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The Effects of the East Asian Crisis on the Region's Energy Consumption

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Abstract

The potential impact of continued economic growth on world energy markets could be substantial. Rapid growth projections into the next ten and twenty years suggested that the East Asian area (Korea, China, Hong Kong, Malaysia, Philippines, Thailand, Indonesia, and Singapore, where Japan is included with the OECD high-income countries) will be a major center of world GDP. Thus, the region's burgeoning energy needs would make an important difference in the supply-demand balance and would raise world energy prices. The environmental implications for the rise in energy are evident.

This paper analyzes the implications of the l997 East Asian crisis on the projections of energy used by this region. Estimates of the energy elasticities based on pooled cross section and time series are used to forecast energy and petroleum consumption and imports into the region under a variety of assumptions about the future economic outlook and policy.

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During the 1980s and l990s, the rapid expansion of East Asian[1] economic growth, what has been termed the "East Asian miracle", was being translated into sharply growing requirements for energy. As the East Asian countries industrialize and motorize, requirements for energy in the form of industrial fuel oil, electrical power, gasoline and diesel fuel grew rapidly. Since many of these countries have only small indigenous energy supplies, or have domestic production of fuels like coal or natural gas whose use in transportation and households is limited, rapid growth translated into rapid expansion of petroleum imports. The potential impact of continued growth on world energy markets could be substantial, particularly as large countries, specifically China, join the rapid development process. Yergin, Eklof, and Edwards (1998) discuss the energy issues related to Asian economic recovery at length. Rapid growth projections into the next century, 2010 and 2020, suggested not only that the East Asian area will be a major center in terms of world GDP, but also that the region's burgeoning energy needs would make an important difference in the supply/demand balance and probably would raise prices in world energy markets. The implications for the accumulation of greenhouse gases and other pollutants are also evident.

The l997 East Asian crisis has greatly changed projections for the future of East Asia. Large energy import requirements would still arise in the future, if rapid economic growth rates resume. But the current recession is already reducing inflows of energy. Lower rates of consumption growth as well as new supplies may provide a breather or, even, a long-term resolution of pressure on world energy supplies. It can be argued that the low level of world oil prices, today, already reflects the anticipated lower path of energy demand.

In this paper, we evaluate the prospects for energy consumption in East Asia. We introduce the 1997 crisis and consider how that will alter future prospects. Estimates of the energy elasticities based on pooled cross section and time series allowing for growth, industrialization, motorization link indigenous energy supplies

[1] Our discussion is concerned with the developing countries of East Asia, i.e. Korea, China, Hong Kong, Malaysia, Philippines, Thailand, Indonesia, and Singapore. We include Japan with the OECD high-income countries. Our discussion will contrast China and the other East Asian countries (OEA).

energy demands and economic activity. These calculations allow us to make projections for energy and petroleum consumption and imports into the region under a variety of assumptions about the future economic outlook and about policy. There are also implications for pollution emissions.

The East Asian Energy Situation

Total energy consumption in East Asia still accounts for only a small share of world requirements (20 percent if we include China; only 10 percent if we consider only the other East Asian countries (OEA). But the growth of GDP and of energy consumption in this region of the world has been so rapid that simple projections yield increasingly large demand shares that may ultimately influence world energy markets significantly. On Table 1, we summarize the relevant information, focusing first on the contrast between China, the OEA countries, and, for comparison, the OECD.

Table 1
Growth and Projections of Energy Demand

	1972-85 %change p. a.	1985-1995 %change p. a.	1995 Millions of t.o.e.	2010 projected Millions of t.o.e. [2]	2020 projected Millions of t.o.e.	Ratio to OECD Consum 1995	Ratio to OECD Consum 2010	Ratio to OECD Consum 2020
OEA	8.07	7.58	437.46	1,625.98	4,043.68	.10	.31	.43
China	5.29	5.52	850.52	1,763.12	2,866.48	.19	.29	.61
E. Asia	6.05	6.01	1,287.98	3,389.11	6,910.16	.29	.60	1.05
OECD	0.98	1.58	4,455.93	5,637.24	6,593.92	1.00	1.00	1.00

