DPRK RENEWABLE ENERGY AND SUSTAINABLE DEVELOPMENT: REGIONAL ENGAGEMENT IMPLICATIONS

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1. Introduction

This essay aims to focus on two tasks: that of collating in one account exactly what sustainable development[1] projects are happening in the DPRK energy sector and who is involved in them, and secondly, in light of the DPRK's call for regional engagement in this area, analysing what the prospects, motivations and implications of such engagement from the regional powers might be. It will assume the reader's familiarity with the general energy situation in the DPRK; those who wish more than the basic summary provided here might read Hayes' and Von Hippel's works, which include excellent accounts of the nature and roots of current DPRK energy difficulties.

1.1 Background to the DPRK energy sector

The DPRK economy industrialised during a period of alliance with its socialist neighbours, the Soviet Union and China. Technical assistance in energy production, materials for power plants, financial loans, and vast quantities of cheap oil were all readily available to the DPRK energy sector under this umbrella of friendship. To a significant extent, the DPRK economy formed its chief characteristics around such energy assistance. Development activities in the rural economy, such as water-pumping, rice-planting, and fertiliser production became increasingly dependent on cheap hydrocarbons. In competition with ROK industrialisation, scant consideration was given by development planners to energy efficiencies, and energy-intensive industries were promoted in the race to develop a strong military economy capable of defeating the ROK.

The end of the Soviet Union, worsening economic relations with China, and extensive flooding shocked the economy in the early 1990s. Without Soviet oil and

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unable to afford global market prices, many sectors of the economy could not maintain production. Flooded coalmines became inoperable. As Soviet-assisted power plants aged, spare parts could not be found and maintenance became difficult. Increasingly internationally ostracised, the DPRK lacked and still lacks the resources to redevelop its economy away from its former dependencies. The current situation is such that the DPRK energy sector, which once fuelled an economy to rival the ROK, is devastated and dependent on international humanitarian assistance.[2]

The DPRK energy sector faces problems at every stage: generation, transmission, and distribution. With significant flood damage to its mines, poorly maintained equipment and lack of electricity to power that equipment, coal production is now severely limited yet remains the country's primary energy source. Coal that is produced is burnt in very inefficient and polluting power plants, and transmitted across a national grid whose wires are decaying and which loses around 16% of total energy production (Von Hippel and Hayes, 1995). The inefficiency of the process means that energy is available to the end user at limited times and is of variable quality. The user—be they industrial, residential or otherwise—has little incentive to use what little energy arrives sparingly as energy is heavily subsidised. To meet basic energy needs, many households use firewood. This is being used at a rate 35% higher than it is being replenished, and is unsustainable (Von Hippel and Hayes, 2007). As hill cover erodes for firewood usage, landslides and flooding become more severe and nutrients are washed away from the soil, harming agricultural production. This is exacerbated by declining chemical fertiliser application (due to lack of coal to produce the fertiliser and oil to transport it across the country), which has fallen to between 20% and 30% of 1990 levels (Williams et al, 2000). The urgency of these points has been recognised by the DPRK (DPRK Delegation, 2006a).

1.2 Sustainable development policies and projects undertaken by the DPRK

To date, P'yŏngyang has initiated a number of policies and projects aimed at improving the sustainability of its energy sector:

- Non-Conventional Energy Development Centre set up in 1993
- National Action Plan issued in 1993, 'focusing on sustainable development [...], the development of New and Renewable Energy and in particular wind' (DPRK Delegation, 2006b)
- Non-Standing Renewable Energy Committee formed in 1994
- Law on Energy Management passed in 1998, legislating for the State to promote 'the active development and the utilization of the renewable energy and its appliances in organizations, institutions and households.'[sic] (ibid.)
- 2000, the government instructs wind turbine production to be executed

'for its important role in greenhouse gas mitigation and national electricity supplement' (ibid.)

- A photovoltaic-powered 50-household test case set up in P'yŏngyang (Liu, 2004)
- Decentralised biomass power stations set up in the countryside
- Research institutions to develop methane technology established, introducing applications of this for households and farms
- Interest expressed in engaging in Clean Development Mechanisms under the Kyoto Protocol
- The government is actively encouraging local construction of small, decentralised hydro-dams and increased efficiencies of existing hydro-plants (DPRK Delegation, 2006a)
- Policy to only upgrade extant thermal power stations, with a moratorium on new plants
- 2MW prototype tidal power plants set up in Hwanghaenamdo, with plans being drawn for a 20MW plant
- National wind atlas to be completed by the end of 2008

As of 2004, the total installed wind turbine capacity amounted to just 3MW, mostly made up of small stand-alone systems below 10KW. The government is currently undertaking a three-stage strategy of national wind development, aiming at 500MW of wind-generated power by 2020. For comparison, the ROK's wind turbine capacity at the close of 2006 was just 173MW (Global Wind Energy Council, 2007). The stages of the strategy are:

- 2006–2010: a 10MW prototype farm to be created, with turbines of 600KW capacity
- 2011–2015: three large wind farms of 100MW capacity to be created, drawing from the lessons of the first stage and to be implemented 'with the cooperation of the international organizations and other NGO groups and communities' [sic] (DPRK Delegation, 2006)
- 2015–2020: onshore and offshore wind farms to be actively pursued

From this survey, we can see that the DPRK does not lack strong goals for sustainable development in the energy sector. However, as DPRK delegations have noted, in the DPRK 'fundamental study on wind energy is conducted relatively in depth, but its industrialization is still premature' (DPRK Delegation, 2006b). It seems that the DPRK is unable to meet its sustainable energy goals by itself, essentially because it lacks appropriate training, technology, and expertise. This represents significant engagement possibilities with the DPRK for international bodies, NGOs, and neighbouring states alike. As shall be explored, some organisations are already engaging with the DPRK in this field. The DPRK seems very keen to promote such collaboration (as noted above, it's a central part of the second stage for energy

development), and there are positive benefits for regional states to get involved as well.

2. The suitability to the DPRK of sustainable energy development

> *'Coal which is one of the primary energy resources in our country is getting inferior in quality and the condition of mining becoming more unfavorable. It makes the prospect of meeting long-term energy demands gloomy'.* (DPRK Delegation, 2004a)

It may seem surprising to imagine the DPRK—traditionally painted as a backward, polluting, Stalinist regime—pursuing sustainable energy development, but in fact such a policy approach is well suited to current DPRK policies and the DPRK situation.

2.1 Freedom from oil dependency

P'yŏngyang sees diversification of energy resources as 'the main path for the long-term energy security of the country,' and renewable energy as the 'relatively most feasible and reliable' route (DPRK Delegation, 2006b). The DPRK has had bad experiences of relying on oil, primarily because it has none of its own to see it through times of adjustment.[3] The first bad experience was in the 1970s, when it tried to emulate the ROK's export-led development strategy. Having purchased expensive technology and materials from overseas, spiralling OPEC-induced oil prices from 1973 cost the country dear, and left it unable (or unwilling) to repay its loans, and unable to further pursue this economic development strategy.

The second shock came after the Soviet Union and China withdrew their supply of oil at friendship prices (until 1990, trade was often done in barter (Oh, 2003)). The DPRK economy, dependent on cheap energy, was unable to convert to operation at global oil prices, paid for with hard currency. The subsequent economic collapse reveals the extent to which the economy was then dependent on the energy support of the USSR and China, and in part explains the difficulty the DPRK has had (to this day) in transitioning its economy away from this reliance. Add to this the 'pariah' status of the DPRK on the international stage, and it quickly becomes apparent why the DPRK fears reliance on an expensive, volatile energy resource for the future, and favours oil substitutes (such as biogas for heating, and hydro- and wind-turbines for electricity generation) instead.[4]

2.2 Unviable route of nuclear power

The DPRK has heavily argued for its right to a civilian nuclear programme, and pushed for international support for the development of Light Water Reactors (LWRs). The LWRs have been domestically important for the DPRK leadership in securing

legitimacy, and as a litmus test for the sincerity of the US in fulfilling its promises (Hayes and Von Hippel, 2007). The LWRs are very unlikely to contribute to solving the DPRK's energy crisis either in the short- or mid-term however, for compelling political and technical reasons.[5]

2.3 Abundance of renewable energy resources

Amongst possible energy sources, P'yŏngyang regards renewable energy as 'relatively most feasible and reliable in consideration of its technology and its abundant resources' (DPRK Delegation, 2006b). In cooperation with other parties (see section 3), and under its own efforts, the DPRK has conducted feasibility surveys for solar, wind, and further hydro developments. It has found that conditions are excellent for wind, solar and tidal power generation.[6]

2.4 Military target factor

As the engine of an industrial economy, the energy sector has important military target considerations. Oil refineries and intensive generation plants are at heightened risk from aerial bombardment. In terms of military security, the reliance of the DPRK on LWRs would leave the economy very exposed in the event of a limited, strategic air strike by the US. Such an attack would not only deprive the economy of much of its power at a single stroke, but would also pose massive radiation risks for the land and population (Sailer, 2004). It would also require massive reinvestment to repair the facilities and a long time to bring them back on grid. Besides nuclear, other power plants carry similar, but less significant, military risks: the destruction of a large hydroelectric dam, for example, could be extremely damaging for both the economy and immediate area.

2.5 The cost of alternatives

As outlined earlier, every stage of the energy supply line—generation, transmission and distribution—has degenerated due to lack of appropriate fuels, maintenance, and spare parts. Alternative energy sector development paths based around nuclear reactors, regional energy grid link-ups or natural gas pipelines will require a total overhaul of the DPRK transmission and distribution network to be able to connect to and integrate the new energy supply. The massive investment and stability in relations (the DPRK is in no way capable of transforming its energy sector in such a way alone) required by these energy options only increases their risks and decreases their feasibility. A sustainable development path, meanwhile, can proceed on a step-by-step basis and provide immediate improvements to the energy sector. Hayes and von Hippel (2007) have estimated the cost of incorporating the currently incomplete

LWRs into the DPRK energy grid system at between three and four billion USD, against an estimated two billion USD for upgrading extant energy components, improving efficiencies, and implementing mass renewable energy systems.

