Global Energy Trends: Development Challenges and Opportunities for the United States

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Abstract

The intent of this paper is to examine current global energy trends and long term projections of energy utilization within developed and emerging economies. Implications of regional trade imbalances are considered as North America becomes increasingly energy self-sufficient largely due to unconventional sources of oil and natural gas in Canada and the United States. Attention is given to ongoing developments in environmental policy which focus on the potential impact to global energy consumption. Finally, it is argued that special emphasis needs to be placed on alternative energy as a strategic economic engine, among selected others, if local production growth, industrial competency upgrading, and overall competitiveness improvement are to be aggressively pursued in the United States.

Introduction

This paper looks at energy trends on a global scale as significant changes have occurred over the last decade. Current estimates anticipated that energy consumption worldwide could increase about 56 percent between 2010 and 2040, with oil consumption reaching 115 million barrels per day. Although previous estimates for liquid consumption projected a greater increase in demand, recent projections indicate a 6 percent decline in liquid fuel consumption by 2040 as nuclear and alternative energy sources gain a larger share of world energy market (EIA, *International Energy Outlook*, 2013).

It should be mentioned that lower projections in total energy consumption are related to the downturn in the global economies as a result of the 2008-2009 recession, higher energy prices, new technologies providing improved efficiencies, and policy implementations. While the energy consumption growth rate is slowing in terms of percentages when compared to previous generations, the increase in supply needed to meet future energy needs remains similar to what has been required during previous decades. However, it is projected that 85 percent of the global demand increase may occur in countries outside the Organization for Economic Cooperation and Development (non-OECD countries) as emerging economies are projected to experience a faster rate of population and economic growth from 2010 to 2040 than OECD countries (EIA, 2013).

New technologies such as hydraulic fracturing (fracking) and horizontal drilling allow suppliers the opportunity to tap into new found resources, and have made previously untapped reserves more profitable. The discovery of new resources in oil and natural gas are beginning to shift supply dynamics as unconventional sources have the potential to significantly change the global energy trade. Shale gas in particular has already begun to alter the outlook for North American natural gas production as US suppliers look to increase liquefied natural gas (LNG) exports. This shift can impact spot market prices for natural gas and the global liquefied natural gas market in years to come.

Unconventional sources of oil such as oil sand and tight-oil (shale and tight sandstone formations) are also having an impact on North American liquids markets, and with an increase in petroleum production, North America is on a path to overall self-sufficiency in liquids over the coming decades. Nuclear power continues to be a great unknown as fundamental issues regarding this form of power have remained unchanged during recent years. Nuclear power remains a relatively expensive source when considering the cost to build and operate nuclear facilities, while concerns regarding safety and waste disposal remain unresolved and the process of acquiring nuclear materials are still very sensitive and controversial topics. Construction of new nuclear plants has been stalled greatly since the tsunami that impacted the Fukushima Daiichi nuclear plant in Japan on March 11, 2011, and does not appear to be gaining any momentum for the foreseeable future. If future policy requirements favor lower carbon emissions nuclear power may become more economically competitive.

The next main sections discuss regional energy consumption factors and environmental policy implications.

Regional Energy Consumption Factors

Energy consumption can be broken down into three factors: population, GDP per capita, and energy intensity related to economic activity. To identify the impacts of carbon emissions, a factor for carbon intensity can be included. The equation for energy consumption (***E***) and the extended equation including carbon emissions can be written as

$E = E/GDP * GDP/Population * Population$
$CO_2 = CO_2/E * E/GDP * GDP/Population * Population$

The relationship between these factors is often referred to as the Kaya Identity and is useful for understanding the underlying factors driving energy consumption, and helps identify what may be required to moderate the growth of energy consumption or emissions (www.ipcc.ch).

Energy use per person in North America and Europe/Eurasia are considerably higher than the rest of the world as income per capita is almost two to four times the level of Central/South America and the Middle East, and four to twelve times the income levels of Asia and Africa. Excluding the Middle East, which exhibits high amounts of energy consumption in relation to its overall economic growth due to subsidization and its energy-intensive industrial base, North America and Europe/Eurasia energy consumption trend mimics the income per capita trend.

