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## INDIA'S ENERGY NEEDS

### EXECUTIVE SUMMARY

*India's exploding demand for energy is confronting New Delhi with two important dilemmas, one internal and one external. India's internal dilemma is that to satisfy its energy needs, India must not only expand but also renovate its energy sector, a huge task. Moreover, New Delhi must balance accelerating the necessary reform of this sector with the need to avoid alienating important domestic constituencies. The external dilemma derives from the fact that India will only be able to meet part of its increased energy demand from its own domestic resources, and therefore will be increasingly forced to rely on energy imports. India is trying to secure its energy supplies in a hostile geo-political climate, since New Delhi's parlous relations with its neighbours make energy cooperation difficult. The resultant fears regarding the vulnerability of India's external sources of energy chime with a core principle of New Delhi's political culture, swadeshi (self-sufficiency), whose influence, while waning, retains its potency. Concerns regarding energy security are particularly prevalent in the case of oil, where India's dependence on imports is becoming acute. The proximity of the Persian Gulf to India's industrialised northwest makes it the main source of growing oil imports. But this in turn increases India's reliance on the unstable Gulf. In order to reduce this risk New Delhi will seek out oil from new energy provinces in the Atlantic Basin, Sudan, Russia and South East Asia. It will also turn to a new energy source – gas – and more imports of liquefied natural gas (LNG) will be one result. India's energy needs have implications for Australia. India's growing demand for energy will see coal continue to dominate the energy mix, and as a result India's demand for imported coking coal, including from Australia, is also set to grow. At the same time, India's quest for diversity of supply means that at least some of India's increased LNG imports are likely to be Australian.*

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## **GLOSSARY**

APM: Administered Pricing Mechanism

BJP: Bharatiya Janata Party, Hindu nationalist political party

BPCL: Bharat Petroleum Co. Ltd

CBM: coal bed methane

CERC: Central Electricity Regulatory Commission

CIL: Coal India Ltd

CMP: Common Minimum Program, the May 2004 agreement between the incoming United Progressive Alliance Government and the Left Front group of communist parties supporting it

CNG: compressed natural gas

CPI (M): Communist Party of India (Marxist), key ally of UPA minority government

EIA: Energy Information Administration

ESI: Electrical Supply Industry

GAIL: Gas Authority of India Ltd, India's state owned gas transportation and marketing firm

GW: gigawatt

HBJ: the Hazira-Bijapur-Jagdishpur pipeline, India's main gas artery

HPCL: Hindustan Petroleum Co. Ltd.

IBP: Indian state owned petroleum products distributor

IEA: International Energy Agency

IOC: Indian Oil Corporation Ltd., an Indian state owned oil importer and refiner

LNG: liquefied natural gas

LPG: liquefied petroleum gas

Mpd: million barrels of oil per day

Mta: million tons per annum

Mtoe: millions of tons of oil equivalent

MW: Megawatt

NDA: National Democratic Alliance; coalition governing India 1999-2004

NTPC: National Thermal Power Corporation

OIL: Oil India Ltd.

ONGC: Oil & Natural Gas Corporation,

Quad btu: quadrillion British thermal units

SAIL: Steel Authority of India Ltd.

SEBs: State Electricity Boards

Tcf: trillion cubic feet of gas

UPA: United Progressive Alliance: the coalition led by the Congress Party which formed a minority government in May 2004

## INDIA'S ENERGY NEEDS

## 1. India's energy dilemmas

The scale of India's energy supply dilemma is daunting: demand for raw energy is set to double in the period 2001-2025, and demand for electricity is rising even more rapidly. This requires urgent decisions on how, from where and in what form India should produce, import and process energy.

In making these decisions, Indian policymakers face two dilemmas, one internal and one external.

New Delhi's *internal* dilemma is how to accelerate the pace of reform of the energy and electricity sectors without alienating important constituencies. There is considerable division in Indian politics over how quickly to proceed with reform, in particular in the energy sector, and in the wake of the United Progressive Alliance (UPA)'s 2004 election victory caution seems to have the upper hand.

India's *external* energy dilemma is how to balance the need for energy security, achievable through diversity of the nature and source of supply, with the need to keep the cost of energy down. New Delhi's diplomatic goals therefore combine broadening relations with Gulf energy suppliers with finding different producers of different energy sources in other regions, an objective which might play to Australia's advantage.

**The internal dilemma**

The internal supply constraint is the performance of India's energy sector, and in particular the Electricity Supply Industry (ESI), which is still bound by the state control established by the Congress Party (the leading party in the UPA) when it was in government in the first decades of independence. These are now impeding the economic utilisation of energy – as important an aspect of energy security as supply

itself – to the extent (it is argued) that they adversely impact GDP growth.

The State Electricity Boards (SEBs) are at the core of the ESI's systemic inefficiency, their initial economic function long since having been subsumed by their political function as vehicles of patronage, delivering cheap or free electricity to powerful electoral lobbies.

In its last year in government the National Democratic Alliance (NDA) challenged this dispensation by enacting legislation to free up the ESI in the form of the Electricity Act 2003. But in the uncertain political climate in 2004 it remained to be seen whether the pace of energy sector reform begun under the NDA government would continue under its UPA successor.

Still, regardless of who forms the government in New Delhi, India's state-owned petroleum industry is changing because of its exposure to the international market. India's public sector energy companies, the *navaratnas*, including the Oil and National Gas Corporation (ONGC) – India's flagship state-owned oil exploration and production firm) – the Gas Authority of India Ltd. (GAIL), and the Indian Oil Corporation (IOC) are expanding their activities both globally and within South Asia.

During its term in office the NDA nudged the *navaratnas* towards privatisation, but even before the election Congress had ruled out surrendering state control of these key energy sector firms as it sought to distinguish itself from the 'pro-rich' NDA. That said, both formally in the Common Minimum Program (CMP), where it promised to 'actively encourage' foreign investment in the petroleum sector, and in practice, when in July 2004 it went further than the NDA by giving state-owned refiners limited freedom to set automotive fuel prices, the UPA is clearly open to reform.

## INDIA'S ENERGY NEEDS

Reform is a precondition of India's meeting its energy needs, not only of the ESI but the economy more generally. But in India's robust, complex and increasingly 'successful' democracy, reform cannot be achieved by executive fiat. Reform requires support to be garnered across a diverse range of constituencies, marshalled and ushered through parliament.

In India's April-May 2004 elections, the energy factor was prominent in the states of (among others) Andhra Pradesh, Tamil Nadu and Gujarat where parties belonging to the NDA, which branded itself as a coalition of reform, fared poorly. The victorious opposition, of which the largest component was the Congress Party led by Mrs Sonia Gandhi, campaigned against the NDA's handling of reform though economic policy was far from being the sole cause of Congress' victory.