Aggregate energy demand has been growing at 5.5 percent, 7.6 percent, and 1.6 percent, in China, OEA, and the OECD respectively. Though China is growing even more rapidly than other East Asian countries, energy consumption growth is slower there than elsewhere in East Asia. Nevertheless, in view of China's size, projections of such growth rates to the year 2020 would mean that China's energy consumption would amount to 60% relative to the energy consumption in the OECD. Importantly, the region as a whole would account for approximately one third of world energy needs. It would consume more energy than the OECD today and a little more than the projected figure for the OECD in 2020. If such developments were to materialize,

energy demand in East Asia would have profound impact on the world energy economy. This impact would fall particularly on world oil markets since marginal energy demands would be satisfied largely in the form of imported petroleum.

The crisis in East Asia in l997 and the slowdown of growth in China that is under way will put these figures into entirely different perspective. It is our purpose in this paper to make a quantitative appraisal of the impact of recent economic slowdowns on East Asian energy needs. Even a resumption of rapid growth will leave total East Asian energy demand well below what it would otherwise have been. The importance of this calculation lays in the fact that oil markets are forward looking. It is likely that this change in perspective for the future is already recognized in today's oil markets, accounting for the unusually low oil prices prevailing recently.

Characteristics of East Asian Energy Markets

Despite the fact that there are wide differences between various regions of the world, certain commonalities about energy use are illustrated in Table 2. We show GDP on a per capita PPP (purchasing power parity) basis and energy consumption per capita and energy consumption per unit of GDP, a measure of intensity. The range of per capita GDP is high, even measured in PPP units. Per capita GDP in the OEA is about twice as high as in China. In turn, per capita GDP in the OECD is about four times that in the OEA. Strikingly, per capita energy consumption follows the same pattern with about the same relative values. In turn, consumption of energy per unit of GDP is quite close, with energy intensity of .00020 in the OECD only a little higher than .00016 and .00015 (tons of oil equivalent per $ of GDP) in China and in OEA respectively. This apparent similarity covers over some substantial differences between countries (Table 3). Note particularly the difference between Hong Kong and Korea reflecting their differing economic structure. Nevertheless on a regional cross section basis, energy consumption appears to be close to, or a little more than, proportional to GDP.

[2] The projections are done assuming the same l985-95 growth rates. Some forecasts, like those of the International Energy Agency (IEA), reached somewhat lower numbers by the simple expedients of assuming decline in projected GDP growth rates and increase in petroleum prices (IEA 1996).

Table 2

Intensity of Energy Use and Self Sufficiency

	1995 GDP per capita $ PPP Equivalent	Energy Consumption per capita (t.o.e)	Energy Consumption per $ of GDP (toe)	Self Sufficiency: energy from domestic sources
OEA	6,268	0.48	.00016	0.67
China	2,970	0.95	.00019	1.01
E Asia	3,817	0.73	.00015	0.90
OECD	24,930	4.94	.00020	0.76

Table 3

Energy Intensity and Self-sufficiency: East Asian Countries

	1995 GDP per capita $PPP equivalent	Energy Consumption per capita (t.o.e.)	Energy Consumption Per $ of GDP (toe)	Self-sufficiency: energy from domestic sources
Korea	11550	2.382	.00021	0.15
Hong Kong	22950	1.65	.00007	0
Malaysia	9520	1.075	.00013	1.80
Taiwan	13415	2.024	.00015	0.17
Thailand	7710	.5569	.00007	0.55
Philippines	2760	0.175	.00006	0.54
Indonesia	3970	0.442	.00011	1.74
Singapore	22610	.2.667	.00012	0

Energy balances (Table 4) for China and for OEA show that there are striking differences within the East Asian region in the sectoral consumption of energy, the share of different fuels, and in the need for imports. This information, summarized in Table 5 shows that final energy consumption by sector in the OEA is approximately one third in industry, one third in transportation, and one third in other uses, similar to the OECD. In China, on the other hand, a much larger fraction of energy consumption is in industry, with little going into transportation. China also is much more self-sufficient than OEA (except Indonesia and Malaysia). This reflects the predominant importance of indigenous coal as a fuel in China (63 percent of fuel consumption), though even that country's imports of petroleum have been rising rapidly. We discuss the special problems of projecting China's energy needs at greater length below.

