



FDI Occasional Paper 3

Energy Security in the Indo-Pacific Basins

Looking at the Broader
Context in a Time of
Change

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with

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Energy Security in an Age of Strategic Change



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Preface

“Energy Security” in a Volatile Era

The extreme volatility of energy and resource markets which began to be exhibited globally in 2008 were intrinsically linked to worldwide economic and political trends, highlighting one of the main themes of this brief study: the linkage between energy security, economic wellbeing, and political stability. This broader perspective of “energy security” was the theme of the First Annual Indo-Pacific Energy Security Round-Table, held on August 22, 2008, in Perth, Western Australia, under the auspices of Future Directions International (FDI) and the International Strategic Studies Association (ISSA), of Washington, DC.

What has become clear is that food prices, social aspirations (and therefore social and political stability), national productivity, and national unity, are all part of the “energy security” matrix. What is also clear, particularly as 2009 dawns, is that the brief era of linear extrapolation of economic and social trends is over; the world — and particularly the Indian and Pacific Oceanic basins — is in a new age of extreme and rapid fluctuation.

The traditional approaches to energy security which became evident with the advent of 19th Century coal-fired power for industry and maritime capabilities — which Britain, with its huge coal reserves, quickly exploited to extend its global influence — have gradually transformed. Energy security has become an abstract and complex matrix, one involving a range of international dependencies, and a growing range of technologies. Energy is at the heart of global interaction in a way never before seen in history, and, with that, national viability is tied directly to energy markets and the stability of access to that vital resource.

It is possible that, given global economic stability and growth (and this, clearly, was not guaranteed as 2009 dawned), new technologies could

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emerge to allow greater sovereign control of energy resources by user nations. Certainly, the vision of abundant energy has moved from the fanciful to the possible, provided appropriate investment and research can be undertaken. At the same time, however, the global economic transformation evidenced in 2008 appears as a chasm between the present and the possible future of energy abundance.

Within the Indian and Pacific Oceanic basins — the subject of this study and the 2008 Roundtable in Perth — the two great emerging energy markets, the People’s Republic of China (PRC) and India, are held hostage to imported energy forms. Their political stability is absolutely dependent on continued economic dynamism, which is in turn dependent on energy and resources which must be imported. The more mature large economies of the region — the United States, Japan, and the Republic of Korea — are also heavily dependent on imported energy and resources, but they have, to a large extent, achieved stable and diverse sources of supply. An economic downturn in those states does not necessarily have the same implications for national stability as is the case with the PRC or India.

It is all the more surprising, then, that “energy security” has not until now been adequately addressed in terms of the overall matrix which has been suggested by the authors in this study. The first chapter, by Gregory Copley, lays out that overarching matrix wherein energy, food, water, social stability (and economic trust and asset value), and therefore strategic power are balanced within an interactive framework.

Even advanced industrial, or mixed, economies, such as Australia, find themselves hostage to the linkage between “energy security” and national progress. This is a situation which can only become more pronounced, particularly as the global economic and political crisis of 2008 deepens, and throws off new ramifications, as yet unforeseen. It highlights the reality that governments cannot afford the luxury of “business as usual” in their methodologies. Governments at all levels — national, state, and local — need to integrate their actions and planning as never before.

In essence, then, this study is about more than “energy security”; it is about national solvency and flexibility in a time of great change.

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Chapter One

The Global Energy Framework: A New Conceptual Matrix

By Gregory R. Copley

The phrase “energy security” has become short-hand to signify whether our existing and anticipated supply chain for energy is running smoothly. That matter — the smooth operation of the energy supply chain — in reality, however, is a second-tier logistical issue. The real question is whether our societies are secure in a more holistic sense. Energy is merely a vital part of the complex diet on which we are dependent.

What is critical in a world in which societies are in transformation is whether or not we can meet massively expanding expectations and ambitions.

It has always been true, throughout history, that societies will absorb almost any degree of deprivation provided that this deprivation is accompanied by a commensurate lack of hope. Once hope is injected into the equation, and the slightest change in circumstances occur for the better, then expectations always grow dramatically ahead of any possible supply options. That is how and why revolutions occur. They rarely occur in times of abject depression and challenge, but almost always occur when things are getting better. The French, Russian, Iranian, and even the American revolutions all occurred under such circumstances of rising expectations, as did, for example, the Chinese revolution of 1911.

And now, for most of the world — except Europe, North America, Australia, and Japan — we see large numbers of people in many different societies expecting and demanding improvements to be delivered in their lives at a pace faster than their governments can deliver. This expectation is fueled by a global media pervasiveness which highlights the possibilities which can theoretically be attained by all, but which realistically cannot.

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And given that all of our expectations for better life are dependent on the delivery of on-demand energy in a multitude of forms, how then can energy security be achieved in a modern, transforming world in which expectations will, for the foreseeable future, outstrip demand? Moreover, how can we address ways of getting ahead of market expectations — expressed as absolute *needs* — if all we do is focus on the finite growth capacity of existing supply chains and existing technologies?

If we fail to get out ahead of the seemingly inexhaustible growth in demand then we certainly see the prospect for social unrest, expressed in varying forms — particularly around the Indian Ocean and Pacific Ocean basins, where change and growth is now endemic in various patches — including those expressions of discontent which emerge as demand for better, cheaper food. If rising expectations, which become profound *rights*, are not met, and economic wealth not constantly increased and spread around the large populations of the PRC, India, and Iran, then we *will* see profound social unrest and revolution, in one form or another.

Indeed, it is worth noting that the Iranian revolution of 1978-79 occurred exactly because the economy, education, and social condition were becoming relaxed and more positive, and the Shah could not deliver results rapidly enough, just as the previous and current Indian governments cannot deliver results rapidly or evenly enough to a population fueled now by great expectations. Significantly, the Iranian *ayatollahs*, after 1979, *absolutely* understood that they must, *à priori*, stamp down *any* expectations of joining the modern world in a better life. They succeeded in this for three decades. Now, however, they are facing a new paradigm, in which openness to the world, and increasing wealth, will fuel a revived set of social expectations which cannot be met.

This, then, will be the time of great danger for the Iranian clerics.¹

¹ The immediate result of the transforming strategic situation which has begun to remove economic and access constraints with regard to the Iranian economy will be rising, but uneven, wealth growth in Iran. Iran's moves to build new domestic oil refining capacity will unleash consumer demand. Domestic consumer demand

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We can, at the same time, expect different versions, in differing intensities, of this theme to play out in India, Pakistan, Indonesia, and other places. One of the key differences, however, is that in India, Pakistan, and Indonesia, for example, social repression or containment has not existed in anything like the manner as in Iran and, until recently, in the PRC. Thus the effect of released and inflated expectations emerging from Iran and the PRC, and some other societies, is more dramatic and explosive, while the leadership hierarchies of these states is also more singular and brittle, whereas in complex societies — what we can call democracies, although they may not all be of totally similar structure — there are many, ongoing outlets for frustration, gradually absorbing societal unrest.²

has until now suppressed as the clerics acquired and stockpiled imported refined fuel (having exchanged it for Iranian crude). Additional wealth will also be generated for the élites through the growth in liquefied natural gas (LNG) exports, possibly seeing Iran emerge as the second largest gas producer/exporter in the world, with 150-million cubic metres a day of gas for export to Europe via pipelines. This export capacity will presumably transit via pipelines through Armenia and Georgia and the Black Sea hub. Indeed, the US decision to relax sanctions against Iran is also key to India, which sees Iran as the major supplier of oil and gas in the future, one reason why India has failed to compete so energetically for oil and gas in the West African marketplace. Iranian Minister of Petroleum Gholam-Hossein Nozari, speaking at the July 2, 2008, 19th World Petroleum Congress in Madrid, said that, by 2014, Iran's oil output would rise to 5.3-million b/d, over its current output of 5.3-million b/d. Natural gas output, he said, would rise to 1.5-billion cubic metres a day from the current 540-million cubic metres a day. Iran would, he said, invest US\$141-billion on new energy projects between 2005 and 2014, with some \$63-billion of that investment being provided locally. Moreover, it seems clear that the climate in Iran for international investment would improve following the US decision — essentially the State Department position — to recognise and support the clerical leaders, postponing, but not eliminating, the threat to the clerics' profound control from an increasingly restive population.

² See Copley, Gregory: *The Art of Victory*. New York, 2006: Simon & Schuster's Threshold Editions. Chapter Eight: "Abstraction, Complexity, and Victory". In this,

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Clearly, any relaxation of social containment, and any improvement in outlook, for the people of the Democratic People's Republic of Korea — North Korea — will equally fuel a revolution which is at presently only barely contained. North Korea's leaders are fully aware of this, as are the PRC leaders who fear a growing surge of North Korean refugees streaming into China.

The unleashing, particularly in the Indo-Pacific basins, of social expectations for more and better food, more and cleaner water, and more and more benefits of modern life, is why demand, for the first time since the beginning of the petroleum age in the late 19th Century, is surging so profoundly that the marketplace is screaming that it is not the *type* of energy source which is important, it is merely the delivery of electrical and motive power to the end consumer.

With that, I get back to the reality that “energy security” today is not about the hydrocarbon supply chain; it is about innovation.

While we are mesmerised by the growing energy consumption of the People's Republic of China (PRC) and the vast initiatives upon which Beijing has embarked to secure oil, gas, and coal from Australia, the Middle East, and Africa, we have yet to consider the strategic implications of the looming collapse in the productivity of what was in 2006 the world's sixth-largest oil producer, Mexico. Not only is Mexico, with Canada and the Gulf of Guinea (essentially Nigeria), one of the three top suppliers of oil to the US market, it is also the great and uneasy partner in North American social trends.

Mexico is a critical element of the Indo-Pacific regional security environment we are considering today. A collapse in the Mexican oil export capability will profoundly impact the artificial economic bubble in which Mexico has been existing, and this will export a myriad of social and economic problems to the United States.

Maxim Eight notes: “Organically evolved complexity defines and sustains victory”.