In mid-2004 the reform stance of the incoming UPA government of Prime Minister Dr Manmohan Singh reflected the ambiguity of Congress' election victory. On the one hand the UPA was bound by the CMP, drafted in reaction to the reform policies of the NDA. On the other hand key members of the UPA were themselves authors of India's thirteen year old reform process.

### The external dilemma

Like any other country facing energy security dilemmas, India's first recourse is to its domestic energy reserves, so New Delhi will continue to rely on India's large coal reserves for the bulk of its energy needs. But coal can only partly fill India's energy needs. The transport sector, for example, requires petroleum; oil for petrol and diesel and now gas for Compressed Natural Gas (CNG).

India has considerable domestic oil reserves and may well find more, but in the absence of major

discoveries India's dependence on imported oil is set to soar, and the security of this supply touches a deeply strategic nerve in New Delhi, as well it might, given the array of threats to it. Global market unease stemming from the events of 2003/2004, not just the Second Gulf War but the Islamist campaign in Saudi Arabia and the external reaction (particularly by the United States) to Iran's nuclear program, contributed to mid-2004's record oil prices.

Against this background of threats to its main source of imported oil, the incoming UPA nominated energy security as a priority. The UPA's manifesto, the May 2004 CMP, committed New Delhi to 'immediately put in place policies to enhance the country's energy security, particularly in the area of oil'.<sup>1</sup> One response has been that the state-owned ONGC has started to look far afield for new petroleum reserves: West Africa, Sudan, Vietnam, and Russia.

Wherever it obtains its energy however, India is constrained by the fact that energy demand is concentrated in its industrialised north west (just as China's is in its south east). Thus in 2004 India's oil and gas imports largely flowed through the northwestern state of Gujarat. Gujarat's petroleum infrastructure includes the world's third largest oil refinery at Jamnagar, a completed LNG facility at Dahej and another nearing construction at nearby Hazira. This state of affairs won't change quickly: the expansion of India's energy import infrastructure outside Gujarat, including LNG regasification plants, is concentrated on the west coast.

The concentration of India's economic growth in the north west dictates the geography of energy infrastructure, to the extent that Reliance's new gas finds in the Bay of Bengal will fuel power stations near New Delhi. This is reinforced by the fact of cheap Gulf oil and its geo-strategic tyranny of

## INDIA'S ENERGY NEEDS

proximity, which will keep New Delhi hostage to the politics of the Persian Gulf.

Demand for gas, both in piped and liquefied natural gas (LNG) form, is also taking off in India's industrialised west. The fact that gas is a new entrant to the energy mix also means the new infrastructure it requires can be tailored to India's emerging energy markets.

Again, geographical proximity makes the Gulf's gas reserves – Iran's in particular – the cheapest source of imports and a pipeline across Pakistan the cheapest method of transporting them. However, India's attempts to import piped gas are mired in South Asia's parlous regional relations, so New Delhi has begun importing LNG, which has the security advantage of being transported by sea. Imported LNG is a new element in India's energy mix, entering it at a time when international trade in gas is booming. The fact that global LNG trade is surging will create new potential sources of energy imports, which New Delhi craves. As it considers how to diversify the sources of its LNG supply beyond the Gulf, India looks to its south east, principally Indonesia, Malaysia and Australia.

### Energy security and diplomacy

Satisfying its growing energy needs therefore requires New Delhi to deal with more and different actors from the international community than it has in the past. These include not just problematic energy suppliers like Saudi Arabia and Iran, but hostile neighbours like Pakistan and Bangladesh, organisations like the International Energy Agency (IEA), other energy importers like China and the United States.

Under the NDA, the bilateral relationship with Washington was a priority in Indian diplomacy; by late 2004 the advent of the left-leaning UPA had not

changed this. Though not an energy exporter, the United States is important to India's energy security. This is true in the general sense of the US being the sole superpower and India's major trading partner. More specific is the key US role in global energy markets – the world's largest energy importer, a major investor in the global energy industry – and as a stabilising factor in the Gulf.

More generally, New Delhi's new diplomacy has sought to smooth India's integration into the global economy, of which securing energy supplies is a key aspect. This has involved greater cooperation with global industry bodies like the IEA and initiatives to gain access to oil provinces in regions like West Africa and the Sudan.

Closer to home, New Delhi's diplomatic outlook is not bright. Regional relations in India's South Asian neighbourhood are poisonous. For decades the tit for tat game of 'you support our rebels and we'll support yours' has been part of the currency of South Asian diplomacy. In mid-2004 Bangladesh and Pakistan willingly, and Myanmar, (until recently) Bhutan and Nepal unwillingly, hosted militant ethnic and religious groups fighting New Delhi. Insurgents, inside and outside India and particularly since September 11 2001, are increasingly targeting energy infrastructure.

### Resolving the dilemmas?

India's energy dilemmas are imposing a new political and diplomatic context on New Delhi, one in which the traditional doctrines of *swadeshi* and non-alignment are of little relevance.

Internally, the reform imperative confronts governments in New Delhi with hard choices they are not used to facing. Reform means allowing the private sector into what has historically been considered a preserve of the Indian state. Reform of

## INDIA'S ENERGY NEEDS

the energy sector angers the rural constituency, the bedrock of the Indian polity.

Externally, India has to accept the strategic risk to which its growing reliance on Gulf oil exposes it. It also has to surrender a degree of freedom of action in order to cooperate with international bodies like the IEA, and more broadly with the international energy market itself.

To this point India's energy predicament doesn't seem all that different, if much smaller, from that currently facing China. But there is a difference: India is a democracy, which could be said to both hinder and help energy production.

Hinder, because in democratic India those aspects of economic and foreign policy which determine the production, importation and distribution of energy are set by regularly changing governments. Their initiatives must run the gauntlet of regional and sectoral lobby pressure, scrutiny by a free media, a parliament the government may or may not control and judicial review.

Help, because India's reform process is proceeding with the consensus support of the population of the world's second largest country. And the fact that reform is proceeding with the backing of popular consensus may well make it more durable.

### 2. India's energy needs

#### Rising demand

According to the US Energy Information Administration (EIA), in 2001 India's Total Primary Energy Consumption was the equivalent of 12.80 quadrillion British thermal units (quad btus), up from 8.06 quad btus in 1991, making it the sixth largest energy consumer in the world. Over this

decade the gap between energy production and energy consumption has widened from 1.2 quad btus to 3.43 quad btus.<sup>2</sup>

On the EIA's reference case projections, India's energy consumption is set to rise from 322 million tons of oil equivalent (mtoe) in 2001 to 690 mtoe in 2025, doubling over the coming quarter century. This amounts to an average annual increase in energy consumption of 3.2 %, above the developing Asia country average of 3.0 %. At this rate India in 2025 will be the fourth largest energy consumer in the world after China, the United States and the countries of the Former Soviet Union.