Table 4

Energy Balances for China and Other East Asia, 1994

(Millions of tons oil equivalent)

China Energy Balance

	Coal	Crude oil	P. products	Gas	Nuclear	Hydro	Elect	Heat	Total
Indig. Prod	619.9	146.1		14.7	3.6	14.5			798.9
Imports (computed.	-7.6	-6.2		0	0	0.2	-0.2	0	-7.9
TPES	612.3	139.9	6.1	14.7	3.6	14.7	-0.2		791
Transform +Losses.	-251.4	-136.7	103	-1.1	-3.6	-14.7	61.9	21.6	-221
TFC (breakdown)	360.9	3.2	109.1	13.6			61.7	21.6	570
Industry	258.3	2.9	36.5	10			42.5	17.4	367.6
Transport	7.8	0.2	39.4	0.1			1.4	0	46.8
Other	94.8	0.1	33.2	3.5	0	0	17.8	4.2	155.6

East Asia less China 1

	Coal	Crude oil	P. products	Gas	Nuclear	Hydro	Elect.	Heat	Total
Indig.Prod	29	117.6		83.1	16.21	2.8	0	0	263.7
Imports (computed)	36.5	134.3	-6.5	62.8	8.19	0	0.7	0	130.8
TPES	65.5	251.9	-6.5	145.9	24.4	2.8	0.7	0	394.5
Transform +losses.	-34.1	-251.8	200.4	-92.8	-24.4	-2.8	38.1	0	-113.8
TFC	31.4	0.1	193.9	53.1	0	0	38.8	0	280.7
Industry	28.8	32	35.1	5.8	0	0	19.3	0	120.5
Transport			74.7	10.5	0	0	0.2	0	83.3
Other	2.6	-31.9	84.1	36.8	0	0	19.3	0	76.9

TPES-total primary energy supply. Note this is really a measure of primary energy used as inputs into transformation and for final use.
TFC - Total Final Consumption including all secondary energy and primary energy going directly into final production. Nuclear and hydro are transferred into electricity in the transformation sector.

Table 5

Sectoral Utilization of Energy and Fuel Shares

	Sectoral Shares (%)				Fuel Shares[3]	
	Industry	**Transport**	**Other**		**% Coal**	**%Petroleum**
OEA	42.9	29.7	27.4		11.2	69.1
China	74.5	8.2	27.3		63.3	19.1
Total EA	57.4	15.3	27.3		45.1	35.6
OECD	30.7	32.9	36.3		4.9	53.3

The Empirical Approach

Since the East Asian crisis, the path of economic growth is being seen as very different, certainly interrupted and perhaps slower, than had been forecast previously. Consequently, a time series or trend projection approach, as above, that might have seemed reasonable while East Asian growth was still in full swing, is no longer appropriate.

A somewhat more structured approach is to link energy consumption to the underlying economic activity variables on a cross section basis. The econometric estimation of the energy demand elasticity with respect to variables measuring various dimensions of economic activity allows us to recognize alternative scenarios of the economic outlook over the near term and the long-term future.

Elasticity demand coefficients with respect to economic activity have been estimated for seven East Asian countries by using cross section data for 1985 and 1995 (Table 6). We allowed in some equations for self-sufficiency, industrialization, and motorization (not all equations are shown). Since our estimates are based principally on the cross section, and since marginal energy prices, for imported fuel, are common to all of the countries involved, no price coefficients are shown.

Similar equation estimates for a broad range of countries are presented next. The data underlying these calculations is for some 150 countries, including developed, developing and poor countries in all parts of the world.

[3] Consumption of secondary energy, the remainder other than coal or petroleum products, is principally electricity.