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Like many of the elements in the complex matrix which we will discuss today, the Mexican energy watershed is a creature of human invention. Mexican Governmental greed and reluctance to open the society to appropriate levels of partnership with the international investment market have determined that there has been inadequate exploration for new reserves of oil and gas, and inadequate investment in energy exploitation.³

The Mexican example is critical because it absolutely impacts on the world's largest economy, which itself has a direct bearing on the ability of the great markets of Asia, including Japan, the People's Republic of China, the Republic of Korea, and India, among others, to weather the emerging economic storms. Moreover, the growing and tight relationship of energy supply to strategic stability issues is such — particularly in the Indo-Pacific basins — that long-term structural damage could occur to our societies from our

³ FDI's *Weekly Global Report*, on July 14, 2008, noted, in a report entitled "Mexico's Energy Outlook Has Potential to Transform by 2012": "The confluence of underinvestment in existing oil fields, a lack of sophisticated technology and declining production rates have the potential to result in Mexico transitioning from being a major exporter of crude oil to a net importer, as early as 2012-2014. Mexico, like many other key energy producing nations, has benefited from the sharp rise in the price of oil due to large domestic reserves. The increase in revenues from the international sale of crude oil has facilitated high levels of government spending and the avoidance of serious structural issues, as well as immediate problems, such as rising food prices and the implications of a potential US slowdown."

"Mexico has, by law, made the state-owned Petróleos Mexicanos (PEMEX) the sole entity responsible for all of the nation's oil production. It is not allowed to partner with foreign oil firms, depriving it of sophisticated technology which could boost production of its declining oil fields. Furthermore, it is being used as a "cash cow" by its owner, the Mexican Government, and funds are not being reinvested in exploration at an adequate rate to build reserves. While this policy is of benefit in the short-term — at present its dividends cover 40 percent of all federal spending— these factors may see Mexico rapidly surrender its status as the fifth largest oil exporter in the world. In the medium-term, there is even potential for Mexico to have to import oil as major domestic fields start to experience a rapid decline in production rates."

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inability, or unwillingness, to strenuously address stabilising and corrective measures.

The challenge today, then, is how we broaden our perspectives on energy security, because it is critical that we develop a new, holistic approach — *a grand strategy approach* which takes account of a whole range of global trends — in how we view this critical area of our stability and progress.

We cannot any longer have the luxury of viewing our energy needs merely as a linear extrapolation of our past needs and approaches.

More importantly, energy is at the core of the matrix which determines the stability, survival, motivations, and actions of the major trading nations. Energy is a topic which cannot be strategically discussed in isolation, *and* this is the new paradigm we must now always consider.

The immediate and direct strategic linkages between energy, food, water, social stability (and economic trust and asset value), and therefore strategic power are now more profound and global than ever before, thanks to emerging technology, population growth and — very importantly — wealth growth, and the globalization of markets and trends. *This* is the indissoluble matrix which we need to define; it is the physical core of the grand strategy framework.⁴

We are in such a confluence of strategic trends that the fragility of the mutually-dependent global condition is evident. Thus, containment of any potential for disruption to national stability must increasingly be in the hands of individual nation states, working in concert with key trading partners to ensure a dampening of any negative consequences of economic or resource-flow reversals.

This is why the collapse of the Doha Round of the World Trade talks could not have come at a better time. This collapse began the inevitable return to the process of giving sovereign power back to the nation-states.

⁴ Parts of this appeared in the article, by this writer, entitled “The Energy-Food-Water-Security Matrix”, which appeared in *Defense & Foreign Affairs Strategic Policy*, 6-2008.

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The demand for energy is a key component in delivering on social demands for more and better food, more and cleaner water, better creature comforts, such as cars, gadgets, and airline travel, and so on. What goes unexpressed, but which is more important, is the stability of asset values, and therefore currency worth.

If we fail to deliver the end requirements demanded by various societies, then social unrest and economic dislocation will ensue in key markets. Indeed, this process is already evident. And if major economic collapse or dislocation occurs, and societies regress, then resource and energy supplier states, such as Western Australia, suffer the consequences. Thus, Western Australians, for example, have a key stake in ensuring that Indian and Chinese consumers are satisfied, *quite apart* from any concerns which may exist that unrest in the People's Republic of China (PRC) or India could feed international competition and conflict.

Nowhere is this linkage between energy, food, water, social stability and economic trust and asset value, and strategic power more sensitive than in the world's key dynamic region: the Indo-Pacific oceanic basins. Australia is very much at the epicentre of the processes now evolving. Australia may — just by relying on luck and the hope that others are taking care of business — continue to fly; or it could become a major victim of a global hiatus in markets and security; or it could inoculate itself against some of the probable pain and build a solid base for future growth and security.

Considerable attention has been paid to the possible impact on the global condition of an economic dislocation in the PRC, or India. The consequences for the PRC's — and, to a lesser extent, India's — major trading partners, such as Australia, would be profound. This is obvious, and immediate. But little attention has been paid to the precursor dislocation of resource supply to the PRC, for example, and particularly the dislocation of energy supplies, with other mineral resources in an important second place. This concern — including the potential vulnerability of Australia's energy pipelines and structures — was highlighted in the 2005 Future Directions International (FDI) study, *Australia's Energy Options*, and then in the December 2007 FDI study, *Australia 2050: An Examination of Australia's Condition, Outlook, and*

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Options for the First Half of the 21st Century. We'll be expanding on this theme again in FDI's major study, which will be issued later this year, on Australia's interests in the Indian Ocean region.

At this point in history, growing and more widely spread wealth has pushed us into a lazy, linear view and implementation of concept and ideals, such as free trade, a philosophy which indeed can do much to stabilize societies and give impetus to innovation through competition. But such philosophies — like any ideals — cannot exist or thrive in a sterile or pure environment. Thus, reality has intervened and brought about the collapse of the Doha Round of the World Trade talks, because India and the People's Republic of China could not agree to withdraw protection for their farmers.

This "reality check" should be welcomed by Australians, not because Australians wish to see those giant markets of India and China denied its exports, but because Australians — like Americans — cannot afford to see the Chinese and Indian economies collapse because they were not yet ready to compete. And they will not be ready to compete until they can more completely and economically automate, and *that* is a process which requires industrialization on a greater scale, and *therefore* demands more energy.

Twenty-first Century mankind, more than any other age of humanity, understands the integral connection between societal survival and all forms of energy. Food equals energy, and *vice-versa*, in the sense that food provides the energy for human life and action. Human energy has always been an important aspect of food production. Now, to a profound degree, non-human forms of energy; *modern* energy for want of a better descriptor — powering automation, computerization, value-added scientific progress, and much more — make the production possible of endlessly multiplying quantities and qualities of food.

This was not true *to this extent* at any time in historical experience. The same significance can be said of the rôle of water to enable — and to energize — human life. Human and other forms of energy increasingly transform landscapes to move water to where it is needed, or transform non-potable water into potable fuel for human activity, including agriculture. Once, mankind went where water was; now water can go where man wishes.

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This great engineering of water, too, is increasingly becoming a viable reality because of energy and automation, not directly linked to human physical effort or human numbers.

The greatest human discovery may well have been the realization that creating energy through secondary, or abstract, means, such as transforming combustible material into heat or transforming hydrodynamic flow into electricity or milling and other industrial actions — and progressing from there — allowed all of the great achievements which have continued through history.

History has proven that mankind can produce as much energy — and therefore foodstuffs and potable water — as the expanding population requires, by moving from one energy source to the next with increasing exploitative skill. History has also proven that the powers which triumph through history are those which have access to, and use, the most energy, not even necessarily with the greatest efficiency. In any event, the links are undeniable: energy is food; energy is water; energy is productivity; energy is communication; energy is transportation; energy is — by transmutation through light, books, societal wealth, and so on — knowledge capable of passage across time and space. Energy, therefore, equals civilisation.

Thus, in almost all respects, energy equates to survival and security. And yet most modern “energy security” discussions revolve solely around the availability of hydrocarbons or the direct capture of natural forces such as sun, wind, and tide. It is now time to take a more holistic view, particularly in the Indian Ocean and Pacific Ocean basins, where the most dynamic energy markets are also among the most active producers of goods and services. Moreover, in many of the markets within these emerging, dynamic strategic zones, there is little buffering between energy availability and output capability, and almost no buffering between the availability of energy/food/water — the inseparable matrix — and asset value, and therefore social cohesion.

APEC, the Asia-Pacific Economic Cooperation forum linking 21 states, has an energy working group. The working group states as its main premises: “Short-term measures include improving transparency of the global oil market,

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maritime security, implementing a real-time emergency information sharing system and encouraging Member Economies to have emergency mechanisms and contingency plans in place.” And “Long-term measures include facilitating investment, trade and technology cooperation in energy infrastructure, natural gas (including LNG), energy efficiency, clean fossil energy (including carbon capture and geological sequestration), renewable energy and hydrogen and fuel cells.”

Clearly, however, the “energy security” matrix which we really need to contemplate *must* embrace a far broader and more multi-disciplined contextual approach than those being considered under the simple, separate rubrics of energy supply, and food and water security for communities. And the linkage of energy supply to population numbers cannot merely be a linear extrapolation based on present consumption numbers and anticipated population growth. Population patterns are becoming increasingly complex, even within societies, as factors such as urbanization and food and water usage patterns vary constantly as wealth patterns themselves transform.

We know, for example, that global population levels will soon peak at under 10-billion — they have already jumped from 2.5-billion in 1950 to 6.38-billion today — and probably begin to decline before mid-century. We know that urbanisation processes continue to become more interesting, and potentially more unstable; and so on, and certainly more dependent on energy production on scales not before achieved.

Of course the transition from one form of energy regime to another, when taken on a global scale, will cause disruptions. It also did so when the movement from whale oil to petroleum transformed first the shape, wealth, and capabilities of societies, and then navies (which were enabled to move away from coal-fired ship engines over a period of about 50 years). Then air transport and air power were totally enabled by the petroleum age. Quite apart from the petroleum contribution to motive power, the late 19th and 20th centuries were transformed by petroleum because of electrification (which evolved from coal, and then was compounded by petroleum-fired power generation), spurring all manner of advances from electrical lighting and machinery power to telecommunications.

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So the societal upheaval caused initially by the move away from whale oil gave us the kind of productivity and reach we have today. The results were mostly, but not entirely, beneficial for society. And yet the competition for whale oil between Britain and France led to the establishment of colonial outposts in South-Western Australia, at Albany, literally providing the foundations for the Swan River colony.

The next generations of power production forms, which will be diverse, overlapping, and of varying efficacy, will be equally transforming, many in ways which are not yet fully clear. Certainly, lower carbon emissions will be just one attribute of new energy developments, but the impact of the changing energy-food-water-security matrix is becoming evident in both positive and negative ways right now.

We see the “green” movement promoting the desirability of using “renewable” resources — trees — in papermaking, but the same movement now spurns the use of renewable resources — agricultural growth, whether corn or other forms — in power generation, because the short-term impact of energy costs and demands on food costs has been *believed* to be disruptive. And yet there has been *no direct linkage proven* to say that food supply chain issues are caused by the growth of some corn or sugar crops solely for the biofuels market.