India's major energy source is domestically produced coal, satisfying more than 50 % of demand, with oil, domestically produced and imported, contributing another 30%, gas some 7% and hydroelectricity and nuclear power making up the rest. India currently imports some 70% of its oil, and unless significant new domestic reserves are found this is set to rise to 94% by 2030.

In the short term, 'it is expected that by 2010 almost three quarters of India's oil and gas needs will be met by imports.'<sup>3</sup> In comparison, China currently imports about one third of its oil, a proportion that will rise to half by 2010.

India's need for electricity is even more acute than that for raw energy: the EIA's projections for the average annual increase in electricity consumption to 2020 range from 2.6% at the low end to 4.5%. 'India's need for (electric) power is growing at a prodigious rate ... the highest for any major country,' judges the US Department of Energy.<sup>4</sup>

Coal plays the dominant role in India's electricity supply industry (ESI), with thermal power stations, nearly all fuelled by coal, accounting for 81.7 % of

## INDIA'S ENERGY NEEDS

generation. Hydroelectricity provides 14.5 % and nuclear some 3.4 %.<sup>5</sup>

To meet its growing energy needs India needs to increase energy production from both domestic and imported sources.

As it looks to safeguard its economic interests and security, New Delhi will seek to maximise energy production from its own domestic resources. This truism applies with particular force to India, the ideal of '*swadeshi*' (self-sufficiency) being rooted in Indian political culture and strategic thinking.

India's founding prime minister Jawaharlal Nehru said 'a country that does not produce its own oil is in a weak position. From the point of view of defence, the absence of oil is a fatal weakness'.<sup>6</sup> His judgement retains its currency: strategic considerations have played and still play a major part in New Delhi's energy policy. For example, the nationalisation of private retail oil companies in the 1970s followed concerns about fuel supply during the 1971 war with Pakistan.<sup>7</sup>

Added to strategic concerns are the economic implications. 'The challenges on the energy front are that it is the single biggest item of import, taking up a large chunk of our foreign exchange reserves,' Mr. Anil Ambani, Vice Chairman of Reliance Industries Limited, said recently.<sup>8</sup> In the financial year ending 31 March 2004, India's oil imports rose 14% in value to \$US20.2 billion.<sup>9</sup> In June 2004 a \$US1 rise in the price of oil translated into a \$US 550 million increase in India's annual oil bill.<sup>10</sup>

### Domestic resources

Maximising domestic sources of energy means using more domestically produced coal. Exploitation of India's coal deposits, the world's fourth largest, is however constrained by their geographical

concentration; two thirds are in the east central states of Bihar, Madhya Pradesh and West Bengal, requiring extensive distribution by rail. India's coal reserves also have a high ash and low calorific content.<sup>11</sup>

Economic reform and a range of new and emerging technologies have the capacity to improve considerably the efficiency and to reduce the environmental impact of the coal industry. For example, the development of coal bed methane (CBM) – the extraction of gas from coal seams – could provide another, cleaner, flow of energy from India's coal reserves.

Maximising domestic energy production also means finding more oil to replace declining output, including from the country's major Mumbai High field off the coast of northwestern India, a region which is the focus of economic growth and energy demand. Mumbai High's operator ONGC – the state-owned jewel in India's energy crown – is engaged in a costly program to restore the field's production.

In March 2004 the UK energy firm Cairn Energy Plc announced an oil find in the Mangala field in India's northwestern state of Rajasthan, taking the field's total potential output to 50,000 barrels a day. By August Cairn had altogether made four finds in the Mangala field during 2004, with a minimum total of 1,280 million barrels of oil.<sup>12</sup>

Maximising available energy production also means more hydroelectricity: not just in India but from Himalayan neighbours Nepal and Bhutan, which have considerable hydroelectric potential. Hydroelectricity causes less environmental damage than power generated from hydrocarbon fuels like coal, oil and gas because it doesn't directly produce carbon dioxide, which contributes to climate change.

## INDIA'S ENERGY NEEDS

But large scale hydroelectric schemes like that in western India's Narmada River valley can still wreak environmental havoc.

Hydroelectricity is a major contributor to India's energy needs; in 2003 it produced 14.5 % of India's electricity. And this contribution is set to increase, the current Five Year Plan requiring 10 % of all new generating capacity to come from renewable sources, which in practice overwhelmingly means hydroelectricity.

Maximising domestic energy production also involves taking up emerging technologies and sources right across the energy spectrum, not just coal bed methane but new drilling and extraction techniques for oil and gas, including in deep water, and consideration of deep sea hydrates, frozen methane.

Finally, India will also maintain its nuclear power program, but for strategic rather than economic reasons.

### The need for imported oil

Even so, India cannot meet its growing energy needs from within its boundaries; imported energy, particularly oil, will become more important.

According to recent estimates by the IEA, between 2000 and 2030 global oil demand will increase from 75 million barrels per day (mpd) to 120 mpd. Of this 45 mpd increase, China will take 16 % and India 8 %. The Tata Energy Research Institute estimates Indian oil demand will rise from 2.1 mpd in 2004 to 5.6 mpd in 2030, the Financial Times pointing out this latter figure amounts to one fifth of current OPEC production.<sup>13</sup>

Some of this increased demand may be met by new domestic supply. The extent of India's domestic oil

and gas reserves is far from fully established. 'Exploration has taken place in only about one-quarter of India's 26 sedimentary basins,' the EIA points out, and therefore more major finds cannot be ruled out, particularly as technology improves.<sup>14</sup>

However, in the absence of major domestic discoveries, India's net oil imports will increase from 1.4 mpd – 65 % of oil consumption – to 5.3 mpd – 94 % of consumption – in the period 2000-2030.<sup>15</sup> In other words, India will confront near total dependence on imports for its oil within a quarter century, unless it can diversify and even successful diversification will only ameliorate this dependence.

In 2003 India was Asia's fourth largest oil importer, behind Japan, South Korea and China, and ahead of Taiwan. India currently relies on Gulf Arab states for the bulk of its imported oil – with some purchases from South East Asian and Atlantic Basin producers – and is much more dependent on the Middle East than East Asia.