Over half the world's population, and more than a third of the global GDP and carbon emissions are accounted for in Asia which is still largely developing. These trend factors could be very different across regions over the coming decades with medium projections estimate global population reaching about 8.5 billion by 2040, or approximately 21 percent higher than the current global population as of 2012. Europe/Eurasia is expected to experience the slowest population growth while Africa will likely experience population growth over 50 percent. Current U.N. projections for 2040 range from a low of 7.5 to a high of 9.5 billion compared to the 8.5 medium (UN, 2004, p. 5 Figure 1).

Furthermore, major outlooks assume roughly 2.9 fold growth in global GDP from 2010 to 2040 when measured in terms of purchasing power parity (PPP). Across the various outlooks, regional GDP growth projections over this 30 year period are in the range of 3.8 percent for non-OECD Europe/Eurasia, 2.6 percent for North America, 2.2 percent for the Middle East, 4.6 percent for Africa, and 5.4 percent or non-OECD Asia countries compared to 1.6 percent for OECD-Asia countries. Between 2010 and 2040, over 64 percent of global income growth appears likely to occur in non-OECD countries with non-OECD Asian countries and Africa account for more than 61 percent of the total world gross domestic product growth. With uncertainty surrounding the continuance of rapid growth in emerging economies, especially Asia, the balance of energy demand and production across various regions are subject to shifts over the coming decades.

The potential for energy trade will increase as patterns of regional demand and supply shift. North America's energy trade imbalance is changing as North America reduces dependency on energy imports and becomes increasingly self-sufficient in energy. According to the EIA 2012 *World Energy Outlook*, the U.S. could surpass Saudi Arabia in 2017 as the world's second largest producer of oil. Recently, however, the IEA revised this estimate and predicts the U.S. would become the world's largest oil producer in 2015 due to the surge in shale oil production. Also, by the mid-2020s, the IEA predicts that non-OPEC production will decrease and countries in the Middle East and core members of OPEC will provide most of the increase in global supply (http://news.msn.com).

Environmental Policy Implications

Future CO_2 emissions attributed to the combustion of fossil fuels are expected to follow trends in energy consumption and vary widely across future energy projections. Therefore, the path of energy and environmental policy is rather unclear due to differing assumptions and varying trajectories related to carbon emissions. Moderate policy scenarios predict that non-OECD developing countries, which rely on fossil fuels, will contribute as much as 69 percent of the world's total carbon dioxide emissions. As developing countries strive to meet the modern demands of economic growth, fluctuations in energy consumption are likely to have significant impacts on CO_2 emissions. Without new policy development, emissions are projected to increase from 31.2 billion metric tons in 2010 to 45.5 billion metric tons in 2040 (EIA, 2013, p. 7).

Electricity consumption continues to become an increasing share of the world's total energy demand. Between 2010 and 2040, electricity generation is expected to increase by 93 percent from 20.2 trillion kilowatt hours to 39.0 trillion kilowatt hours. Future policies are likely to encourage energy conservation through efficiency programs, advanced technologies, alternative fuel sources, and the reduction in carbon emissions through pricing mechanisms. These policies have the potential to impact how the fuel mix for electricity generation develops in the future. In 2010, the global electricity generation mix was less than five percent liquid, 40 percent coal, 22 percent natural gas, 13 percent nuclear, 21 percent other renewables including wind, hydroelectric, biomass/waste, geothermal, and solar. By 2040 liquid energy sources for electricity generation is projected to decline by 22 percent as other forms of electricity energy sources increase with renewables leading the way with a 128 percent increase by 2040 (EIA, 2013, p. 7).

Renewable energy sources should continue to gain an increasing share of the total energy mix. In 2010, hydroelectric accounted for 81 percent for the total renewable energy mix with wind the next closest contributor at 8 percent followed by various other sources, such as biomass, at slightly less than 8 percent. It should be mentioned that biomass is considered a net zero CO_2 contributor as new biomass growth offsets the release of CO_2 during the biomass combustion process. According to the 2013 IEO reference case, hydroelectric power generation is on track to make up about 65 percent of the renewable energy mix as high capital costs and environmental concerns continue to remain challenges. Fiscal constraints as a result of the 2009 financial crisis will likely cause energy producers to look for alternative financial mechanisms as government funding for renewables and advanced technologies is reduced.