The question, in any event, is moot as to whether rising petroleum costs are more damaging to societies than rising food costs: they are both part of the same equation. Indeed, the recent rise in petroleum costs can be ascribed as much as 20 percent to panic in the markets over the perceptions of unrest in the Niger Delta, which was itself born out of political and constitutional frustrations which have *direct* parallels to Australia’s current debate over state-federal relations. Moreover, the politics of oil in Nigeria both drove and diverted people away from agriculture and food production over the past half-century, just as the resource sector has lured Australia and Australians away from their pride in their agricultural genius. [The current decline in oil prices at the wellhead can also in part be ascribed to the fact that the Niger Delta crisis has disappeared from the headlines, although not from reality.]

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Perhaps US taxation breaks which reward some farmers for ploughing-under unprofitable crops are mechanisms which could be removed legislatively, allowing the high market prices for food to ensure that cornfields will be harvested and sold.

The answer is not that bio-fuels should be curtailed to help reduce the current and sudden rise in food costs, because it is doubtful that this, indeed, would be the result of abandoning ethanol production from corn. Rather — as with all emerging technological processes — the question is how quickly bio-fuels can be created more efficiently, while ensuring that energy can contribute to the efficacious development of water resources.

The circle of energy production to create food, and bio-fuel to help in agricultural production and water distribution, is increasingly apparent. What is less apparent are the underlying population trends — and the politics and short-term and often unarticulated ambitions of those populations — induced by wealth and lured by the globalized vision of the wealthy ease of an apparently-attainable, and yet chimeric, post-industrial lifestyle.

It is true that most reactive journalism cannot see the importance of long-term strategies when “the sky is falling”, and political upheavals can result from short-term disruption in food supplies.⁵ The answers, in the fairly short-

⁵ As the populist US academic, Jeffery D. Sachs, noted in *Scientific American* in the June 2006 edition: “In early 2006 a metric ton of wheat cost around \$375 on the commodity exchanges. In March 2008 it stood at more than \$900. Concurrently maize went from around \$250 to \$560. Rice prices have also soared.” Sachs, whose tendency is to blame all such outrages on the US Bush Administration (and its attempts to stimulate bio-fuels development), did, however, also note that “World incomes have been growing at around five percent annually in recent years, and four percent in per capita terms, leading to an increased global demand for food and for meat as a share of the diet. The rising demand for meat exacerbates the pressures on grain and oilseed prices because several kilograms of animal feed are required to produce each kilogram of meat. The grain supply has also been disrupted by climate shocks, such as Australia’s massive droughts.” The selective application of logic ignores the reality that Australia’s droughts are by no means constant (and the 2008 crops may actually be high), and the reality

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term, need to include a resolution of the spurious arguments against genetically-modified crops so that greater supplies of food — and other agriculturally-produced goods — can be delivered where they are needed. Farmers, through breeding of animals and plants, have been modifying crops since the origination of agriculture enabled to construction of cities and the birth of what we can call human history. According to the entirely city-based “green” advocates, genetic modification of crops and animals is acceptable if carried out on farms, but not if a laboratory is involved.

But apart from reconsidering GM foods and agriculturally-produced fabrics and fuels, we can also begin transforming energy production with new thorium-based technologies — already being pursued in the US and Australia — to produce lower-temperature, low-pressure power producers. A single mini thorium power *Producer* will be able to generate enough power for a town of, say, 5,000 people: 10 megawatt units of electricity for 10 years for far less per megawatt of output than any comparable source now available.⁶

that global wealth increases may be the single greatest contributor to rising food costs, as well as increases in petroleum costs. As well, rising petroleum costs are equally impacted by lack of adequate investment in refining capacity to cope with the adequate stocks and supply of crude oil. The Australian production of all winter crops was, in June 2008, forecast by agricultural analysts at the National Australia Bank to increase by 66 percent in 2008-09 over 2007-08, to 37-million tonnes; of this, Australian wheat production was forecast to reach 24.3-million tonnes in 2008-09, up from around 12-million tonnes the year before. Hardly the declining production which Sachs and others have noted. And similar situations are evident elsewhere. Clearly, then, the problem of rising food prices has more at its roots than declining food supply and rising oil prices.

⁶ The use of thorium for power generation has been proven by viable light-water thorium reactors since the 1970s, but the new approaches to the use of thorium for medium-temperature (300 to 500 deg. C), low-pressure (and therefore low cost) energy producers was first outlined by this writer in the *Australia's Energy Options* study, produced by Future Directions International, Australia's center for strategic analysis, on October 6, 2005. Australia has the world's largest supplies of thorium; India has the second-largest.

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These mini-energy plants will have no carbon output, and produce very little waste, and even that waste has a short half-life.

These units could be in production in five to 10 years. Given the reality that Western Australia holds the world's largest reserves of thorium (India has the second-largest), these thorium *Producers* could start being deployed along the Australian coastline, pumping energy into dispersed communities, and also desalinating and pumping sea water inland to germinate new agricultural output.

So the energy revolution is now afoot, and the integral linkage with water and food supply — and therefore social stability, robust economic growth, and conflict minimization — is at our fingertips. This is one of the great opportunities for the positive transformation of a range of major challenges to global and regional stability, given the fact that cheap, stable power can transform social, and therefore political, situations.

When we talk, then, of “energy security”, it must be in the broadest context, and must embrace a dynamic loop which looks at global (and country-by-country) population levels, urbanization patterns and ensuing political and value and wealth outcomes, food production, the opportunities and timescales dictated by science and technology budgets, the direct requirement for energy to be part of the water solution, and so on. It is also necessary to understand the fact that the urgency of situations varies from country to country depending on the closeness of the linkages between political stability and food/water/energy shortages. Indeed, the linkage between food/water/energy and population wealth and education then have a flow-on effect with regard to inward investment, and so on.

The ultimate determinant is whether the “dynamic loop” is balanced, or whether, because of uneven rising wealth patterns and media-driven social expectations, or some other dislocation of an element in the loop leads to social unrest. This is already happening in the PRC, and places like Iran and India. It will happen increasingly in these places. And this can and will drive policy decisions which can lead to regional conflict.

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However, by adopting, for example, the new thorium and other energy options, we can insulate our society to a great degree against fluctuating markets and regional security upheavals.

We are on the verge of a revolution, and all the turbulence which accompanies such an upheaval. We can make this a “glorious revolution” in which we secure our destiny.

Chapter Two

The Strategic Impact of the Convergence of Food, Water and Energy on Urbanisation and Population Trends

By Andrew Pickford

A great deal has been written about agricultural commodities, the trend towards biofuels and the potential for genetically modified plants to significantly alter agricultural production practices. These issues have received particular attention over the past two years as soft commodity markets have fundamentally changed, challenging existing views of agriculture which has resulted in the belated understanding that energy and food issues are linked.

Water, a critical component in agricultural practices and for human survival, can also be added to the list. The convergence of food, water and energy is occurring at the same time as urbanisation accelerates, global population numbers approach a peak and a new “global middle class” accelerates its consumption levels. The interplay between all of these diverse factors will shape the world of the 21st Century and will have a significant impact of energy, as well as energy prices and availability.

Whereas the long period of relative stability and global certainty over the past few decades was marked by relatively low food and energy prices, albeit with supply-side oil shocks in the 1970s and fluctuations in soft commodity markets, new demand patterns and the emergence of a global middle class are forcing changes to key assumptions of the value of food and energy inputs. Due to the increase in global population numbers and demographic mix, food, energy and water are starting to influence each other, with the old paradigm of treating each as a discrete matter now reaching an end. Any discussion of energy, especially in the context of the Indo-Pacific region, should now include food and water, as well as general population trends.

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The impact of the convergence of food, water and energy is going to be noticed first in the Indo-Pacific Basins. The citizens across the Indo-Pacific Basins, often living in fast growing coastal cities have high expectations of their future living standards, which includes access to consumer goods and lifestyle patterns that Western countries have enjoyed since the end of World War II. This is already putting a large strain on the environment. However, the major short-term issue for many governments will be maintaining stability and national unity at a time where societal pressures, stemming from expectations not being met, occur, alongside inconsistent access to the fundamentals of life which includes food, water and energy. In fact, it is the cost and availability of these three items which will drive many of the social changes within all cities, especially those within the Indo-Pacific Basin. And, as history has shown, turmoil in the cities can drive the broader trajectory of a country, or even empire.

Global Population. In July 2008, there were around 6.83-billion people on the earth. It is expected that it will only take another 12 years for the next one billion to be added to this total. Depending on the model and the assumptions, the global population is forecast to reach a peak of around 10-billion by mid-century.⁷ The increase in global population, by itself, will put a greater demand on resources and will have implications for a number of commodities and also for energy markets.

⁷ Accurately forecasting population numbers is very difficult. In 2004, the United Nations has noted that: "If fertility were to remain constant at current levels in all countries, the world population would almost double by 2050, reaching 11.7-billion. In the high variant, where fertility is assumed to remain mostly half a child higher than in the medium variant, the world population in 2050 would reach 10.6-billion. In the low variant, where fertility is projected to be half a child lower than in the medium variant, world population would still grow, but only to reach 7.7-billion by 2050. In the low variant, the population of the least developed countries will still double, to 1.5-billion, but the population of the more developed regions would decline to less than 1.1-billion." United Nations. (2004). *World population prospects: the 2004 revision; highlights*. Department of Economic and Social Affairs, Population Division. P. 1.

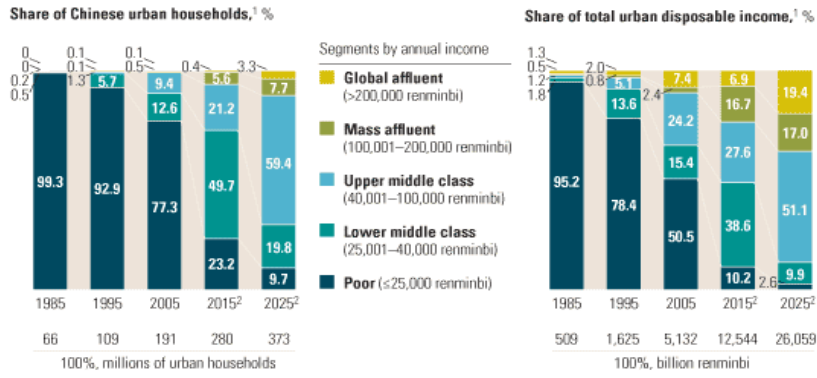
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Global Population Mix. More importantly than the total population, is the size of the global middle class, which is forecast to grow by as many as 1.8-billion, with 600-million located in the People's Republic of China (PRC) over the next 12 years.⁸ In this re-orientation to a global middle class⁹, with a large number of new entrants located in India and the PRC, pressures on the natural environment to supply the raw inputs of life, including food, water and energy, may start to accelerate the slowing of global population increase as price and availability issues restrict further population growth. Even with uneven economic growth and periodic setbacks in so-called developing nations, there will be a significant change to the global demographic mix and the global middle class, as a proportion of total population. For example, the following McKinsey & Company charts shows the growth and proportion of the People's Republic of China's (PRC) middle class. It should be noted that this trend is occurring in a number of other developing nations, with India expected to undergo a similar transformation, albeit on a slightly delayed timeline when compared to the PRC.