In large part this reflects the low transport costs associated with geographical proximity. The focus of economic growth is along India's Arabian Sea coast, in northwestern and southern India, rather than in the eastern states. The more developed northwestern states like Maharashtra (population 96 million) and Gujarat (population 50 million), the capital New Delhi and surrounding Haryana, are currently the magnet of India's energy demand. Not only does Gujarat host the new LNG regasification facility at Dahej and that of Royal Dutch/Shell nearing completion at Hazira, it also hosts the world's third largest oil refinery, Reliance's 665,000 bpd facility at Jamnagar. South East Asian - and Australian - energy producers trying to sell into this northwestern Indian market face stiff competition from much closer Persian Gulf producers.

## INDIA'S ENERGY NEEDS

Still, like other countries dependent on Gulf oil, India worries about political risk in the region. 'The general political instability in the region is a cause of anxiety from the oil supply security perspective,' India's then Petroleum Minister Mr. Ram Naik said on 21 January 2004. 'The world has already witnessed about 20 oil disruptions, in the past 52 years, of various sizes and durations affecting the oil importing economies.'<sup>16</sup>

Moreover, as India grows, its Gulf exposure expands.

New Delhi's awareness of a growing exposure to international oil shocks in the wake of the Iraq War was reflected in its January 2004 decision to establish a 15 day strategic oil reserve on the US model (over and above the 60 day stocks held by refineries). The oil will be stored at Mangalore in southern Karnataka on India's west coast and on the east coast at Visakhapatnam, the Indian Navy's main base on the Bay of Bengal.

New Delhi is therefore now confronting the energy importers' dilemma of trading off the security imperative (diversity of supply and diversity of source of supply) against the economic imperative of keeping the cost of supply low. Even as India imports more oil from the Gulf, it will intensify its search for other sources of energy, different fuels from different regions.

### Gas

The global energy market is currently experiencing a 'dash to gas'. In the past decade world gas consumption has increased by 20 percent, nearly twice as much as oil.<sup>17</sup>

Gas, including imports of LNG, will play an increasing role in meeting India's energy needs. February 2004 saw the commissioning of India's

first Liquefied Natural Gas (LNG) regasification terminal, at Dahej on the Arabian Sea coast of Gujarat. India, in fact, received its first LNG cargo before China. February also saw the ceremonial commencement of a 3300MW gas fired power station project (billed as the world's largest) at Dadri in north central Uttar Pradesh.

The Dadri plant will be built by Reliance which, as India's largest private listed company, is seizing on the opportunities offered by the simultaneous leap in demand for energy and liberalisation of the Indian economy.

Reliance also made the world's largest gas discovery of 2002, in the Krishna Godavari basin off the coast of India's eastern state of Andhra Pradesh. The find has been independently assessed at 9.96 trillion cubic feet (tcf), but Reliance claims reserves of 14.5tcf, which would put it on a par with Australia's North West Shelf Gorgon field, or BP's Tangguh field in the Indonesian province of Papua.<sup>18</sup>

To prospective South East Asian and Australian exporters of LNG hampered by their distance from the Indian energy market's focus in the northwest, the Krishna-Godavari discovery constitutes another obstacle. It offers the gas market along India's east coast a domestic supply close by, seeming to preclude LNG imports in the short term. Indeed, the ascendancy of northwestern demand in India's energy needs is such that the first allocation of Krishna-Godavari gas will not be to the east of the country. Instead, it will be piped across India to Reliance's Dadri plant, near New Delhi.

This dampening effect on estimates of demand for LNG imports was reinforced on 24 June 2004 when Reliance announced the discovery of another major gas field, also in the Bay of Bengal, off the coast of the eastern state of Orissa. With reserves of 4-5 tcf,

## INDIA'S ENERGY NEEDS

the Orissa find was of the same order of Conoco Phillips' Bayu Udan field in the Timor Sea or January 2004's find in Myanmar's Shwe Prospect off Arakan.

### Looking ahead

In the future, domestic coal will remain the dominant fuel in India's power mix, India will become even more dependent on imported oil, and no region is likely to replace or even approach the Gulf as India's main supplier of imported energy.

But gas, as a new entrant involving new technologies of extraction, transportation and distribution, is also set to establish itself in India's energy mix. Technologies like the conversion of gas to liquids (GTL), the extraction of gas from coal seams (Coal Bed Methane – CBM) and even the maritime transport of compressed natural gas (CNG) open up new opportunities. And the adoption of gas allows New Delhi to diversify its range of energy suppliers to include new partners like Qatar and Iran, Myanmar and maybe Bangladesh. Indeed, as LNG is imported and pipelines built, as private capital seizes on opportunities opened up by reform, gas is acting as an indicator of the changes India is making to resolve its energy dilemmas.

### 3. Supply and India's energy sector

As India looks to its energy security it is considering not only the type and source of energy it will use, but also how to generate, transmit and distribute that energy through its electricity supply industry (ESI). These policy decisions are formally expressed through government regulation and continuing state ownership of the ESI.

'We can't talk about energy security and not discuss the power sector;' Reliance's Anil Ambani recently

thus drew attention to this symbiosis between energy security, the type and source of fuel and the ESI.<sup>19</sup> In this broader view, improving the efficiency of generation and transmission is an energy security measure as well as an economic imperative.

### India's electricity supply industry

To satisfy India's energy needs, not only its sources of raw energy but its capacity to generate, transmit and distribute electricity must double by 2025. The consequent restructuring of the ESI will not only require significant investment, including from wary foreign investors, but as a precondition of that investment, the reduction of government influence of the state. The economic reform which began in 1991 has laid the groundwork for such a transformation.

Control of India's ESI is shared between the federal government in New Delhi, referred to as the Centre, and the states. The 'concurrent' list of powers in India's constitution gives the central government and the states shared control of a number of areas, including energy. This constitutional division of authority means that reform initiatives from the Centre, such as setting viable power tariffs, must win the support of the states. This is no easy political task.

New Delhi's authority is exercised through the Centre's Ministry of Power, which oversees the Central Electricity Regulatory Commission (CERC) responsible, together with state regulatory commissions, for setting tariffs. Other key institutions are the National Thermal Power Corporation (NTPC), India's largest power generator, which plans to expand its own capacity by 20,000 Megawatts (MW) by 2012, and the Power Finance Corporation, which ensures finance for additions to generating or transmission capacity.

## INDIA'S ENERGY NEEDS

The regulatory basis of India's ESI was laid by the Electricity (Supply) Act of 1948. The policy of state control was crystallised in the Industrial Policy Resolution of 1956, which set in place the State Electricity Boards (SEBs). State government control of the SEB's gave state politicians control of power tariffs, which became a major tool of political patronage.

### The need for reform

The SEBs are a major obstacle to the fulfillment of India's energy needs. Their viability 'has been deteriorating because of very high operating costs and pricing policies that keep tariffs to most customers well below the cost of supply,' Claude Mandil, Executive Director of the IEA said recently<sup>20</sup>.