Total coal consumption grew by about the same amount for both non-OECD and OECD countries between 1980 and 2001. Between 2001 and 2009 China accounted for 88 percent of the world coal consumption growth total. The International Energy Outlook (IEO, 2013) Reference Case projects near term increases in global coal consumption by China, India, and other non-OECD countries, growing from 70 percent of the global share in 2010 to 81 percent in 2040. The same projections indicate that India will surpass the U.S. in 2030 as the world's second largest consumer of coal. However, current trends indicate that coal consumption used for electricity generation would decline from 43 percent in 2010 to 37 percent in 2040 (EIA, 2013, p. 67). How much coal consumption changes will depend largely on ongoing developments in environmental policy as policies resulting in moderate cost applied to carbon emissions (e.g., the World Energy Outlook 2012-450 Scenario) could cause coal consumption to decline substantially.

Nuclear power accounted for 13 percent of electricity generation in 2010, and world nuclear power is forecasted to increase by 110 percent between 2010 and 2040 with strong growth expected in non-OECD Asia where average growth rates of 9.2 percent per year are possible (EIA, 2013, p. 95). China leads the way accounting for more than 40 percent of the active reactor projects as of 2011 and continues increasing nuclear power capacity potentially reaching 160 gigawatts of net generation power from nuclear reactors. However, the incident at the Fukushima Daiichi nuclear plant in Japan in 2011 has resulted in potentially long-lasting impacts regarding the role for nuclear power in the global energy mix. While reactors in Japan are beginning to return to service after the 2011 disaster, other countries such as Germany and Switzerland have announced plans to decommission currently operating reactors between 2022 and 2034. The *International Energy Association* has also developed a Low Nuclear Case which assumes no new reactors in OECD countries and 50 percent lower capacities in non-OECD countries. Under the Low Nuclear Case, the world's nuclear capacity decreases by 15 percent over the same projection period rather than rising 60 percent. The EIA's Low Nuclear Case differs considerably with ExxonMobil's outlook which expects an 80 percent increase in nuclear capacity by 2040 (ExxonMobil 2012).

As more stringent regulations and restrictions are placed on nuclear power generation, increased contributions from renewables, efficiency gains, and energy conservation will also need to be increased to bridge the gap.

The following part discusses the pattern of North American energy production whereas the final section provides justification for singling out alternative energy as a main sector based on the developmental state-new competition line of argument in the US context.

North American Energy Production

North America has the potential to significantly increase its oil production over the coming decades as advanced technologies in horizontal drilling and multi-stage fracturing have significantly increased North American production of tight oil and liquefied gas. Strong growth is expected to continue in the US and Canada between 2010 and 2040 with Canada's liquid production outpacing US production by more than two fold. Total US liquid production is projected to increase as new technologies improve recovery efficiency for resources. As world oil prices rise in coming decades and consumption increases in industrial and transportation sectors, petroleum and other liquid fuels will remain the largest energy source. However, rising oil prices along with a decrease in liquid consumption used for electricity generation will drive technology advancements in areas involving the development of alternative fuel sources. In the *International Energy Outlook 2013* Reference Case, global consumption of liquids is projected to decline from 34 percent in 2010 to 28 percent in 2040.

The turnaround in US liquid production is due to onshore production in the lower 48 states through the application of advanced techniques in horizontal drilling and hydraulic fracturing technology developed for the extraction of shale gas. As these technologies continue to be deployed in areas of oil recovery, previous economic and physical constraints are reduced allowing North American liquid production to increase as resources become more accessible. Large growth in North American petroleum production over the next quarter-century could come from unconventional Canadian oil sands. Production from the Albertan oil sands accounted for more than 50 percent of Canada's oil output in 2011, and has the potential to increase the country's oil production in the future. The extent to which oil sands production develops will depend upon world oil prices and the degree to which environmental impacts related to CO_2 emissions will be addressed. Major projections of future liquid supplies assume that Canadian oil sands production will continue to expand. Increases in liquid production from the U.S. and Canada will be required to offset production shortages as Mexico experiences continued output declines from maturing fields with total liquid supplies decreasing by 0.9 million barrels per day by 2040 (EIA, 2013, p. 35).