Table 6

Energy Demand Regression Estimates

Dependent variable: Log Energy Consumption per capita
Coefficients of Independent variables: (* statically significant)

	LGDP Per capita	Change in LGDP per capita	Share of Industry in GDP	Dummy 95	Dummy China	Motori-zation Lcarspc	R-Squared
		East Asian	**Countries**	**Sample**			
1.	1.24*						.79
2.	1.09*		9.77*				.98
3.	1.13*		10.16*	-.02			.99
4.	1.30*		6.87*		0.69*		.99
5.	2.25*					-0.6	.85
		Worldwide	**Countries**	**Sample**			
1.	1.51*						.78
2.	1.62*	-.77*	.	.33*	1.71*		.87
3.	1.43*		2.22*	,29	1.30*		.83
4.	0.85*				1.80*	0.43*	.88

The statistical calculations on aggregate energy demand data show clearly that the energy demand elasticity with respect to economic activity exceeds unity. In the East Asian countries separately, elasticity estimates range from 1.09 to 1.30, (except in Equation 5 which we consider below). A critical consideration is inclusion of a separate variable for industrialization, which tends to reduce the elasticity with respect to GDP. The inclusion or exclusion of China with a dummy variable does not materially change the GDP elasticity, though China is clearly an outlier with relatively high-energy consumption for its level of per capita GDP (adjusted for purchasing power parity). In the East Asian case, the cross section elasticity does not appear to be very different from the elasticity that would have been obtained from time series relationships because the coefficient of time (a dummy variable for l995) is not statistically significant. Motorization does not appear to have a separate significant effect in the East Asian data set. Indeed, in Equation 5 the coefficient of motorization is negative and the coefficient with respect to GDP is greatly increased. This may reflect the common movement of the variables with motorization rising very rapidly with increase of per capita GDP. Moreover, as motorization advances, consumption

per vehicle declines. Energy self-sufficiency does not significantly affect energy consumption, given the GDP variable.

Roughly similar results, even a little higher energy elasticities, are obtained from a calculation encompassing a large number of countries, again for l985 and l995. The elasticities range from 1.4 to 1.5. Again the degree of industrialization is statistically significant and reduces the overall energy elasticity, though only by a small amount. The rate of change of GDP shows a significantly negative effect suggesting that adjustment of energy demand over time is gradual and that the short-term elasticity over time may be somewhat lower than the elasticity measured in the cross section. There is a significant relationship with motorization, which reduces the elasticity with respect to GDP substantially, but that is likely to reflect the fact that motorization and energy consumption are both sharply related to GDP per capita. China again shows a positive effect above the other countries, a significant dummy variable.

We apply such coefficients in an evaluation of alternative forecast scenarios below. To cover the range of the estimates we use a value of l.0 for a low elasticity estimate and 1.5 for a high estimate.

The Chinese Situation

China represents a special case in evaluating the East Asian energy situation. As we have already noted in our discussion of the Chinese energy balance, the Chinese economy is based largely on coal consumed in industry Energy use in transportation and other parts of the economy is relatively much lower than in other economies of East Asia. Moreover, the elasticity of energy consumption with respect to economic activity in China is only 0.5 as compared to elasticities close to unity in the cross section and over time elsewhere.[4] What, then, is the appropriate value for the projection elasticity?

Since industry in China is not growing slowly, a low elasticity can be justified only if very large gains in efficiency offset the need for energy as the economy grows.[5] In view of the inefficient use of coal in Chinese industry, this is possible. But it is not

[4] A student in China said to me that the energy demand elasticity for China was "of course, just like in the United States". The great differences between China, a developing economy and the United States cast doubt on this view.

likely. Moreover, as Chinese energy use extends into transportation and the "other" category, it is likely that the elasticity will be closer to that observed elsewhere in East Asia. On the other hand, there is evidence that the very high GDP growth rates reported for China overstate the actual growth of output (Adams and Chen, 1997). That leaves two choices: To assume the reported numbers both for growth and for the elasticity, i.e. high growth and low elasticity, or, alternatively, to assume a high elasticity but lower growth than reported. For long term projections the results would be approximately the same. We have chosen the first alternative. For our low simulation we have assumed an elasticity of 0.5. For our high elasticity calculation, we have chosen 1.0 for China. In line with most forecasts for China, we assume a somewhat lower GDP growth rate than in the past, though a growth rate that is still high by world and even by East Asian standards.[6]

Energy Demand Projections

Projections to 2010 and 2020 were made applying the assumed cross section coefficients to the l995 data. The exogenous economic activity forecasts are drawn from WEFA (1998) and shown in Appendix Table 1. We have modified the numbers in some cases, to adjust for more recent developments, the greater seriousness of the current crisis slowdown that had earlier been anticipated.