Mandil said India would need to spend \$US800 billion on its energy sector by 2030, warning that funding this expansion would be difficult. 'We have to recognise that the track record of electricity activities in India is very poor and attracting new investment will be very challenging,' Mandil said.<sup>21</sup> In 2004 India's installed generating capacity was 132,000MW, compared with some 400,000MW in China.<sup>22</sup> But in the financial year to 31 March 2003 FDI in India totalled only \$US3.6 billion, compared with China's \$US53.5 billion in calendar 2003.<sup>23</sup>

The SEBs feature prominently in critiques of India's economic reform. 'India's electricity sector illustrates just how government control of companies can promote inefficiency,' McKinsey said. 'Government-owned state electricity boards lose a staggering 30 to 40 % of their power, mostly to theft. By comparison, best practice private power distributors lose only around 10 %, mostly for technical reasons.'

'Government subsidies, and corruption, give public-sector managers less motivation to control theft. Subsidies also limit their incentive to prevent blackouts and to maintain power lines – tasks that private companies undertake with better results.'

'Privatising the state electricity boards would save their government subsidies, amounting to almost 1.5 % of GDP, and oblige managers to improve their financial and thus their operational performance,' McKinsey said.

### The 2003 Electricity Act

The Electricity Act of May 2003 laid the basis for transition to private ownership in the ESI. It dismantled 'the monopoly power of SEBs, allowing the private sector not only to generate but also to transmit, distribute and trade in power,' said S D Naik in The Hindu Business Line.<sup>24</sup>

The Act set 'a path-breaking pro-competitive framework whereby producers and consumers of electricity can interact in an unfettered market,' Dr Vijay Kelkar, an adviser to then governing NDA, said in his 2004 Narayanan Oration at the Australian National University. 'We are already seeing myriad changes in the electricity sector in India as a consequence of this simple fact: that producers and consumers of power are now free to contract with each other across the country,' he said.

For example, Reliance is expanding its transmission activities through subsidiary Reliance Power.<sup>25</sup> Reform is allowing Reliance not just to expand into the ESI but to create a vertically integrated business within it. Thus in 2003 Reliance's generation capacity was limited to a 500MW coal fired plant at Dahanu in Maharashtra (though it also produced electricity at cogeneration plants in Gujarat). But by early 2004 Reliance already had five million power customers in Mumbai, New Delhi and Orissa,

## INDIA'S ENERGY NEEDS

requiring it to buy 4500MW of capacity from other generators to supply them.<sup>26</sup> Prior to reform, power plants were built according to the Centre's priorities, expressed in Five Year Plans. Now, reform has created a context in which Reliance acquired this market before building a power plant to satisfy it, bearing out Dr Kelkar's point above about freedom to contract.<sup>27</sup>

The Electricity Act set a 10 June 2004 deadline for the SEBs to split themselves into separate generation, transmission and distribution networks – 'unbundling'. This requirement had been partly anticipated by some states, for example, the Uttar Pradesh SEB had already set up separate companies to operate the state's thermal and hydroelectric generators.

One of the first actions of the incoming UPA government was on 28 May 2004 to extend, initially at least indefinitely, the 10 June deadline for this unbundling reform. Government sources in New Delhi cited 'concern' by states at the effect of the deadline. Shares in private sector energy companies Reliance Energy and Tata Power, which were poised to buy into an ESI opened up by the Electricity Act, dipped on the news. 'Unbundling of distribution assets was the key feature of power reforms and it now appears to have been delayed,' commented one Mumbai analyst cited by Bloomberg.<sup>28</sup> 'Distribution reforms were meant to open up a lot of opportunities' for the private sector, they said.

But to supply India's energy needs New Delhi must not only reform the ESI but the sectors supplying it energy as well: coal, oil and gas.

### Coal

Coal will remain central to meeting India's energy needs. The 'goal of energy security will be achieved primarily by expanding the production of India's

large coal reserves,' judges the EIA. It calculates India's coal consumption will rise from 382 million tons in 2005 to 580 million tons in 2025.<sup>29</sup>

Coal's dominance rests on its abundance: India's 7 % of global coal reserves are the world's fourth largest. From a strategic viewpoint they are securely concentrated in India's east central states of Bihar, Madhya Pradesh and West Bengal. This concentration, however, imposes a penalty in transportation costs to distribute the coal to thermal power stations in the booming northwest and south.

But while India's coal reserves are vast, only a small proportion (5 % according to the EIA) are of the coking quality required by the steel industry; as a result India imports about one quarter of its coking coal. About 60 % of coking coal used by the flagship state owned Steel Authority of India Ltd. (SAIL) is imported.

India's reliance on coal imports, boosted by growing demand from the country's expanding steel industry, has been complicated by the current surge in Chinese demand for raw materials, including energy. As a result of Chinese demand, by early 2004 the global coking coal trade was beset by shortages, rising prices and transport costs.

Squeezed by a tight market, the Indian coal and steel industry looked to secure its supplies by buying coal leases abroad, a strategy the Indian oil and energy intensive fertiliser industries are already pursuing. State-owned SAIL and Coal India Ltd (CIL – the world's largest coal company) and Tata Steel were reportedly considering combining to form a holding company.

'Looking at the large demand-supply gap and the volatile prices of coking coal as well as thermal coal in the international market, CIL has firmed up plans

## INDIA'S ENERGY NEEDS

of floating a company that will own mines overseas,' Sashi Kumar, Chairman of CIL told The Business Standard. 'The countries being looked at include Australia, Indonesia and South Africa,' he said.<sup>30</sup>

Reform of the domestic coal industry is also part of the approach. New Delhi's Ministry of Coal controls CIL, and the Neyveli Lignite Corporation Ltd. 'CIL's operations are characterised by low productivity levels, distribution problems and market share losses to higher quality, less expensive coal from overseas,' comments the EIA.<sup>31</sup>

New Delhi has partially opened the coal sector to private investment, including foreign investment. The latter is subject to approval by a Foreign Investment Promotion Board, but because the coal industry is such a major employer its reform is politically highly sensitive.

### Oil

Besides domestic coal India will remain reliant on imported oil. Because of the globalised nature of the international oil industry, as it becomes more reliant on imports the pressure on India to reform its oil sector increases. Like the coal sector, India's oil industry is still almost completely stateowned, but its opening to private capital is more advanced.