In terms of potential production, consumption, and trade, no other major fuel source has seen as much change as natural gas where demand from industrial and electric power sectors continue to support its use as the fastest growing fossil globally. The U.S. is the largest producer of natural gas among OECD countries accounting for over 51 percent of the total output by OECD members. The United States together with Canada accounted for 24 percent of global production in 2010, with Russia accounting for less than 19 percent. Increases in demand for liquefied natural gas caused a shift in production towards LNG because liquefied gas could be sold for significantly higher prices compared to dry gas. As a result of these developments, the U.S. shale gas production now accounts for more than 30 percent of U.S. dry gas production. Environmental rules and public concerns regarding the environmental impact on water and air resources have increased and some countries (France and Bulgaria) have banned hydraulic fracturing. However, shale gas production in the U.S. has not been significantly impeded by environmental concerns related to hydraulic fracturing as evident by the increasing development in shale gas drilling over the past decade despite low natural gas prices. As natural gas continues to become a preferred fuel source for electricity generation worldwide, future policy recommendations should address public awareness while recognizing the benefits of natural gas (e.g., low CO_2 emissions). This is particularly important as global electricity generation increases and non-OECD countries depend increasingly on the consumption of coal for electricity generation (EIA, 2013, p. 93).

The increase in U.S. shale gas production continues with future exports from the U.S. expected to rise to help meet the demand for LNG in Asia and Europe. The United States and Canada are the largest producers of natural gas in the Americas, and continued increase in North American production will drive up exports to markets outside the region. This increase in exports would provide domestic benefits such as economic growth, job creation, and supply stability that would come from an additional demand for currently oversupplied US natural gas markets. The global LNG traded grew from 5 trillion cubic feet in 2000 to slightly over 10 trillion cubic feet in 2010.

This growth has resulted in the development of several projects in North America with the Sabine Pass Liquefaction Project in the United States expected to reach full capacity in 2015, producing 18 million metric tons per year and aiding the US in becoming a net exporter of LNG in 2016 (EIA, 2013, p. 57).

Alternative Energy as a Key Industrial Engine and Growth Booster for the U.S. Economy

Within such a challenging international environment (previously discussed), this section seeks to provide a production-oriented strategy for the United States that fully and effectively utilizes current resources to develop alternative energy sectors and products while taking a range of development-related impediments into account. As technological improvements in energy development and use create a shift from traditional energy sources, the US government's mandate should be limited to the following kernel objectives (Karagiannis and Madjd-Sadjadi, 2012):

- the vision, which should guide a production-oriented approach, is summarized as industrial growth and upgrading, structural transformation, rejuvenation and strategic repositioning;
- to deploy strong institutional vehicles in order to mobilize industrial financing and channel local capital into those key energy sectors (that is, specification of the "economic engines") expected to spread benefits to the economy as a whole; and
- to coordinate productive investments and strengthen forward and backward linkages between all sectors of the domestic economy.

Therefore, it is imperative to aggressively pursue research and development in certain dynamic sectors of future potential and achievability (such as solar, renewable, and alternative energy) until there are market opportunities for their growth, which can open up possibilities and set up incentives for a wide range of new economic activities:

- Demand-based considerations as there is an increasing demand (domestic demand *plus* export opportunities) for solar, renewable, and alternative energy products. Energy development strategies should assure seamless substitution between traditional energy sources and alternative energy products once they become profitable;
- Resource utilization and competitiveness considerations as targeted sectors should better utilize local resources and create linkages with other sectors and activities. Furthermore, the USA can foster dynamic competitive advantage in energy-based industries – higher capability to compete internationally will be responsible for endogenous growth, a greater market share, and betterment of the country's industrial and balance-of-payments performance;
- Competency upgrading and structural transformation factors since these sectors will enhance the local skill/knowledge base, stimulate further technological progress, develop a pool of expertise, create more managerial and entrepreneurial talent and increase productivity. Alternative energy sectors and products will boost the structural transformation and diversification of the US production lines, and will develop and promote stronger intersectoral linkages, resulting in investments in infrastructure and growth *accelerators*;
- Energy conservation is a realistic and feasible policy suggestion which requires employment of existing resources in more efficient ways and ongoing public education.

Growth is expected to create extra demand, improve supply capacity, and will bring about modernization of industry and overall competitiveness improvement. After resources are developed and put to use, changes in technology and production techniques will broaden the production base, induce higher levels of investment, and more effectively use available resources towards economic growth (Karagiannis and Madjd-Sadjadi, 2012).

The last part of the paper offers the necessary policy requirements which are deemed necessary towards developing alternative energy sectors and products in the United States.

Development Policy Requirements

1. Conducive Macroeconomic Policies

Appropriate fiscal, monetary, and exchange rate policies can contribute much towards enhancing the performance of the US economy and facilitating industrial growth and development efforts. A prudent fiscal management and tax incentives should seek to achieve private productive investments and promote national purpose goals within budget constraints.