⁸ Naim, M., "Can the World Afford a Middle Class", Los Angeles Times online, February 8, 2008. Retrieved August 18, 2008 from <http://www.latimes.com/news/opinion/la-oe-naim8feb08,0,3322827.story>.

⁹ This generally refers to a group of people who have reached, or reaching, "middle class" lifestyles but are not located in Western countries. The best indication of this trend is what Goldman Sachs defines as "BRICs" Brazil, Russia, India, and People's Republic of China, four nations with fast growing GDPs and significant population bases, with a large number of people moving from poverty to low- and middle-class.

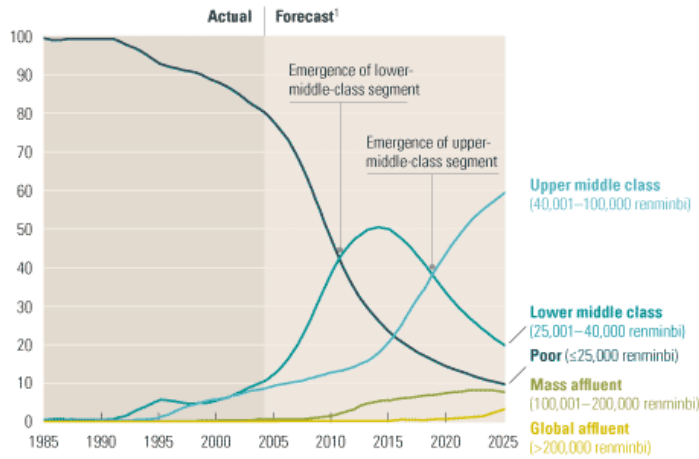
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¹ Some figures do not sum to 100%, because of rounding; disposable income = after-tax income, including savings; real renminbi, base year = 2000; 1 renminbi = \$0.12.
² Base case forecast, Q1 2006.

Source: National Bureau of Statistics of China; McKinsey Global Institute analysis

Share of urban households by income class, %



¹ Base case forecast, Q1 2006.

Source: National Bureau of Statistics of China; McKinsey Global Institute analysis

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“The Value of China's Emerging Middle class”, McKinsey & Company¹⁰

In global terms, the transition from national demographics being dominated by the poor, to that of lower-middle class and, in time, middle class groups, will accelerate in the period 2010 to 2020. In fact, in a very short period of time, the mix of the division between classes will switch. A former economist, now working at the Brookings Institute, Homi Kharas, estimates that by 2020, the world's middle class will grow to contain 52 percent of the global population, up from approximately 30 percent in 2008.¹¹ Also worth mentioning is the fact that Western middle classes will not be the force that they once were. The World Bank has noted that in 2000, developing countries were home to 56 percent of the global middle class, however, by 2030 that figure is expected to reach 93 percent.¹²

Dietary Habits. With demographic change comes a noticeable change in consumer trends, particularly in the dietary habits of new middle class citizens. When relatively higher disposable incomes are achieved, the pattern of progressing from a grain or rice dependant diet to incorporating meat into regular diets is well documented.

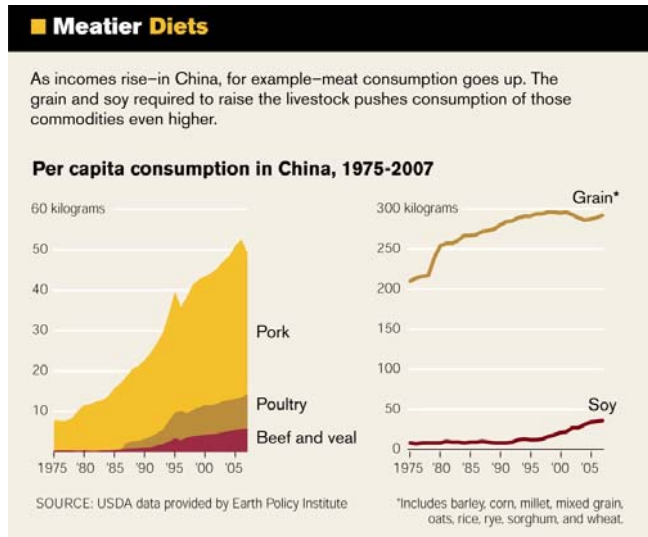
When compared with traditional cereal-dominated diets, a diet which includes meat requires considerably larger quantities of grains to feed animals for meat production.

¹⁰ Diana Farrell, Ulrich A. Gersch, and Elizabeth Stephenson, “The Value of China's Emerging Middle class”
http://www.mckinseyquarterly.com/The_value_of_Chinas_emerging_middle_class_1798

¹¹ Naim, M., “Can the World Afford a Middle Class Population?”, *The China Post*, February 13, 2008. Retrieved August 18, 2008, from
<<http://www.chinapost.com.tw/commentary/los%20angeles%20times/2008/02/13/142704/Can-the.htm>>.

¹² See <http://knowledge.wharton.upenn.edu/article.cfm?articleid=2011>

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Extracted from Bruce Stokes, "Food is Different", *National Journal*, July 7, 2008, p 24.

The following table shows the amount of grain required in the production of certain types of meat, and the energy yield from those particular forms of meat in human consumption.

	Beef	Pork	Poultry	Fish
Grain required per gram of animal weight gain (grams)	8.3	3.1	2.0	1.5
Energy yield per gram of meat (kcal)	2.78	3.76	2.13	1.16

Extracted from Goldman Sachs, *Commodities: Food, Feed and Fuel. An agriculture, livestock and biofuel primer*, March 2007

The amount of grain required to support a vegetarian diet is much less than that of a high-protein diet, due to the nature of energy loss in the progressive levels of the food chain. Even with static global population numbers, a

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change in the mix of people eating meat changes the total amount of soft commodities required. This leads to a high “exchange-rate”, in the conversion from grain to meat.

Water Requirements. As dietary habits change, the demand for grain increases accordingly. Relying on rainfall patterns to produce grain has its limitations; however, through irrigation techniques, grain production can be expanded. In fact, one of the main reasons behind escalating fresh water consumption in the 21st Century is the irrigation technique used in agriculture and intensive farming, which currently accounts for 70 percent of the world’s fresh water use.¹³ While non-irrigated crops rely solely on rainfall, irrigation involves channelling ground water — from aquifers or surface water, by diverting rivers and lakes onto the farm land — and providing enough water for crops to grow on otherwise marginal lands. In some countries, such as India, Pakistan and Egypt, irrigation accounts for approximately 90 percent of fresh water use. Other large irrigating nations include the People’s Republic of China (PRC) and Mexico, in which 60 percent of their fresh water use is in agricultural sector.¹⁴

In the 21st Century, due to the *de facto* trade of water, through the international sale of grain grown using irrigation, water shortages and localised collapses, will quickly become a global issue and could result in conflict, as well as significant movement of people within and across borders. Historically, there have been instances when successful civilizations faced difficulties, relating to their ability to store and transport water. According to a recent scientific study¹⁵, Cambodia’s Angkor Wat temple complex was once

¹³ World Business Council for Sustainable Development, 2005, *Water: Facts and Trends*. Retrieved June 12, 2008, from
<http://www.wbcsd.ch/web/publications/Water_facts_and_trends.pdf>.

¹⁴ Food and Agricultural Organization of the United Nations, 2008, *AQUASTAT Database Query*. Retrieved June 12, 2008, from
<<http://www.fao.org/nr/water/aquastat/data/>>.

¹⁵ Evans, D., Pottier, C., Fletcher, R., Hensley, S., Tapley, I., Milne, A. & Barbetti, M., 2007. ‘A Comprehensive Archaeological Map of the World’s Largest Preindustrial

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surrounded by a very large urban sprawl, with an estimated population of 500,000 to one-million people. This civilisation thrived, between the 9th and 16th Centuries, by harnessing water through a complex network of channels and irrigation systems, storing and delivering water to 500 square kilometres of farmland. However, the study also revealed shortcomings in the irrigation network, leading to the hypothesis that mismanagement of water resources contributed to the demise of an entire civilisation. This theory, regarding Angkor's desertion, is that the immense water management system had damaging effects on the environment which were not addressed and the system was allowed to fall into disrepair, ultimately leading to water shortages, which resulted in food shortages.

In 2005, a report by the World Business Council for Sustainable Development (WBCSD) estimated that 15 to 35 percent of global irrigation is drawing water from unsustainable sources. That is, water is being used faster than it is being replenished by nature's water cycle. Many of these water sources will soon dry up, adding to the demand to secure new fresh water supplies.

During the coming decade, the demand on fresh water for irrigation in agriculture will experience a steep increase, because of a growing population and changing demographic mix. This is primarily driven by additional calories, required on a daily basis, to feed the world's population. However, basic staples derived from cereal crops, such as rice and wheat, are required as feed themselves, and also as a direct input for animal production which are subsequently consumed by humans. Large volumes of water are needed in the production of irrigated cereal crops. For example, the following table shows estimates¹⁶ of the volume of water required to produce one kilogram of grain.

Settlement Complex at Angkor, Cambodia', *Proceedings of the National Academy of Sciences of the United States of America*, vol. 104, no. 36, pp. 14277-14282.

¹⁶ Table data estimations from: Bindraban, P. & Hengsdijk, H., 2005. *Water Saving in Rice Based Ecosystems*. Retrieved June 12, 2008, from <ftp://ftp.fao.org/agl/emailconf/wfe2005/watersaving_rice_ecosystems.pdf>; Bennett, D., 2007, 'It takes a lot of water to grow a corn crop', *Southeast Farm Press*, December 28, 2007. Retrieved June 12, 2008, from

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	1 kilogram of Rice	1 kilogram of Wheat	1 kilogram of Corn
Water Required for Production (L)	2,000 – 5,000	1,000 – 1,800	450 - 600

The above table illustrates why such a large proportion of fresh water is needed for agriculture. As the global population increases, so does the proportional demand on water in providing irrigation for cereal crops. It is not only the earth's increasing population which is elevating the demand for fresh water, but a change in the socio-economic composition of developing nations leading to increasing levels of the consumption of meat. The growing number of protein-based diets among the emerging global middle class will have a significant effect on agricultural demands.