Oil comes under New Delhi's Ministry of Petroleum and Natural Gas, which controls the ONGC and Oil India Ltd (OIL), which are involved in exploration and production. Other petroleum *navaratnas* include the Indian Oil Corporation, the country's largest refiner, which imports, refines and distributes oil. Hindustan Petroleum Co. Ltd. (HPCL) and Bharat Petroleum Co. Ltd (BPCL) are the second and third-largest oil refiners respectively, and own chains of petrol stations coveted by investors. Gas Authority of India Ltd (GAIL), part of the consortium

proposing to revive Dhabol, covers the transportation and marketing of gas.

In late February/early March 2004, two months before its election defeat, the NDA Government raised \$US 3.11 billion by selling shares in six state-owned companies, mainly in the energy sector. This was the first major opportunity for private capital to buy into India's state-owned petroleum and power sectors.

The sales included 10 % of ONGC, 10 % of GAIL, 29 % of Indian Petrochemicals and shares in the National Power Trading Corp., an electricity trader set up by state-owned power producers. They also included the sale of shares in gas processor Petronet LNG, responsible for India's first import of liquefied gas.

New Delhi still retained 74 % ownership of ONGC and before it lost the 2004 elections the NDA was considering selling a further 12 %, crossholding stakes held by GAIL and Indian Oil. But as with the proposed unbundling of the State Electricity Boards, the advent of the UPA changed the political context of reform of the energy sector.

Other changes came in April 2002 when the NDA government made its attempt at unravelling the Gordian knot of India's fuel price regime, relaxing its control over retail fuel distribution and ending the Administered Pricing Mechanism (APM) through New Delhi which set fuel prices. In addition to state-owned refiners Indian Oil, Hindustan Petroleum, Bharat Petroleum and distributor IBP the NDA admitted other companies, public and private, into the petrol station business. ONGC was given a licence to establish 1100 petroleum products outlets, its subsidiaries Mangalore Refinery and Petrochemicals Ltd and Numaligarh Refineries Ltd

## INDIA'S ENERGY NEEDS

500 and 510 respectively, Essar Oil 1700, Reliance 5849, and Royal Dutch Shell 2000.<sup>32</sup>

New Delhi's January 2004 establishment of an oil reserve was another significant indicator, quite apart from its strategic significance. 'The aim of this project is not just to pre-empt any disruption in crude oil arrivals but also to ensure smooth oil supplies in the home market at affordable rates,' said Jagdish Shettigar, one of the board who advised the reserve's establishment.<sup>33</sup>

The ONGC through its overseas arm ONGC Videsh is also expanding production beyond India, acquiring interests in exploration blocks in Myanmar and Sudan, Iran, Iraq, Russia, Vietnam and Libya. Reliance has a stake in an exploration block in Yemen where oil was found in 2003. ONGC has also begun a deep-water drilling program in the Bay of Bengal and was expected to spend \$US3.5 billion on exploration altogether in the Indian fiscal year of April 2003/March 2004.<sup>34</sup>

But new oil finds in India and ONGC's globalisation of its exploration and production activities in Russia, Africa and elsewhere won't by themselves defeat Gulf oil's tyranny of proximity over India. So in addition to these attempts to diversify its sources of oil, New Delhi wants substitutes for oil.

### Gas

Gas is one such substitute, for example in the public transportation sector, where Compressed Natural Gas (CNG) is being introduced. This means that 'a major shift from oil to gas in the energy mix is in the offing,' according to Mukesh Ambani, chairman of Reliance Industries.<sup>35</sup> New Delhi's state-owned GAIL will play the leading role in this process.

As with oil, India's domestic gas production can't meet current, let alone projected, demand. India has

gas reserves of some 27 trillion cubic feet.<sup>36</sup> The US Department of Energy calculates that India's consumption of gas will be 1.3 trillion cubic feet in 2005, 3.4 tcf in 2025.

India's gas supply deficit is expected to increase fivefold by 2012 to 218 million cubic meters a day. New Delhi has calculated gas's share of national energy consumption will rise from its current level of 7 % to over 20 % in 2025<sup>37</sup>. GAIL has estimated the cost of gas infrastructure required by 2009 at \$US 11 billion.

The Krishna-Godavari discovery and the 2004 Orissa find will fill some of India's gas supply deficit, and the gas industry is adopting practices to enhance at the margin the efficiency of domestic production: in June 2004 ONGC announced it would stop the flaring off of gas at its offshore oil wells<sup>38</sup>.

Nevertheless, in the longer term the need to import gas on a large scale is unavoidable, posing New Delhi with a choice between expensive but secure LNG, transported by sea, or piped gas, which must run the gauntlet of chronic regional insecurity.

According to the Australian Bureau of Agricultural and Resource Economics, by 2015 India's LNG imports may reach 12 million tons per annum (mta).<sup>39</sup>

In February 2004 Petronet began importing LNG into India through its regasification terminal at Dahej in the north-western state of Gujarat, under a long-term agreement with Qatar's Rasgas to take 5 million tons of LNG, worth about \$US800 million, a year. On 31 May 2004 Petronet announced it would double the regasification capacity of the Dahej terminal from 5 to 10 million tons a year by 2007.<sup>40</sup> Regasified LNG from Dahej will flow through Gujarat and Madhya Pradesh to Uttar Pradesh and

## INDIA'S ENERGY NEEDS

on to New Delhi through the Hazira-Bijapur-Jagdishpur (HBJ) pipeline. The HBJ will also connect with Reliance's planned pipeline bringing Krishna Godavari gas to the North West, confirming its role as India's main gas artery.

India will construct other LNG regasification plants, but in mid-2004 the most likely prospects were on India's west coast. Besides the revival of the nearly complete Dabhol under consideration by the GAIL/BP/Tata consortium, Shell's Hazira plant, the price of its admission to India's retail fuel distribution industry, was on track for commissioning in the last quarter of 2004.

In addition, ONGC is proposing a plant at Mangalore in the south-western state of Karnataka, connected by pipeline to markets in the neighbouring states of Goa and Kerala on the west coast and Tamil Nadu on the east. The project would mark oil giant ONGC's formal diversification into gas.

Presiding over the 9 February 2004 official opening of the \$US550 million Dahej facility, the NDA's Petroleum Minister Ram Naik stressed the complexity of the 'high-value chain type project'. 'India is a huge market for natural gas,' Mr. Naik said. 'The government plans to shift the focus from liquid products (oil) to natural gas, which is environment-friendly and a cheaper alternative'.<sup>41</sup>

In addition to LNG's security advantages, India is emerging as an LNG importer just as the global LNG industry is being galvanised by rising demand. Global LNG demand, in 2004 some 80 mta, is set to rise to 119 mta by 2010 and 164 mta by 2015, according to ABARE.