We have made no attempt, however, to allow for potential changes in energy prices. This would greatly complicate the projection approach.[7] The absence of price effects works in two ways: in the short run energy prices are likely to be very low, in part as a result of the decline in growth. But short run price effects on energy consumption are low anyway so that there is not likely to be a great effect. In the long run, price effects may be more important. On the other hand, long term movements of

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[5] For a discussion, see Jang (1994).

[6] One might also ask what would happen if China continued its rapid economic growth rate and had much higher energy elasticity than in the past. Such a case might occur if China were to motorize rapidly. It is unlikely, however, that such a case, which would call for very rapid increase in petroleum imports, is presently being factored into energy market expectations.

[7] A complete system would call for endogenous determination of energy prices. This would pose special difficulties in our calculations because it would require:

1. A world energy price model,
2. Calculation of imported fuel prices in the consuming countries based on exchange rates and transport costs, and
3. Evaluation of the pricing of indigenous energy supplies.

energy prices are difficult to predict and are dependent not only on consumption trends but also on trends in the use of resources and in technology. Since the price determination process is forward looking, predictable price developments are likely already to be embodied in the current price.[8]

Projections under Various Assumptions

The changing pattern of economic activity in East Asia calls for considering alternative scenarios.

A variety of simulations were carried out as follows:

1. **Trend simulation (T)**, assuming a trend in energy consumption growth close to what would have been forecast in l995. While these simulations are not realistic since the continued growth postulated did not materialize, they are useful as a base simulation since they provide a picture close to that being projected until recently. This is a forecast of very sharply increasing energy needs in the region.
2. **Business cycle with gradual return to the growth path (BC).** This simulation adds a degree of realism by recognizing the crisis-associated slowdown. In line with many economic forecasters, this simulation based on recent forecasts by the WEFA Group, assumes that the East Asian crisis represents a temporary slowdown, lasting two to three years. A slowdown into negative growth for the OEA region in l998 and zero or slow growth in l999, will turn to resumption of growth, close to past growth rates, in the year 2000 and beyond. A long-term slowdown in Chinese growth is also projected. We note, here, that this scenario will greatly reduce future energy needs in the area since growth is postponed into the future and the **level** of GDP, and, consequently, of energy consumption, in the future will be substantially less than in the base simulation.
3. **Stagnation, An extended period of lost growth (S).** This, simulation, is based on a pattern similar to that observed following the l982 Latin American debt crisis, It assumes drastically reduced East Asian GDP growth for an extended year period, approximately at half rate experienced in the pre-1995 decade.

[8] Hotelling's (1931) approach would see today's energy prices adjusted to a present discounted perception of future availabilities and needs. While there is much disagreement about whether the Hotelling principle applies, there is little dispute that significant changes in future anticipated energy demand and supply will affect today's petroleum price.

As we note above, simulations have been carried out on the basis of two assumed elasticities,, a *low elasticity* calculation with an elasticity of 1.0 (0.5 for China) and a *high elasticity* calculation with elasticities of l.5 (except 1.0 for China). These elasticities bracket the numbers obtained in the regressions.

The simulation results are summarized in Table 7. They show a drastically changed energy demand situation.