The objectives of monetary policy, on the other hand, must promote longer time horizons, encourage financial stability (i.e., reduce "capital flight", prevent asset bubbles and speculative attacks, maintain an interest rate policy that allows small firms to acquire necessary capital). Policies may also be directed toward removing imbalances between private savings and investments (in order to raise the level of domestic savings and finance higher levels of productive investments) and easing balance-of-payments constraints (Karagiannis and Madjd-Sadjadi, 2012).

2. The Importance of Strategic Planning

The US economy lacks a long-term economic strategy, depends excessively on the current state of the markets, and has no coherent set of policies to ensure industrial growth and overall competitiveness over the long haul. Furthermore, the market and financial institutions rarely see beyond the next quarter. This tyranny of short-term decision making, although beneficial in the short-run, often crowds out long-term issues. Short-termism is especially true for small firms that lack the ability to generate funds internally and must rely on the market or financial institutions for financing. Such a market feature allows the short-term perspective of financial institutions to impinge decisively on rational planning of the long-term future of the industrial base (Karagiannis and Madjd-Sadjadi, 2007).

Therefore, we have a strong basis for recommending a framework of, and establishing a role for, strategic planning in selected policy arenas in the US. While it is important to "leave the market to do what it is good at doing: looking after the myriad, incremental changes which are required within the broad strategy and, of course, running those sectors which don't require strategic intervention", we must ensure rules under which these markets operate are well-defined (Cowling, 1990, p. 17). Such strategic planning seeks to enhance the creative dynamics of the market while recognizing that "the governed-market" view is a valid and necessary perspective (Karagiannis and Madjd-Sadjadi, 2007).

3. Mixture of Domestic and Competitive Developmentalism

Developmentalism in the U.S. context could be best understood as consisting of a range of technically proficient strategies and policies that place energy sectors at the center of economic development. The key is to ensure industrial and resource development serves the national interest and this requires a two-pronged approach of "inward focus" (to take care of the human, material, and financial requisites deemed necessary to boost local production lines) and "outward orientation" (to expand productive capacity and export growth).

Central choices for implementation should be energy sectors that are closely aligned with development of modern technology: solar, renewable and alternative energy. These dynamic engines are expected to be supply-chain partners for the country's other sectors. So long as these sectors are indigenous, it will make them more likely that product differentiation will prove successful. These activities will also increase benefits to primary production and services because they will enhance complementarities and forward and backward linkages, and would allow for product differentiation on the international stage (Karagiannis and Madjd-Sadjadi, 2012).

4. The Need for Industrial Growth

Growth is governed by the growth of aggregate demand and supply, and demand for industrial products leads to output growth and important efficiency benefits which induce further growth of demand. The expansion of industry represents a net addition to the effective use of resources and contributes to a higher degree of capacity utilization. Indeed, the growth of aggregate demand provides the opportunities for the growth of supply. Thus, supply-side considerations are needed and may themselves be influenced by aggregate demand management policies. Energy policy has a role as an important component of such a growth strategy.

The US government's role at the national level should be limited to strategic oversight of endogenous development efforts "which are essential in the case of a limited array of key industries or sectors (e.g., liquefied natural gas, solar, renewable and alternative energy) – many activities being left to market processes without strategic guidance" (Cowling, 1990, p. 18). The US government should adopt a strategic view of future energy sector as a major engine of economic growth. The newly-developed energy sectors can utilize modern knowledge and transform this knowledge into new technologies and products. As profitability depends upon continuous technological advancement, technical change can be expected to influence the volume of investment expenditure and opens up new and more profitable opportunities for expansion.

Still, there are dangers associated with this energy targeting approach. It is difficult to identify certain areas of industrial activity on which human, material, and financial resources should be concentrated and thus neglect others. It is also potentially dangerous to continually protect certain areas of industrial activity from the market discipline and international competition (Cowling, 1990, p. 20). There are three reasons that support this approach. The first is the obvious one: if policy makers try to subsidize as many firms as possible, they will quickly run into fiscal constraints. The second is less intuitively obvious but actually far more important: only unequal subsidization can alter or extend a competitive advantage (Karagiannis and Madjd-Sadjadi, 2007). The third has to do with the harsh reality: the US government must address systemic deficiencies manifested in key macroeconomic imbalances (i.e., massive national debt, the imbalance between savings and domestic investments, and the trade deficit) by implementing a strategically focused production-oriented approach.