In response to this rising demand, LNG production in the Persian Gulf is expanding fast. In mid-October 2003 Exxon Mobil announced a \$US 8 billion

investment to treble the Rasgas LNG production facilities in Qatar. In June 2004 the Qatar Gas Transport Co. said it was on the verge of ordering 16 new LNG tankers from South Korean yards, part of its plan to quadruple its fleet by 2010.<sup>42</sup> In Asia Rasgas' customers included Japan and Korea as well as India, outside it the Atlantic Basin markets of Spain and the US East Coast.

The global boom in the LNG industry is not only reducing the cost of gas, it is also increasing the potential sources, and commercial arrangements for the sale, of LNG.

### Nuclear

Nuclear power won't contribute much to satisfying India's energy needs. Nevertheless New Delhi's retention of nuclear power as an element of its energy mix emphasises India's pursuit of energy security through diversity of supply. India will keep open the option to expand the contribution of nuclear power to the energy mix. The program also supports a much more important national asset: India's nuclear weapons program.

In 2003 India's nuclear power generation capacity of 2770 MW accounted for only 3.4 % of total electricity supply.<sup>43</sup> Anil Kakodar, Chairman of India's Atomic Energy Commission, recently announced a goal of increasing this capacity 20,000 MW by 2020<sup>44</sup> but the EIA doubts whether nuclear capacity will exceed 7000 MW by 2020.<sup>45</sup>

The state-owned Nuclear Power Corp. recently announced it was selling 2 billion rupees worth of bonds to finance the expansion of generating capacity. These bonds attract tax concessions because they finance public works, part of New Delhi's effort to attract private capital to the energy sector.<sup>46</sup>

## INDIA'S ENERGY NEEDS

Why, given the doubts about nuclear power, expand at all? Because, according to analyst T.S. Gopi Rethinaraj, of a 'peculiar ideological commitment to nuclear power'.<sup>47</sup> New Delhi sees a nuclear power program, with its associated research capacity and establishment, as a strategic asset irrespective of its contribution to electricity supply.

The nuclear power sector is another example of India's long quest for autarky based on energy security. In the 1950s the influential Chairman of India's Atomic Energy Commission Homi Bhabha advanced a vision of an India electrified by nuclear power, using an unlimited domestic supply of mixed thorium-uranium 233 fuel. Bhabha's vision of an autarkic nuclear power sector failed to materialise. In the 1990s India's nuclear power plants were operating at about 40 % load, the world's lowest and 'below levels needed for economic efficiency'.<sup>48</sup> 'The bottom line is that India's investment in nuclear power in the 1950s and beyond represented a major diversion of capital into a relatively unproductive area,' Perkovich judges.

In the meantime, because of its military application India's civilian nuclear program remains a major diplomatic preoccupation for New Delhi.

#### 4. Implications for Australia

India's growing energy needs, along with New Delhi's search for energy security, and in particular for diversity of supply, could lead to growing opportunities for Australia, and hence a deepening of the bilateral relationship.

##### An 'attenuated' relationship?

In the past the bilateral relationship has been described in Canberra's official diplomatic history as 'attenuated'. This is one way of saying India has

always been a blind spot in Canberra's foreign policy and, with somewhat more justification, Australia in New Delhi's. But if Australia isn't very important to India, in 2004 India's importance to Australia was growing fast.

Australia is already an important supplier to India's coking coal market, and it has potentially a broader role in the coal sector. In the medium term Australian LNG exports to India could, when added to the growing coal trade, broaden the relationship further.

##### Australian coal

As noted above, India is *already* a major export market for Australian coking coal, which is used in the manufacture of steel. In 2002-03 India was Australia's third largest coal export market, behind South Korea and ahead of Taiwan: coal will be Australia's main contribution to India's energy needs for the foreseeable future.

In addition to existing sales of coking coal there is also scope for sales of Australian steaming coal to India as Indian electricity generators skirt domestic supply bottlenecks in a land transport infrastructure still geared to autarky.

There is also an important environmental angle for Australia. A key feature of India's coal reserves is their high ash content, which exacerbates the environmental effect of coal, the dirtiest of the hydrocarbon fuels. New Delhi has introduced requirements for certain categories of coal to be washed before transportation. As India seeks to optimise the use of its coal reserves it is looking to new and emerging technologies which are enhancing the fuel's potential, including by making it a cleaner fuel, lessening its environmental impact.

## INDIA'S ENERGY NEEDS

These range from more efficient mining techniques, different processing methods and advances in generation technology to the use of fuels previously considered waste. Clean coal technology is of particular importance because of Indian coal's high ash content and here Australia's own reliance on coal creates an obvious match with India's energy needs.

For example, CSIRO is promoting its CSIRO-Liquatech hybrid coal and gas turbine as one way of cleaning up Indian generation from coal. 'The major sources of coal for this system would be the currently under-utilised waste coal available and the methane gas now escaping into the atmosphere from inefficient coal mines,' Dr Cliff Mallett, Research Investment Manager in CSIRO Exploration and Mining in Queensland, said in an 18 February 2003 media release.<sup>49</sup>

'India is already heavily coal-dependent, and being under no constraint to cut back coal production – as it is not subject to the Kyoto agreement provisions – the coal industry in the sub-continent is expected to increase production over the next decade,' Dr Mallett said.

The exploitation of coal bed methane (CBM) is another emerging technology, coming into use in Australia, which holds considerable promise. India has large prospective coal bed methane deposits near the Andaman and Nicobar islands whose exploitation would heighten their strategic importance.<sup>50</sup>

### Australian LNG

The Australian LNG industry has been watching the development of the Indian gas market for a decade: in the 1990s Woodside joined a consortium proposing to build an LNG terminal on the south east coast. The impact of the Krishna Godavari

discoveries was apparently to reduce in the short term the prospects of Australian LNG sales to markets on India's east coast, but not, perhaps, to preclude sales to India entirely.

True, the expansion of New Delhi's capacity to import LNG will occur on India's west coast. Demand for gas in India's economically lagging east will, it seems, be satisfied for the foreseeable future by Krishna Godavari and, after Reliance's June 2004 announcement, Orissa gas. This reinforces the attraction of cheaper-to-transport Gulf LNG for Indian importers.

Moreover, Australia is far from New Delhi's only option. A range of LNG exporters, established and prospective, lie to India's south east. Australia, Indonesia, Malaysia and Brunei all export LNG, East Timor and Myanmar are set to join them and so too conceivably could Papua New Guinea. Further east, Russia's Sakhalin is set to produce LNG. But because of the focus on India's northwest and the Krishna-Godavari basin discoveries, these LNG producers face higher transportation costs compared with Gulf competitors.