Water and Food. A population, in which the dietary standard involves regular meat consumption, demands much larger amounts of grain than a population with cereal-based diets. This higher demand for grain translates to a higher demand for water. By combining data from the above table — which shows estimates of the water required to produce certain types of grain — with statistics extracted from an abovementioned Goldman Sachs report, it would take approximately 8,300 to 14,900 litres of water to produce one kilogram of beef which had been fed with wheat. This equates to approximately 8 to 15 tonnes of fresh water, not including the water consumed by the livestock, or the water used in the industry during meat preparation, to produce one kilogram of beef. The accommodation of an increase in middle class diets will see further stress on fresh water supplies in developing nations for grain to feed stock.

As a larger middle class increase their regular protein intake, the demands on meat will also increase during this time, therefore increasing demand on agriculture to produce livestock feed. In turn, this will create demand for

<<http://southeastfarmpress.com/grains/122807-corn-water/>>; and Antonios, P., 'Water for Life' Decade: Appropriate Policies Needed to Make Better Use of Water, *FAO Newsroom*, March 21, 2005. Retrieved June 12, 2008, from <<http://www.fao.org/newsroom/en/news/2005/100274/index.html>>.

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fresh water supplies to be used in irrigation, to create crops for feed. In these nations of rapidly changing socio-economic structure, the strain on fresh water supplies will be more severe, and arise much earlier, than in more developed nations.

The industrialisation of developing nations will also contribute to an increase in demand on fresh water. According to a 2003 report by the United Nations Educational, Scientific and Cultural Organization (UNESCO)¹⁷, the percentage of fresh water used for industrial purposes in high income countries was 59 percent, while only 30 percent was allocated to agriculture. The report also showed that, on average, a low to middle income nation allocates only 10 percent of its total fresh water consumption to industry, while 82 percent is used in agriculture. As large, developing nations, such as India and the PRC, move into a period of heavy industrialisation, fresh water resources will be stretched to accommodate both agriculture and industrial demands. In 2000, the PRC's use of fresh water for industrial purposes had risen to 26 percent of total use, having been recorded as 10 percent in 1990. The percentage of fresh water allocated to agriculture fell from 83 percent in 1990 to 68 percent in 2000. India is beginning to follow the same trend, with water use for industry in 2000 more than doubling the 1990 figure.¹⁸

The history of development and increasing wealth shows that affluent nations consume more water per capita for domestic use than developing nations. As new, middle class populations emerge, the demand for fresh water supplies for domestic use will also increase, contributing to the growing pressures on this resource. This will also displace agriculture on the

¹⁷ United Nations Educational, Scientific and Cultural Organization, 2003, *United Nations World Water Development Report: Water for People, Water for Life*, cited in World Business Council for Sustainable Development, 2005, *Water: Facts and Trends*. Retrieved June 12, 2008, from http://www.wbcsd.ch/web/publications/Water_facts_and_trends.pdf.

¹⁸ Food and Agricultural Organization of the United Nations, 2008, *AQUASTAT Database Query*. Retrieved June 12, 2008, from <http://www.fao.org/nr/water/aquastat/data/>.

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most suitable lands as economics often favour industry to agricultural production on premium land.

The combination of increases in agricultural, industrial and domestic fresh water demands could result in widespread water scarcity in the 2010s. In the coming decade, nations will be affected individually depending on local circumstances; however, local shocks will be transmitted throughout the international system, through the *de facto* water trade via irrigated wheat crops. In countries such as the United Kingdom, for example, less than 3 percent of their total water usage is utilised for agricultural purposes, and existing industry is well established. Nations such as India, Pakistan, Egypt and the PRC, however, which largely depend on water for irrigation, will be extremely vulnerable. In these places, water scarcity will heavily affect agriculture, creating food shortages and forcing governments to seek alternatives. As the need arises, water suppliers will increase the price attached to water provisions, which, in turn, may lead to a preference in sales towards a more profitable urban market. In countries with rapid urban expansion, water prices will be dictated by industry and domestic consumption and cause a dramatic increase in food prices and inflation as farmers are forced to pay more for irrigation.

As the demand for fresh water supplies intensifies, water sources in bordering countries would become more attractive, resulting in rising international tension and, quite possibly, conflicts over water resources.¹⁹ Fresh water sources passing through more than one country, such as rivers and lakes, may be the cause of international disputes. As water scarcity begins to impact on agricultural production, richer nations will import food as an immediate solution. However, this will not deal with the fundamental issue, but simply shift the problem of water shortage around the globe. As the Angkor Wat example illustrates, simply deferring a water problem, or, in the modern sense, outsourcing it to another country, can potentially threaten the ongoing viability of a society.

¹⁹ This is discussed in depth in Goh, E., 2007, *Developing the Mekong: Regionalism and Regional Security in China-Southeast Asian Relations*, the International Institute of Strategic Studies, London.

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Urbanisation. It is not only the trend towards a new global middle class which is causing additional burdens on the environment which is impacting food, water and energy patterns. With the trend towards urbanisation²⁰, large cities and an increasing number of mega-cities will require ever increasing amounts of raw supplies, such as food, water and energy, from the countryside which will create a number of imbalances. This is by no means limited to developing nations. Western Australia, which has one of the most efficient farm sectors in the world, producing significant levels of soft commodities for the international market, only has a fraction of its population living in rural areas. In fact, it has one of the higher urban to rural ratios in the world.

A changing demographic mix, away from rural areas, has meant that the decisions in Western Australia are almost always done from a city-centric perspective. This has resulted in increasing number of laws and regulations which work against the interests of agriculture, in favour of those living in sprawling urban centres. The tension is also being felt as the supply of food, water and often energy is drawn from rural and non-urban sectors of the state. The city, in this case Perth, expects these supplies to keep flowing, uninterrupted and does not invest the funds or time in ensuring these areas are sustainable over the long-term, as there is simply no political capital to be gained in such exercises.²¹ Imbalances in this case results in the long-term erosion of the means to produce food, water and energy. However, this is not immediately noticeable and within a rich, Western context does not result in physical violence and turmoil, like it has in areas of Nigeria which have a similar state-federal structure as Australia.

Within developing nations the trend towards urbanisation is creating imbalances of a different kind. Mumbai, in India, lays claim to around 40 percent of India's foreign trade and 33 percent of income tax collections.

²⁰ The point at which the majority of the global population became urbanised only occurred in 2007. This relatively slow process took millennia to occur.

²¹ This is by no means the only case. There have been a limited number of visionary Western Australian political leaders who have viewed the state in its entirety, rather than areas of political importance.

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However, with over 14-million citizens, it consumes a significant level of raw inputs to produce this economic outcome. Because of the wealth disparity between rural and urban settings, Mumbai, and prosperous cities like it, act as magnets for those seeking to improve their living conditions. As a result, there is continual migration from rural to urban areas, with many thousands of rural labourers entering the cities in search of work each week. Many of these labourers find work, however, their presence adds to the pressure on city infrastructure and also increases the demand for imported food, water and energy.

Emerging Indo-Pacific cities are creating millions of new middle-class citizens who are seeking to participate more fully in the global economy and emulating Western dietary patterns. This is creating size and scale for new types of consumer goods, effectively creating large consumer segments which exist within what those in the West would term the “Walmart” end of the market. The result of this trend is that it has made what are common Western, middle class consumer goods, stripped them down to a basic format, available to a potential market of hundreds of millions. This is resulted in such products as the Tata car, which will be priced around \$2,000. For many families who would have traditionally been labourers or farm workers, factory and office jobs in cities are providing new options unheard of as recently as a couple of decades ago. The stories of the Tata car in the West are often viewed as quaint human interest stories; however, the impact of these types of consumer revolutions would have a major impact on Indian society, comparable with that of the Model T Ford in North America last century.

As an increasing number of people, especially in the developing world, start to transition to an urban middle class lifestyle, and leave their rural, ancestral homelands, there are broader matters to ponder. It is the relative period of global peace and advancements in a variety of sciences which has allowed the abstraction of human activity. Where once there was a requirement for a large portion of the earth’s population to grow its food and collect its own water, we are now seeing vast sections of humanity totally reliant on complex food supply chains and water infrastructure networks. What is different today is that the total proportion of humanity de-linking itself from

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traditional means of survival to abstract, urban settings is increasing and, for the first time, in significant levels outside traditional Western nations.

Implications. In the period in which significant new entrants in the global middle class form new lifestyle patterns, food, water and energy will rise in importance and become the focus of many national governments and will see diverging attitudes to the agriculture production, electricity generation and associated negative outcomes such as pollution. The breakdown of the World Trade Organization Doha round talks in August 2008 and the disagreement between developed and developing nations over carbon emissions represents a symptom of these forces rather than fundamental differences over free trade and the environment. It also indicates that the various responses to a changing global framework, which will put pressure on agricultural production and water availability, may be addressed through regional or local responses, rather than an overarching global response favoured by many in the Western world. For those in the West, this will cause a great deal of frustration. However, for developing nations which are set to transition large numbers of their citizens out of poverty, or simply maintaining stability, it will be viewed in a much different light.

There will also be a number of other forces which start to play out as the convergence of food, water and energy occurs and urbanisation accelerates, global population numbers approach a peak and a new “global middle class” accelerates its consumption levels. These include:

- **Stability versus Liberalisation.** The result of these forces means that governments, especially those governing diverse, large populations will start to look to mechanisms which ensure stability as, economic growth, even at double digit rates, still does not bring enough people out of poverty. Higher structural prices for soft commodities, and their impact on energy and water markets, negate a great deal of the economic growth which has been experienced in the coastal zones of the PRC and Indian IT and commercial centres. The trend towards liberalisation of markets has also caused great strains in many parts of the rural hinterland. For example, India, which has removed

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subsidies for cotton producers, has seen around 160,000 farmers commit suicide because of mounting debts.