Table 7

Energy Demand Projections
(Millions of t.o.e)

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Low elasticity.		1996	1997	1998	1999	2000	2010	2020
OEA	Trend	476.4	519.1	565.7	616.7	672.5	1,626.0	4,043.7
	BC	451.2	473.8	462.2	472.9	501.0	893.3	1,595.6
	S	451.2	472.9	461.3	470.9	488.9	724.5	1,077.6
China	Trend	892.9	937.3	984.0	1,033.0	1,084.5	1,763.1	2,886.5
	BC	891.8	931.0	968.2	1,009.9	1,053.8	1,636.5	2,541.5
	S	891.8	931.0	968.2	997.3	1,027.2	1,380.5	1,855.3
EA	Trend	1,369.3	1,456.4	1,549.7	1,649.7	1,756.9	3,389.1	6,910.1
	BC	1,343.0	1,404.8	1,430.4	1,482.8	1,554.8	2,529.8	4,137.0
	S	1,343.9	1,403,0	1,429.5	1,467.3	1,516.1	2,105.0	2,932.8
High elasicit.								
OEA	BC	458.1	492.5	474.5	491.5	535.3	1,259.3	2,974.5
	S	458.1	491.1	473.1	486.9	516.2	926.3	1,680.9
China	BC	933.0	1,015.1	1,096,3	1,190.6	1,297.8	3,072.3	7,273.3
	S	933.0	1,015.1	1,096.3	1,162.1	1,231.8	2,206.0	3,950.7
EA	BC	1,391.1	1,507.6	1,570.9	1,682.1	1,833.1	4,331.6	10,2478
	S	1,391.1	1,506.2	1,569.5	1,649.1	1,748.1	3,132.4	5,631.6

Low Elasticity—1.0 for OEA and 0.5 for China
High Elasticity---1.5 for OEA and 1 for China
BC—business cycle between l996 and 1999, return to trend from 2000
S---stagnation, business cycle and 2/3 growth from 2000.

For the year 2000, energy demand in East Asia is approximately 200 million t.o.e. lower than would otherwise have been projected. Most of this reduction reflects the cyclical slowdown in the OEA countries. Even though one may not want to take the trend path of energy demand growth too seriously over the long term, it is noteworthy that the estimate of East Asian energy demand in the BC simulation for 2010 is almost 1.2 billion t.o.e. lower than the trend estimate. For 2020 the S simulations shows energy use in East Asia a colossal 3 billion t.o.e. lower than the base projection.[9] These reductions reflect the crisis and the lower base for growth in the BC simulation, particularly in the OEA countries, which reduces their energy demand by almost by almost 50 percent below the trend projection level by 2010. In the S simulations, a further reduction results from the assumption of a lower long run trend after the end of the current crisis. In China, the crisis has less impact, given the

[9] In this case, of course, the lower long-term growth path dominates the impact, as compared to the business cycle effect that is most important in the shorter-term projections.

assumption of a much smaller crisis in the l990s. While, in percentage terms, the change is much smaller than elsewhere, it amounts to a large figure, 1 billion t.o.e. in 2020, in absolute terms.

On the basis of higher assumed elasticities, the effects of the crisis are somewhat muted given the fact that the higher elasticity increases the effect of GDP growth on demand in countries where upward growth trends have been retained after the crisis slowdown. Particularly for China, the higher elasticity estimates show projections that are substantially higher than past trends. This is the result of combining optimistic estimates about GDP growth (based on current Chinese data) with an energy elasticity comparable to that in the OEA countries. That may produce unrealistic projections of Chinese energy requirements. Thus, we place greater credence on the estimates using the lower elasticity for China.

What are the implications of these considerable changes in East Asian energy demand prospects for world energy and petroleum markets. In terms of world energy consumption forecasts (IEA 1999), the results of our S simulation for 2010 suggest a 10-12 percent downward), adjustment in world energy demand (1.2 billion t.o.e. out of 10 to 11 billion t.o.e., IEA 1996 reference world forecast[10].)

An analysis of world petroleum market prospects is beyond the scope of this paper. To put the energy demand analysis above in a quantitative context in relationship to the world petroleum market, we note that imported petroleum is the marginal source of energy for East Asia. There are some prospects for natural gas and coal in the area itself and there are possibilities for developing additional petroleum, though the major regional supplier of petroleum, Indonesia, appears to be near its limit (USEIA 1998). The bulk of the adjustment in prospective regional energy demand will surely fall on world oil producers. Comparing the changes in the East Asian region's energy demand prospects with likely world consumption in 2010, the impact is likely to be of the order of magnitude of 25 percent (23 million b/d as compared to IEA 1996 estimates of world consumption of petroleum of 92 to 97 million b/d). As we suggest above, such expectations may already be taken into account in today's depressed oil prices.