Still, while Australian LNG producers are disadvantaged by comparatively high transport costs they have one signal advantage over Gulf, and even South East Asian, suppliers: secure production facilities. This may prove attractive to a New Delhi worried about energy security.

For example, announcing on 31 May 2004 that Iran would follow Qatar as India's next major supplier of LNG, Petronet CEO Suresh Mathur indicated that India would look beyond the Gulf for its next 20 year contract, to 'either Australia, Malaysia, or Indonesia'. But he also added that to be successful, the supplier 'should be price competitive, in the sense of competitiveness to supply (from) the Gulf.'<sup>51</sup>

## INDIA'S ENERGY NEEDS

This was not the first time Australia had been cited as a possible source of LNG imports. In September 2003 Royal Dutch Shell said it was considering Australia, along with Gulf producers, Oman, Malaysia and Russia's Sakhalin, as sources of supply for its Hazira regasification plant. Shell was 'betting on China and India to emerge as the major markets for LNG in the next fifty years,' group managing director Malcolm Brinded said.<sup>52</sup>

So Petronet's May 2004 statement can be seen in a context of New Delhi seeking security through diversity of supply, though not at any cost, with non-Gulf producers facing higher transport costs but emphasising their lower risk.

From an Australian perspective, the gas industry is well aware of the Indian market. 'From Woodside's perspective, there is potential for Australian LNG producers to go to the South Indian market, as Australian LNG could provide competitive commercial terms,' Woodside told the Lowy Institute in April 2004.

Woodside points out 'Australian LNG producers sell to markets further away than the Indian west coast; however the disadvantage is that the Middle East producers are closer, benefiting from lower shipping costs. However, Australian producers may be in a position to offer a total commercial package which the Indian market may find attractive.' And Australian producers may benefit from an international context in which gas importers' desire for guaranteed long-term supplies comes to outweigh high transportation costs. For example, on 11 August 2004 the UK's largest gas distributor, Centrica Plc, announced a \$US 7.3 billion, 15 year deal to buy LNG from Malaysia's Petronas.

'However,' Woodside continued, 'the Indian market would need to be weighed against other market opportunities'. And what with strong Japanese and Korean demand, the emergence of China as a customer and the US West Coast market opening up, the Australian LNG industry would appear to have a good range of market opportunities.

Australian gas can also be consumed by Indian business in Australia. In mid 2004 an \$AUD630 million liquid ammonia plant, using gas from the offshore North West field, was under construction on West Australia's Burrup Peninsula by the Indian company Oswals Projects.

Overall however, when considered in India's broader energy security context, one that is dominated by Gulf oil, it's clear that seen from New Delhi any Australian role in filling India's energy needs will be a minor one. This stands in contrast with the case of, for example, Japan, which buys half of its coal and some 10 % of its LNG from Australia.

<sup>1</sup> Common Minimum Program, website of Prime Minister Manmohan Singh: <http://pmindia.nic>

<sup>2</sup> Energy Information Administration. International total primary energy and related information

<sup>3</sup> EIA. An energy overview of India

<sup>4</sup> EIA

<sup>5</sup> CIA world factbook

<sup>6</sup> The Hindu special report on ONGC

<sup>7</sup> Dow Jones 07/01/04

<sup>8</sup> The Financial Express 16/03/04

<sup>9</sup> Bloomberg 17/04/04

<sup>10</sup> IANS 10/06/04

<sup>11</sup> EIA

<sup>12</sup> BBC 11/08/04

<sup>13</sup> FT 01/06/04

<sup>14</sup> EIA

## INDIA'S ENERGY NEEDS

<sup>15</sup> IEA World Energy Outlook

<sup>16</sup> PTI 21/01/04

<sup>17</sup> Bloomberg 1/3/04

<sup>18</sup> India Infoline 01/04/04

<sup>19</sup> The Financial Express (03/04)

<sup>20</sup> Bloomberg 20/11/03 CHK

<sup>21</sup> Bloomberg 11/11/03

<sup>22</sup> Bloomberg 02/07/04

<sup>23</sup> Bloomberg 08/07/04

<sup>24</sup> The Hindu Business Line (24/02/04)

<sup>25</sup> Formerly known as BSES

<sup>26</sup> Naik, The Hindu Business Line 24/02/04

<sup>27</sup> Other major Indian firms are entering the ESI besides Reliance and Tata. Hinduja, through its Hinduja National Power Corp. Ltd, was reported in March 2004 to be close to proceeding with a 1040MW coal fired plant at the port of Vishakapatnam in Andhra Pradesh. And not just private firms: on 21 July 2004 the *navaratna* GAIL announced it would spend 50 billion rupees to enter the ESI, acquiring generating capacity of 1500 MW. Dow Jones 21/07/04

<sup>28</sup> Bloomberg 28/05/04

<sup>29</sup> EIA

<sup>30</sup> The Business Standard 31/03/04

<sup>31</sup> EIA

<sup>32</sup> PTI 11/02/04

<sup>33</sup> Dow Jones 07/01/04

<sup>34</sup> The globalisation of India's oil industry goes beyond production. In mid June 2004 it was reported ONGC was considering entering the oil and LNG transportation business (Dow Jones 07/01/04). And India has an oversupply of refining capacity, which by March 2012 was set to rise to 3.2 million barrels a day compared with demand of 2.8 million barrels. As a result Indian refiners were seeking overseas markets for their product, like Thailand – and Sri Lanka and Bangladesh – as a priority. Bloomberg 14/06/04

<sup>35</sup> Reuters 02/02/04

<sup>36</sup> Oil & Gas Journal; as of 01/01/2003

<sup>37</sup> Reuters 02/02/04

<sup>38</sup> Dow Jones 11/06/04

<sup>39</sup> Bloomberg 08/06/04

<sup>40</sup> India Infoline 31/05/04

<sup>41</sup> UNI 09/02/04

<sup>42</sup> Bloomberg 14/06/04

<sup>43</sup> CIA world factbook

<sup>44</sup> DPA 11/01/04

<sup>45</sup> JIR 11/03 p39. In comparison, China plans to increase nuclear generating capacity from 8500 MW in 2004 to 36,000 in 2020 – though as in India, nuclear energy will be only a small contributor to overall energy needs. Uranium Information Centre weekly digest 19/03/04

<sup>46</sup> Bloomberg 16/03/04

<sup>47</sup> JIR 11/03 p37

<sup>48</sup> Perkovich p32

<sup>49</sup> Dr Cliff Mallett, Research Investment Manager in CSIRO Exploration and Mining in Queensland, said in an 18 February 2003 media release.

<sup>50</sup> EIA

<sup>51</sup> Reuters 30/05/06

<sup>52</sup> The Economic Times 19/09/03

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