Targeting and support of the energy sectors require detailed information on the quantity (*how much*) and quality (*what type*) of human and material resources needed by these sectors so new investments are profitable. It is this thoroughness and proficiency that can make national development goals and strategic investments successful.

5. Emphasis on Quality

For the U.S.A. to succeed, it must do so as a quality *value-based* producer, as opposed to simply a low-cost one. The United States simply cannot compete in the low-wage areas and so must be vigilant to improve quality and provide good value for the consumer, including energy products. This must be a recurrent theme throughout the supply chain and requires modern management techniques such as total quality management. This also requires constant retraining of workers, an emphasis on purchasing high-quality machinery, and having an adequate supply of labor to configure and maintain these machines. It requires an understanding of proper inventory control procedures and minimization of transportation costs, as well as rigorous quality control and testing.

The government and society must realize actions of individual businesses will reflect on all companies in the country. American firms must realize that, in order to be globally competitive, they must achieve on both quality and price, providing the most "bang for the buck". Products that do not live up to these standards not only will backfire against the firms that produce them but against other American companies too, causing a further deterioration in the terms of trade and the balance of payments (Heizer and Render, 1996, pp. 79-80).

6. Necessary Politico-institutional Reforms and Regulatory Environment

In the United States, policies are developed in short segments by one elected government and often circumvented or conflicted by the next administration as experienced by the *Energy Policy Act* of 2005. This is a fundamental feature of any political system that has term limitations on its executive branch and, therefore, a major constraint on the pursuit of developmental strategies and policies. For this important reason, and perhaps for others, development of any national energy policy in the USA would require wide consultation, broad political consensus, a strong sense of realism, and commitment to "national purpose" goals in order to ensure such policies cannot easily be reversed. Such policy formulation needs to be crafted in a consultative manner with scientists, experts, and forward-looking businessmen (Karagiannis and Madjd-Sadjadi, 2012).

Energy policies, including developmental and environmental issues, should be supported by the proper regulatory framework. Still, without fundamental reform of relevant government institutions, the results will likely be stillborn. Government intervention requires a technocratic but managerially competent public sector that can thoroughly formulate and properly execute policy to bring about desired results. It has to be reminded that by promoting the interests of the few over the needs of the many the American society has suffered from an overemphasis on the needs of special interests (Karagiannis and Madjd-Sadjadi, 2012).

In order to achieve success, the following preconditions must be met: 1. the government must credibly commit to pursuing a production-oriented strategy; 2. the government bureaucracy must be streamlined and insulated from political and industrial pressure, and the skill base of government employees must be upgraded; 3. government employees must be given greater power to implement policies as well as greater responsibility for consequences of these activities; 4. a long-term development view must replace the current focus on the short-run in both government and the financial sector; and 5. the government sector must have its incentive structure changed so as to dissuade rent-seeking and other corrupt behavior (Ahrens, 1997, p. 116).

Without these preconditions, such an alternative energy development strategy will founder on short-term expedients, the deficiencies and conservatism of the civil service, the existing configuration of socio-economic power and certain interests, or the mindset of politicians and people (Karagiannis and Madjd-Sadjadi, 2012).

Conclusion

Energy consumption continues to grow, especially in the developing world, as technological improvements in energy efficiencies create a shift from traditional energy sources and structural transformation in the economy increase the demand for alternative forms of energy production and distribution. The energy mix will be dominated by fossil fuels, but their share is expected to plateau and potentially decline in years to come. Over the next two to three decades, coal and oil may reach near peak consumption in the West, and global coal consumption is likely to level off and decrease if environmental policies unfold as expected.

If the United States wishes to place special emphasis on the development of alternative energy sectors while taking full advantage of current opportunities, a strategic approach encompassing technically proficient developmental action must be seen as necessary in the face of the unprecedented changes in the global environment. To be successful will require realism, determination, wide consultation, broad consensus, and market-augmenting policy of high quality. There is no need for vast bureaucratic machinery and procedure because the approach is clearly entrepreneurial. Such an approach will utilize and maximize productive resources available for endogenous growth; promote cross-sectoral links, and create economies of scale across a whole range of industries; place emphasis on industrial accelerators; and, finally, identify inefficiencies and gaps to adequately develop and use new products and processes. Such an alternative framework will have to be underpinned by a strong commitment to national development, and focused collaboration among government, business, and civil society.

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