[10] We make the comparison with the 1996 (pre crisis) forecast. More recent IEA projections allow for some of the crisis effects measured by our computations.

Conclusions

Modeling the energy economy of East Asia provides a basis for projecting the energy requirements of the region under different assumptions about economic conditions. Such an approach is particularly important in the present situation. Rapid economic growth in East Asia suggested that by the early part of the next century East Asia would be a very large center of economic activity. Since the region is energy deficient on balance and since growth had extended to include a huge country, China, it appeared that East Asian requirements for energy would loom very large in world energy markets.

Our study suggests that the 1997 East Asian crisis has significantly changed this prospect. The interruption in East Asian growth means that future demands for energy and for imported oil will be substantially lower than had earlier been expected. Moreover, if the recession crisis extends for longer and/or if earlier high growth rates cannot be resumed, the path of East Asian fuel requirements is much lower than had been expected.

China represents a puzzle in these calculations. On one hand, China is a relatively heavier user of energy than one would expect, in part because of heavy industries using coal inefficiently. Chinese energy consumption has not been growing nearly as rapidly as one would anticipate given the very high reported growth of Chinese GDP. It is not clear whether this represents improvement of energy utilization efficiency or whether it reflects overstatement of the Chinese GDP growth figures.

Estimates based on a range of energy/GDP elasticities and current much reduced forecasts for East Asia suggest that the energy needs of the area will be greatly below what had earlier been projected.

The East Asian crisis has substantially reduced pressure on world markets. Earlier projections had estimated that continued rapid East Asian growth would impact

heavily on world energy and petroleum markets. Even if the 1997 crisis turns out only to be a temporary interruption, our BC simulation, energy demand will be sharply reduced. If the East Asian problem is a more extended slowdown, like the decade long recession of Latin America following the debt crisis, energy requirements and imports of petroleum into the area would be far lower than had earlier been envisaged. Expectations of such a decline may well account for the weakness of prices in world oil markets.

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Appendix Table 1
GDP Growth Assumptions

	Alternative GDP Projections (% per year)							Population
	1996	1997	1998	1999	2000	2000-10	2010-20	1995-2020
China								
Bc	9.7	8.8	8	8.6	8.7	9	9	1.1
S	9.7	8.8	8	6	6	6	6	1.1
Hong-Kong								
Bc	4.9	5.2	2.7	4.2	5.2	5	5	1.6
S	4.9	5.2	2.7	3.5	3.5	3.5	3.5	1.6
South Korea								
Bc	7.1	5.5	-3.8	2.2	5.7	5.6	5.6	0.9
S	7.1	5.5	-3.8	2.2	3.8	3.8	3.8	0.9
Malaysia								
Bc	8.6	7.8	2	3	5.5	7	7	2.4
S	8.6	7.8	2	3	3.6	4.7	7	2.4
Thailand								
Bc	6	-0.5	-5	1.5	3.7	6	6	0.9
S	6	-0.5	-5	1.5	2.6	4	4	0.9
Philippines								
Bc	5.7	5.1	3	4.5	5.5	6	6	2.2
S	5.7	1	3	3	3.8	4	4	2.2
Singapore								
Bc	6.9	7.8	2.5	4	6.8	6.6	6.6	2
S	6.9	7.8	2.5	2.7	4.5	4.4	4.4	2

Taiwan								
Bc	5.7	6.3	5.7	5.6	6	5.8	5.8	1
S	5.7	6.3	5.7	4	4	4	4	1
Indonesia								
Bc	8	4.6	-10	-1.7	4.2	6.2	6.2	1.6
S	8	4.6	-10	-1.7	2.8	4.1	4.1	1.6

bc = business cycle with resumption of growth path

s = stagnation, business cycle and lower growth trend after 2000