- **Internal Migration.** In many ways India — which has around 700-million citizens living in rural areas — and the PRC — which has around 500-million citizens living in rural areas — should benefit from higher structural prices for food. However, many of these farmers operate at subsistence level with relatively small, inefficient sized plots, which do not have the benefit of economies of scale. The Indian farmers which committed suicide had to deal with increased cost inputs, without the ability to absorb, or pass on greater costs. In this sense, the PRC and Indian approach to the Doha round of WTO talks was driven by consideration of the 1.2-billion people living in rural areas which would be heavily dependent on changes to their agricultural sector. Suicide, for failing farmers, is one option. However, another outcome, which is of perhaps greater concern to both Indian and PRC leaders, is an internal mass migration of cities of poor rural farmers which are seeking a better future. This could create major unrest which would have international ramifications, especially if it occurs during an economic recession.
- **New Approaches to Infrastructure.** In the Western Australian context, there was discussion of the non-metropolitan energy entity, Horizon Power merging with the non-metropolitan parts of the Water Corporation.²² While this remains only a discussion point, if the remote parts of Western Australia were settled for the first time, in 2008, a combined energy and water utility would certainly be a potential option. As desalination technologies improve, which themselves require significant amounts of energy, and new generation technologies remove requirements for a traditional electricity grid, planning for energy and water infrastructure will become more intertwined. Also, with desalination set to provide a larger component of Perth's water, electricity costs will likely

²² Pownall, M., "Change on the Horizon", *WA Business News*, March 27, 2008.

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comprise a greater percentage of the unit cost of delivering water services.²³

- **“Agriflation”.** As the world transitions to a higher proportion of people living a middle class style lifestyle, many nations will experience a high demand growth for meat products. Subsequently, this will increase the demand for grain, creating more demand for sub-standard and marginal land to come into production. As the costs of bringing new production on-line flow through to prices, it could be expected that relatively minor demand increases could have significant impact on the price of soft commodities, and ultimately farmland. The demands on farmland during this time will also intensify. Agro-forestry, for carbon credits, and biofuel input production are amongst some of the competing users of productive farmland. The end result of these forces is that soft commodities, ending their historical run of decreasing in real prices, will now start to contribute to inflation, *The Economist* has termed this trend “agriflation”.
- **Expansion of Biofuels.** The use of biofuels has been expanded by a number of nations seeking energy security. This has been a factor in the higher price of food driven in part by the mandated expansion of biofuel production.²⁴ Certain categories of soft commodities are now moving with energy prices. Competition for productive farmland is set to intensify, and prior to the introduction of next generation biofuels, which use plant by-products rather than the grains which humans can consume, there will be increasingly heated debates on this topic. The separate, but related, debate over genetically modified crops will also start to become linked to discussions over biofuels.

²³ As the water and energy utilities are both Western Australian Government owned entities, they are not subject to market forces and often sell water and electricity below market prices.

²⁴ The interplay between biofuels and agricultural production of products for human consumption is much more complex than the simple food versus fuel debates suggest.

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- **Increasing Cost of Water.** As the underground supplies of water become overused, there will be a greater real cost paid for water. With less “cheap” or free water available for irrigation, the cost of food will also increase. Options such as desalination will become attractive, however, energy costs will start to have a large impact on the price of water. Furthermore, as energy assets and infrastructure are increasing in private hands, commercial investors will seek to maintain profit margins, which mean that the higher marginal costs will flow through to consumers.
- **Unrealistic Expectations from Urban “Consumers”.** A generation or two ago, the provision of food, water and energy, from the country side, to urban centres, was regarded as a welcome luxury. That being said, there was much more tolerance of a break in supply of water and energy when there were issues with infrastructure, or circumstances which interrupted supply. In modern, urban settings, especially in the West, there is zero tolerance for any break in supply and a belief that the supply of these goods should not only be continuous, but it should be cheap. The increased awareness of climate change has changed some of the discourse; however, it is questionable whether actions have substantially changed. The other side-effect of the high demands from urban consumers is the political and management time which is narrowly focused on the short time supply issues, to the detriment of broader, strategic issues which could represent an existential threat to the energy and water provider, and even the society itself.
- **Redefinition between supply and consumption zones.** For the past half century, the relationship between developing and developed nations has been relatively static and the mass consumer markets have been located in the developed nations. It is clear that in the coming decades that the so-called “developing” states will start to command a greater, and then perhaps, dominant rôle in global consumer markets. Adjusting to these changes will be particularly difficult for the West, however, it will represent a great deal of opportunities and a number of them will be related to providing

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infrastructure around the provision of food, water and energy. As this pattern progresses, there will need to be consideration given to the fact that the technology gap which began in the West during the enlightenment period and accelerated in the European colonial era, is now closing and has the potential to reverse. This may mean that some of the emerging technologies around water, food and energy may need to be imported from what today are known as “developing” nations. In this sense, the definition of global “consumption” and “supply” zones will also change.

- **Energy Pricing and Availability.** The post-World War II energy paradigm has been to use crude pricing in key trading points such as New York and Singapore alongside energy availability through global hydrocarbon audits. This approach has separated out energy, from food and water. For the past half century as technology and the strategic environment permitted, this was a rational approach to categorising energy. As it appears the world is approaching a tipping point in its use of hydrocarbons for electricity generation and transport, it will be soon necessary to re-evaluate some of the metrics used for energy potential. Just as soft commodity prices are starting to be redefined, energy markets are as well.

Conclusion. The period in which the majority of the world’s citizens transition from poverty to middle class, is set to occur over the next two decades. The impact of the trend which is shifting millions into the middle class has started to be noted over the past 12 months, most obviously with the high price of soft commodities. The overall impact of this large group attaining a lifestyle which will demand a great deal of the earth’s resources may also alter the time at which the global population peaks and the subsequent adjustment to a flattening, or even decline, in global population numbers.

Chapter Three

US Perspectives on Asia-Pacific Energy Security

By Kenneth Chern²⁵

The US Department of Energy projects that non-OECD economies' consumption will grow 85 percent by 2030, driven largely by the People's Republic of China and India. When Department of Energy Acting Assistant Secretary Jim Slutz was in Australia for the Australian Petroleum Production & Exploration Association (APPEA) meetings in October 2007, he introduced the report of the US National Petroleum Council, *Facing the Hard Truths about Energy*, estimating that global demand for energy would grow by about 60 percent by the same date, 2030.

Asia and Oceania consumed 32 percent of global energy production in 2005. Asia and Oceania also have the largest difference between production and consumption – the largest production deficit – of any region in the world, making the security of energy supply a critical national priority for any country in the region looking forward.

Some US priorities concerning energy security in the Asia-Pacific include the following considerations: (1) Australia is an energy security anchor in the Asia-Pacific region; (2) closer integration in the region – including with China, as well as with ASEAN nations and others, such as India – will enhance energy security; (3) energy security in the Asia-Pacific is indivisible from economic development and action – particularly the development of technology – to address climate change; and (4) energy security is linked to global stability and economic opportunity. The overarching framework for these priorities is the functioning of free energy markets that underpin energy security, and

²⁵ The author thanks Mr David Atkinson of the US Embassy in Canberra, and Ms Regina Soos of the US Consulate General in Perth, for their assistance in preparing these remarks.

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provide the context in which all the ideas I will discuss can move forward most effectively.

On the first point, **Australia's rôle**: Australia, with its abundant LNG, coal, and uranium, is a crucial energy security anchor for many of the most important players in the region. Several speakers at Future Directions International's Annual Indo-Pacific Energy Security Round-Table described the key rôle which Australia plays in the global energy supply chain, and the significant expansions which are planned in all of Australia's main resources. These include: (1) almost A\$100-billion in planned LNG expansion projects; (2) plans to expand the Olympic Dam uranium mine (which will be twice the size of the current world leader in Canada); and (3) coal infrastructure developments on the East coast.

Although some have suggested that the development of an emissions reduction policy by Australia is a "sovereign risk", the energy security question marks for Australia are significantly lower than for many other important suppliers.

On the second point, **regional integration**: the energy security dynamic we see in the Asia-Pacific region is driving a multiplicity of new relationships and trade linkages. A wide range of countries in the region are involved in these initiatives. From the US perspective, closer economic and political integration in the region can only enhance — not detract from — energy security.

APEC, the Asia-Pacific Economic Cooperation forum, for example, has taken up the issue of energy security, most clearly in the 2007 Leaders' Declaration at Sydney. In addition, the Major Economies Meeting process, recently endorsed by the G8, focuses not just on reducing greenhouse gas emissions, but also on improving energy reliability, efficiency, and security. This will ensure that economies can decouple their economic growth from increasing greenhouse gas emissions.

ASEAN and other regional groupings have also taken on energy access as a critical element of their discussions. In an interesting article on "ASEAN Fiscal and Monetary Policy Responses to Rising Oil Prices," published in May 2007, Australian Peter Downes noted that: (1) from 2004-06, the ASEAN countries

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were hit by the largest oil price increases since the 1970s; (2) ASEAN countries are far more oil-intensive in production than other countries, as well as more trade intensive; and (3) in understanding both the indirect and direct channels for transmission of oil price shock, we can try to explore fiscal and monetary responses that will cushion ASEAN economies from the worst effects of shock.

Further south, a new regional approach is the Energy Development for Island Nations (EDIN) partnership. This joint US-New Zealand-Iceland initiative will drive clean energy development in island states and reduce the impact of global energy price spikes and other disruptions on fragile economies in the region.

We are all aware of China's interest in securing energy resources, including in Australia, to fuel its growing economy. We recognize China's legitimate need for energy security, and we promote responsible international engagement by China. We are actively encouraging China to seek membership in the International Energy Agency (IEA) and to support the Extractive Industries Transparency Initiative (EITI).

Daniel Yergen, of Cambridge Energy Research Associates, has addressed the issue of whether the US and China will necessarily be energy rivals, and has made the point that the US-Chinese Strategic Economic Dialogue and its byproducts are crucial to defusing stresses in the bilateral relationship and preventing commercial competition from prompting geostrategic rivalry.

The United States, Australia, and China have an ongoing cooperative relationship through which they enhance energy security while promoting sustainable economic development. The Asia-Pacific Partnership on Clean Development and Climate (APP) is a seven-country public-private initiative (that also includes Canada, India, Japan, and South Korea) focusing clean energy technology deployment in eight energy-intensive sectors, including fossil energy and renewable energy and distributed generation. By supporting investment in and development of clean energy technologies, the APP is enhancing energy efficiency and reducing greenhouse gas emissions in the Asia-Pacific region, while also contributing to the goals of energy security. Within only the past few months, the APP has approved eight projects in

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China, spearheaded and funded by the US Department of State, and valued at more than US\$6.7-million. These grants complement the actions we are already taking in India. Working within the APP, the seven Partners are able to address energy security concerns through cooperative, concrete action that fosters a spirit of collaboration in the energy security context.

On my third point, the US believes that **energy security is indivisible from economic development and action** – including development of new technologies – to address climate change. Those economies which are increasing energy consumption (including Australia) will have to do so in more efficient ways. But we think that telling a country it can't produce or use more energy to satisfy the demands of improving standards of living will be a non-starter.

