 1979), p 626

¹Ibid, p 643

²Ibid, p 645

⁴Ibid, p 668

⁵Energy in a Finite World A Global Systems Analysis, Energy Systems Program Group, International Institute for Applied Systems Analysis (Cambridge, Mass Ballinger Publishing Co, 1981), p 440

^bEnergy in Transition, p 626)

Energy demand (Quads)

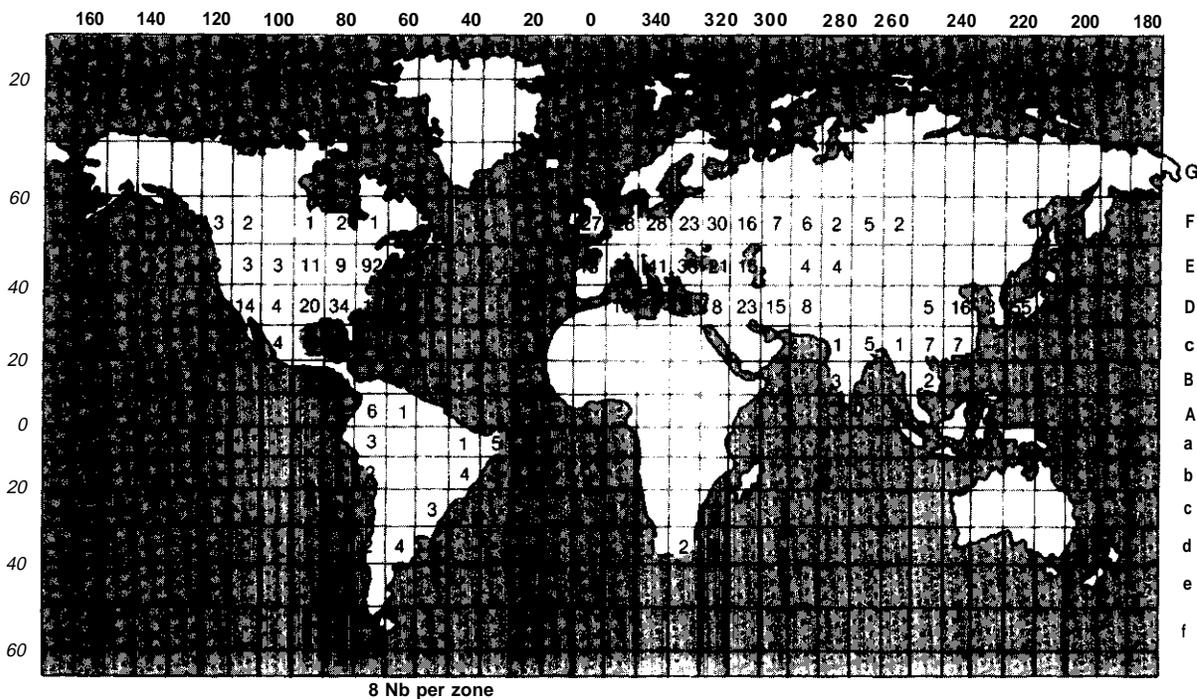
	1975	2000		2025/2020	
		CWRU	WEC	CWRU	WEC
OECD	146.8	3453	266.2	618.8	395.1
SU/EE	55.0	98.3	126.1	205.7	235.0
Developing,	37.7	103.0	174.0	296.8	434.2
Global.	239.5	5466	566.3	1,121.3	1,064.3

End-use electricity demand (Quads electric) (estimated by Clav. and Dupas from model data)

	1975	2000		2025/2020	
		CWRU	WEC	CWRU	WEC
OECD	12.5	55.8	386	106.9	66.1
SU/EE	3.9	152	216	353	353
Developing	1.8	102	135	40.2	465
Global,	18.2	812	737	182.4	1479

Compare these figures to the lower IIASA estimates in figure C-1. The worldwide distribution of LEPP in 2025 for the CWR model is:

Figure C-1.—Large Electric Powerplants in 2025



SOURCE: From Claverie and Dupas, "Preliminary Evaluation of Ground and Space Solar Electricity Market in 2025," 29th IAF Congress, October 1978

7. The World Bank report on Energy in the Developing Countries projects energy use and demand over the next decade. From 1973-78, growth in electricity consumption in developing countries averaged 8 percent per year, compared to 3.5 percent in developed countries; the Bank estimates this will continue through the 1980's. The Bank reports that in 1980 Oil-Importing Developing Countries (OIDC) invested \$18.5 billion in electric power (70 percent for generation, 20 percent for distribution, 10 percent for transmission) out of a total of \$24.6 billion invested in all forms of energy—over 75 percent. This is expected to more than double, to \$39.7 billion/year, by 1990.

The amount of installed capacity is estimated to be 241 gW in 1980, rising to 523.7 in 1990. Large increases will be made in gas and nuclear fired generators though absolute levels will remain relatively low; hydro power will remain the largest single source, at approximately 40 percent of the total, with oil generation declining rapidly from 37 to 25 percent. '

'Energy in the Developing Countries, World Bank, August 1980, pp 42-49