Improvements in energy efficiency are not only a way to reduce emissions; they are just as important in developing greater energy security. Technology will be critical – and yet, there is no silver bullet. Partnerships that develop technology, like the Clean Technology Fund (proposed by President George W. Bush and reaffirmed by the G8 in Hokkaido Toyako in July 2008), are an important part of the answer to the problem.

Another example of new energy relationships to drive technology is the Global Nuclear Energy Partnership (GNEP), which currently includes 21 countries as members. The GNEP is not only intended to make the fuel cycle safer and less vulnerable to proliferation. It is also aimed at developing cleaner, safer nuclear power as one alternative to address energy security. We've welcomed Australian participation in GNEP as a major supplier of fuel, and we hope Australia will continue to play a rôle in that effort, even if nuclear energy is not a priority for the country at this point. GNEP has active Working Groups on Infrastructure Development and Reliable Fuel Services, issues of importance to members just starting to consider nuclear energy. Australia could make valuable contributions to the work of both Groups.

And let's not forget investment. Growing foreign interest in investing in Australian energy resources is driven – at least in part – by confidence that Australia will be a reliable source of energy exports in the decades to come.

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On my fourth point, recent events in Georgia have reminded us that **energy security has crucial links to global stability and economic opportunity**. Global concerns over recent events in Georgia have been amplified by the possible impact on energy security of pipelines and ports in Georgia.

And the circumstance of Iranian influence over the Straits of Hormuz continues to be a challenge to global energy supply and global energy prices. More generally, piracy, shipping disruptions, and maritime safety conditions remain challenges to keeping energy flowing as efficiently as possible.

The bottom line is that stakeholders in the US, Australia, and elsewhere in the Asia-Pacific have the obligation to address not only the regional challenges, but also the global challenges related to the Asia-Pacific energy equation.

The implementation of US priorities in the region will require continued cooperation with Australia to drive the regional integration, economic development, technological breakthroughs, and global stabilization which are crucial to both our nations and to the energy security of the entire Asia-Pacific.

Chapter Four

Australia's Energy Options

Future Directions International (FDI), on October 6, 2005, launched *Australia's Energy Options* in the Federal Parliament, Canberra. This study has profound strategic implications for Australia and how it plans for its future energy use. Furthermore, the study — officially welcomed by both the then Prime Minister of Australia, John Howard, and the then Opposition Australian Labor Party leader Kim Beazley — looks at issues of key significance to the regional strategic balance and regional trade, but, significantly, was hailed as a major breakthrough in the debate to introduce nuclear power to Australia to address the growing shortfall in local supply of oil. *Australia's Energy Options*, outlined in the study, are considered in context of both global and market trends.

The 135-page study had information of significance to global energy markets and planners, and, for the first time, introduced significant new information on modular nuclear reactor technology being developed in the US, but, because of its thorium fuel base, of particular significance to Australia, which has the world's largest reserves of the mineral. The study succeeded in generating media interest and fostering debate on the options available for decision makers.

Based on the recommendations of *Australia's Energy Options*, Craig Lawrence AM, FDI CEO and Executive Director, delivered a submission to a Public Hearing on the Review of a Nuclear Material Transfer Agreement with China by the Joint Standing Committee on Treaties, Parliament of Australia on October 6, 2006. The submission addressed the possible impact of two potential bilateral agreements with the People's Republic of China in a broader strategic framework. It also presented a review of global energy patterns essential to expanding understanding of the implications of bilateral agreements between Australia and the People's Republic of China. Many of the recommendations FDI presented to the Joint Standing Committee,

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particularly those regarding further exploration in the applications and trade of thorium, were incorporated into the Committee's recommendations to parliament.

The report summary and findings from *Australia's Energy Options* report are republished below. While three years have past since the original study was published, and the global framework has changed considerably, the recommendations remain relevant and hold particular relevance to Western Australia.

Report Summary and Recommendations

There is abundant evidence — highlighted in this report — that Australia, and most nations of the world, have viable options to improve the stability, security, volume, ecological quality, and economic competitiveness of energy supply. Options, however, require decisions and leadership if they are to be exercised, and decisions and leadership require public and political consensus.

Australia's Energy Options lays the foundation for a policy debate and identifies the options which are emerging for Australia as a result of local and global conditions, and result of developments in science and technology, and the marketplace. Australia is not running out of energy sources. However, its continued economic growth and wellbeing, as well as its strategic independence, is dependent upon important decisions being taken on future sources and types of energy, and on the infrastructure needed to develop, sustain, and distribute it. A disconnect between the strategic dimensions of energy policy, market dynamics and long-term solutions is becoming evident. This is not to criticise the basis of prior decisions but rather to highlight the fact that we find ourselves at strategic crossroads. Energy decisions made

— or not made — today will impact on the future of Australia's energy usage over the next 20 to 30 years.

Australia, and the entire world, is facing an energy options transition period driven by the cost of energy, concern over greenhouse gases, and the need for energy security. While individual state priorities may differ, the

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imperatives for nations to act today cannot be overstated. Australia is part of this global energy framework and ignores it at its peril.

Australia's Energy Options

This report calls for immediate action by Australia to develop a comprehensive strategic energy policy. Future Directions International (FDI) considers that neither Australia nor the world is running out of energy sources. Increased demand and tight supply chains are, however, pushing the cost of energy upwards. This increase in cost is likely to spur new investment in, and expansion of, new energy projects. While a number of new alternative energy projects are now becoming viable, it is likely that fossil fuels will remain critical in the short to medium term. It is also likely that nuclear energy will play a much more important rôle in the years ahead. Renewable forms of energy, while increasing in popularity, cannot alone solve energy problems. While major industrialised countries will continue to experience growth in demand for energy, the greatest level of increase in energy demand will come from emerging industrial economies, particularly the People's Republic of China (PRC) and India.

For these reasons we recommend the following issues as worthy of consideration when formulating a new national energy policy:

Oil and Natural Gas

Australia should insulate itself from sudden transport fuel shortages by encouraging oil shale and coal liquefaction projects and greater exploration as well as promoting greater fuel efficiency options for motor vehicles and ensuring the option to readily convert to natural gas as a transport fuel.

Australia is extremely vulnerable to disruption of its energy supply, particularly fuel necessary for transportation. This is especially relevant given the high, and growing, reliance on imported oil. There are a number of demand side solutions which can reduce reliance on imported oil. Greater fuel efficiency for motor vehicles and ensuring the option to convert readily to natural gas — as an alternative transport fuel — can assist in addressing this problem. Australia's exploration efforts need to be redoubled so to identify local sources of hydrocarbons. In defence parlance, Australia has very

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limited strategic depth of energy supply. This vulnerability could become critical if there was an international crisis, such as a blockade of the Persian Gulf. Given Australia's large supplies of brown coal and oil shale, it makes sense to nurture extraction industries, in particular from brown coal. It is essential that the necessary skills, technology, investment and expertise, for both coal liquefaction and oil shale extraction, are attracted to Australia. This would ensure that in a crisis situation Australia would have the ability to ramp up local production. Assisting these industries to establish a presence in Australia, while at the same time recognizing environmental concerns, would give the Federal Government options in the case of an international emergency.

Australia's vital offshore oil and gas platforms install and implement sophisticated surveillance technologies and the Federal Government provides a rapid response capability for such facilities to protect against either hostage situations or intentional destruction. In addition, however, an enhanced program of incident response exercising should be instituted by Defence and security organisations.

Australia needs to consider the vulnerabilities of domestic energy supplies as well as those transported from overseas. For Vital National Installations (VNI) such as offshore oil and gas platforms, natural gas pipelines and major oil refineries, there remain a number of vulnerabilities which need to be reviewed. Growing reliance on imported oil means that the relative importance of certain VNI is actually increasing over time. It should be noted that, in recent years, there have been a number of improvements in all areas of VNI protection. Despite this, offshore oil and gas platforms, critical to Australia's economy, remain relatively unprotected in some areas. While maritime surveillance has improved, it remains possible that terrorist or sabotage units could take control of one, or more, offshore oil and gas platforms, as has happened recently in Nigeria.

Coal

Investment in ultra-clean coal, and other associated forms of clean coal technology, should be prioritised so that coal can continue as an important power source.

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Australia should take greater advantage of existing coal reserves and utilise ultraclean coal (UCC) and other technologies which make using this fuel source cleaner. Abundant coal resources have been a major export earner. However, the fact that some of Australia's coal resources are less pollutant than others should be turned to Australia's advantage. Carbon sequestration is but one example of how the coal industry can adapt itself to continue to be relevant in the 21st Century. Moreover, Australia needs to focus more on the development of UCC technologies, which would contribute to minimise environmental concerns as well as helping ensure that the Australian coal industry could benefit from some vertical integration, or value-added, aspects of the market. Furthermore, by participating in the new climate agreement — the Asia-Pacific Partnership for clean development, energy security, and climate change — Australia will help emerging economies and be able to transfer such technologies as UCC which will further improve the environmental impact of existing industries in the Asia-Pacific region. Australia should take a leadership rôle in UCC and carbon sequestration technologies and assist emerging economies, such as the PRC and India, who rely heavily on coal.

Nuclear Life Cycle

It is now time for Australia to undertake a complete review of new nuclear technologies, such as thorium-based and pebble-bed reactors.

Government policies opting out of conventional nuclear power generation were feasible, and may have been desirable, until this point. The safety, environmental friendliness, efficiencies, and potential benefits of new forms of smaller reactors for the decentralisation of power generation cannot be ignored. In the Australian environment, they could provide remote area power sources “leapfrogging” the need for increasingly costly investment in a massive national grid. Australia must now undertake a complete review of new, safer nuclear power generation options offered by thorium-based reactors and pebble-bed reactors. Our proven, large resources of thorium and uranium could give the country a major strategic advantage.

Federal and State governments should undertake a complete review of the entire nuclear life cycle.

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Australia must, in parallel with a study of new nuclear technologies, reconsider all aspects of the nuclear life cycle. This includes the extraction and refinement of both thorium and uranium as well as the question of responsible nuclear waste storage. Australia is uniquely positioned to participate in all of these tasks. Even without Australia's involvement, this industry will continue to grow and expand. From a security perspective, as well as a strategic point of view, it is better to have legislative control over the safeguards to ensure that world's best practices are established, maintained and enforced. Australia is a nation stable both geologically and politically. It could play a key international strategic rôle in the nuclear life cycle, including extraction, refinement, and the storage of nuclear waste generated from Australian sources.

Alternative Energy Sources

Federal and State governments should consider implementing appropriate zoning concessions for biomass refineries, as well as specifically targeted tax incentives for primary producers producing biomass inputs within an economically feasible distance from these refineries.

Australia has a significant agricultural industry. This gives it the option to pursue to a greater extent fuel sources derived from agricultural production. Australia has the ability to take advantage of global energy market conditions to participate and contribute to the development of new, agriculturally-based biomass refineries. These refineries, as Brazil has shown, can provide both electric power and liquid forms of energy for motive power, often using waste from existing agricultural production. As with the new forms of nuclear power, renewable power from biomass is assuming new potential in the 21st Century. Dedicated refinery capacity for biomass in its various forms must be considered at a commercial level within the coming decade.

Research into hydrogen as an alternative transport fuel should continue.

Australia, like many other nations, is conducting important research into hydrogen. Nevertheless, a comprehensively hydrogen-based economy is unlikely to be a reality in the next 10 to 20 years. While hydrogen has the potential to alter the basis for our economy, and even how society exists and

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functions, it is still a considerable time from being universally practicable. With current technology, hydrogen requires as much energy to make as it produces. It merely moves the site of pollution from one point to another. In this context, there continues to be problems to be overcome before the full benefits of the hydrogen-based economy can be realised. While resources should be allocated to continue research into this issue, it should not be viewed as a “silver bullet” which could resolve energy issues in the immediate future.

Regulatory System

Governments must maintain their regulatory oversight of energy markets; however, once the strategic direction is set, they need to allow the market to select the best, and most efficient, approach to implementing energy solutions.

Australia’s evolution into new, more productive and stable supplies of energy for motive power, together with electrical power generation and distribution, will be most effectively met by allowing market forces to operate within a framework of minimal commercial interference by Federal and State Governments. FDI concludes that the marketplace, and the emerging new technologies and practices, are demonstrably and more naturally geared far more to safety, environmental considerations, efficiency, and investment considerations than are the traditional technologies. This is not to deny government its vital oversight and regulatory functions in the energy marketplace, but to highlight the fact that change — both for the purposes of efficiencies and ecology — is more rapid and responsive in the private sector. There is strong evidence that state-controlled energy distribution has proven incapable of the required flexibility, not because of a lack of competent leadership or staffing, but because political considerations have lagged behind market demand.

Governments should encourage research and development into energy by providing tax incentives and subsidies for new technologies so that Australia remains at the forefront of the next generation of energy technology.

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Federal and state government research and development funding is desirable in areas of new nuclear technology, biomass refining, and other areas. It is however also necessary for government to take a more integrated rôle with the private sector in questions of energy development, with greater emphasis on tax concessions and incentives to produce desired outcomes. This approach should look at the industry in an holistic manner and consider solutions in terms of the benefits for national outcomes rather than short-term, regional or state-based objectives. As a member of the new climate agreement — the Asia-Pacific Partnership for clean development, energy security, and climate change — Australia has shown that it can build a bridge between advanced Western economies and the emerging powerhouses of both the PRC and India. Seen in this light, Australia's energy options cannot be isolated from international developments. When formulating a national energy policy, much can be gained from considering Australia's position in the context of the international environment within which it exists.

Appendix One:

First Annual Energy Security Indo-Pacific Event Agenda

The First Annual Indo-Pacific Energy Security Round-Table was held on August 22, 2008, in Perth, Western Australia. Future Directions International and the International Strategic Studies Association (ISSA), based in Washington, DC, jointly presented the event which covered the following topics.

10.00 Formal Opening

10.10 First Session: *The Global Energy Framework: A New Conceptual Matrix*

Areas of discussion:

- Indo-Pacific basin growth trajectories: new energy usage modalities
- Turning points for crude oil and its replacement(s)
- New energy technologies and the impact of carbon regimes
- The future of the nuclear life cycle
- Population trends in the Indo-Pacific region and new energy demand centres
- Changes in the mix of energy importing and exporting nations
- The last period of major investment in refining capacity and petroleum transport networks?
- Domestic electricity generation and infrastructure requirements and the potential for decentralisation

1.00 Second Session: *Factoring Water, Food and Carbon Pricing into Long-Term Energy Investment Decisions*

Areas of discussion:

- Future energy infrastructure requirements and capital investment plans

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- New energy generation requirements and challenges for the grid
- Water availability, desalination plants and pipeline networks: options for partnerships between nations located in low-rainfall zones (i.e. Australia, Israel and Somalia)
- Biofuels and the agricultural potential of nations
- General trend towards food and productive agricultural land becoming a more important component of grand strategy

1.50 Third Session: *Legacy Energy Sources and Upcoming Tipping Points*

Areas of discussion:

- LNG Suppliers and Consumers in the Indo-Pacific basin: greater common interests?
- Lessons from previous historical shifts to new energy sources: whale oil, coal, etc.
- Role which key Sea Lines of Communication will have on energy transport networks
- A new era of gunboat diplomacy to secure and protect energy sources?

3.00 Final Session: *Future Challenges and Possibilities for Regional Cooperation*

Areas of discussion:

- The need to re-evaluate relationships and alliances across the Indo-Pacific basin as energy, food and water markets converge
- Potential for climate agreements to act as a precursor to deeper global integration of energy production and supply networks
- Emergence of new geo-political *blocs* based on energy relationships (i.e. the Shanghai Cooperation Organization and the US-led Global Nuclear Energy Partnership)
- Potential for new alliances and partnerships across the energy supply chain

3.50 Formal Close

The FDI *Occasional Paper Series*

Occasional Papers are FDI research publications are focused studies which are shorter than FDI's landmark studies, and yet more comprehensive than reports in FDI's electronic periodical, the *Weekly Global Report*. The Occasional Papers conform to FDI's research goal of independent, integrated research and analysis of issues of strategic importance to Australia's long-term future. FDI's *Occasional Papers* are released several times a year, and draw upon the experience and knowledge of the organisation's staff and FDI's expansive network of associates.

This is No. 3 in the FDI Occasional Paper series. No. 1 in the series, ***Australia's External Territories: The Forgotten Frontiers***, and No. 2 in the series, ***Australia's National Security: Considerations for Planning Defence and Security Capabilities Well Into the 21st Century***, both published in 2008, are available from FDI.

The Authors

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Gregory Copley is a founding Director (and currently Chairman of the Research Committee) of Future Directions International (FDI). An Australian, he is also President of the International Strategic Studies Association (ISSA), based in Washington, DC. He is Editor-in-Chief of *Defense & Foreign Affairs* publications, and the Director of Intelligence at the Global Information System (GIS), an on-line, encrypted-access, global intelligence service which provides strategic current intelligence to governments.

Mr Copley is author of more than two dozen books, and several thousand articles, papers, and lectures on strategic issues and history. His recent book, *The Art of Victory*, was published in October 2006 by Simon & Schuster's Threshold Editions in New York. He was principal author of the major study, *Australia 2050: An Examination of Australia's Condition, Outlook, and Options for the First Half of the 21st Century*, which was launched in the Australian Parliament in December 2007. As a result, he was a delegate to the Australian Prime Minister's *Australia 2020 Summit* in Canberra in April 2008. Meanwhile, the 16th edition of his 2,340pp encyclopedia, the *Defense & Foreign Affairs Handbook*, was published in June 2006, and his *Defense & Foreign Affairs Handbook on Azerbaijan* was published in July 2006, with an expanded second edition in May 2007.

His Washington-based institute has for almost four decades worked grand strategy issues, and he has advised a number of governments at head-of-state level.

He has received a significant number of orders and decorations from governments, including, in 2007, being made a Member of the Order of Australia.

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Andrew Pickford

Mr Andrew Pickford is currently employed in the energy industry. He was previously the Research Manager at Future Directions International (FDI) where he was also the Editor of FDI's *Weekly Global Report*. Before joining FDI in early 2005, he was employed by KPMG as an Advisor and also completed a secondment to the US energy firm Chevron. Andrew is on the management committee of the Australia Day Council of Western Australia, the Australian Institute of International Affairs (WA Branch) and is a councillor on the Royal United Services Institute of WA. He has a

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Masters of Accounting from Curtin University of Technology and is in the process of completing a Masters of Strategic Affairs from Australian National University. In 2007, Mr Pickford completed the Australian Institute of Company Directors' Company Directors Course.

Dr Kenneth Chern

Dr Kenneth Chern is Consul-General of the United States of America in Perth, Western Australia. He took up his duties in Perth in August 2007. His immediate prior assignment was as Deputy Consul General in Ho Chi Minh City, Vietnam; before that, he served as Deputy Director of the Office of Philippines, Malaysia, Brunei, and Singapore Affairs at the US Department of State.

Focusing on East Asian and Pacific affairs, he has also been posted to Beijing, Taipei, Hong Kong, Manila, and Cebu. In earlier Washington assignments, he worked at the State Department's China Desk, the Japan Desk, and the Australia/New Zealand Desk. He served in the White House as Director of Asian Affairs at the National Security Council, helping to organize the first APEC leaders meeting in Seattle. He has won three individual Superior Honor Awards for his work in counterterrorism, human rights, and public diplomacy, and has been cited in several group awards. He has an extensive background in political affairs, and is experienced in trade, science and technology issues.

Ken has a BA degree from Brooklyn College, and an MA and PhD from the University of Chicago, where he specialized in the history of U.S.-East Asian relations. Before joining the Foreign Service, he taught for two years at the University of Rochester and for 10 years at the University of Hong Kong, where he attained the rank of Senior Lecturer in History, published a book and numerous articles on US-East Asian relations, and researched and presented a seven-week television series on twentieth century China. He speaks French, Chinese, and Vietnamese.

Future Directions International

Future Directions International (formerly known as the Centre for International Strategic Analysis), is an independent, not-for-profit research institute established to conduct comprehensive, integrated research and analysis of important medium to long-term issues facing Australia. FDI is a Commonwealth Government-endorsed Approved Research Institute and Deductible Gift Recipient. FDI was created to fulfill an important strategic analysis rôle in the Australian policy community and was positioned in Perth, Western Australia, to offer a unique perspective on national issues. FDI has strong links to the policy and research community and prides itself on being able to draw upon experts in the field to contribute to its research.

FDI is located in Perth, placing it at the heart of Australia's fastest growing and most dynamic economic environment. FDI is the sister organisation of the International Strategic Studies Association (ISSA). ISSA is based in the Washington DC area in the United States, and is a worldwide membership Non-Governmental Organisation (NGO) of professionals involved in national management, particularly in national and international security and strategic policy. FDI also maintains close links with strategic research organisations around the world.

For further information about FDI, including how to participate in its activities as a donor or in other capacities, please contact the Chief Executive Officer, Craig Lawrence AM, by email at CLawrence@FutureDirections.org.au.



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