2.6 Benefits of an off-grid system

Liu (2004) proposes a renewables-based off-grid solution for rural areas and an on-grid system for urban areas. Off-grid solutions for rural areas might include the extension of biogas schemes for cooking and domestic heating in order to take the pressure off dwindling forest stocks, Combined Heat and Power (CHP) plants, and locally produced energy through wind turbines, small hydro projects, and photovoltaic systems. An off-grid system such as this would be physically sustainable, as it relies on abundant locally sourced resources that do not detriment the local environment. It would also be socially sustainable, as it would be able to provide a more consistent supply of energy and thus be better able to meet basic human needs. Furthermore, an off-grid rural energy system would save central government large amounts of resources, as the alternative would be to replace outdated rural transmission lines at considerable expense and, if training were provided to the local population during installation, would require little central expertise or funding for maintenance. Liu recommends that the savings made by enabling an off-grid solution for rural areas be channelled into funding concentrated on renewable energy parks for urban areas.

2.7 Environmental benefits

P'yŏngyang is increasingly aware of the environmental damage inflicted by previous development. In 2003 the UNDP and UNEP co-published a 'State of the Environment' with the DPRK's National Coordinating Committee for Environment, in which it was confirmed that one of the four long term policy priorities in the DPRKs energy strategy was:

> to minimize the environmental impact of energy generation and use […] and secure environmental sustainability by promoting a switch to the use of renewable energy use [sic] (UNEP, 2003).

This is presumably in response to the very serious condition of much of the DPRK's forest, water, and air supplies, as identified in the report, which now threaten DPRK development (e.g. the lack of firewood for rural heating appliances).

3. NGO experiences of sustainable development engagement

> *'The main barrier in the activities of the DPRK for the rehabilitation of its energy system and energy security is the lack of funds and technologies'*. (DPRK Delegation, 2004a)

The DPRK needs external investment to make significant developments in its economy and energy sector: it lacks the necessary technology, expertise, and components to develop. Not-for-profit, non-state actors have already started to provide such investment. Three of the most significant independent organisations providing such technical and financial support have been the United Nations Development Programme (UNDP), the Environmental Education Media Project (EEMP), and the Nautilus Institute for Security and Sustainable Development (hereafter 'Nautilus'). This section outlines the areas in which these organisations have proactively engaged with the DPRK energy sector, and the unique benefits such organisations can bring to engagement.

3.1 UNDP involvement

The United Nations Development Programme has been supporting projects in the DPRK since it first opened its P'yŏngyang office in 1980, though operations have been suspended since March 2007 over allegations of financial mismanagement. Its engagement with the DPRK energy sector has been to promote regional sustainable development programmes with the aim of alleviating poverty (as in involvement with the Greater Tumen Initiative), assisting the DPRK in complying with its international obligations under the United Nations Framework Convention on Climate Change (UNFCCC), and promoting localised energy development projects to assist those who are effectively 'off-grid'.[7]

The Small Wind Energy Development and Promotion in Rural Areas (SWEDPRA) project built on previous DPRK commitment to renewable energy and the 1999 UNDP survey 'Renewable Energy Development for Rural Electrification Project'. It aimed for the "development and widespread implementation of small-scale wind energy systems (SWES) to replace part of the current fossil fuel use in the DPRK."[8] The project funded the creation of wind maps, wind-energy education, the development of domestic and foreign markets for domestically produced SWES, technical assistance in SWES development, and assistance with national policy formation.

UNDP energy engagement with the DPRK cannot be said to be primarily politically motivated, and aims to improve the living standards and prospects of the people of the DPRK through sustainable development. Its approach has been to work through the DPRK State, assisting it in complying with international standards and helping to improve its capacity to initiate and sustain sustainable energy projects.

3.2 EEMP involvement

The predecessor to the Environmental Education Media Project (EEMP) was founded in 1997. One of EEMPS' goals is:

> 'directed at getting as much information as quickly as possible into the hands of those groups and organizations that can use it to increase public awareness and promote more sustainable approaches to development.' (http://www.eempc.org/profile.php)

As part of this, it has made efforts to act as a catalyst for wind-energy adoption in the DPRK. It differs from UNDP projects in that instead of developing nascent DPRK turbine production capacity, it is aiming to introduce German/Chinese turbines. This certainly meets EEMP's goal of delivering 'as quickly as possible' and avoids the problem of poor current domestic production capacity. However, importing the turbines is not a long-term sustainable solution, and it may be difficult for the DPRK to source the highly developed parts for turbine repairs, maintenance, and further rollout. If the project goes ahead with sourcing Chinese turbines this problem may be somewhat mitigated.

EEMP started its involvement with the DPRK energy sector in 2002. EEMP held talks with Nordex (a large international turbine producer) and visited the DPRK several times in 2003 to survey conditions and exchange information, which was reciprocated by a DPRK energy delegation visit to Nordex's Chinese plant. Later that year the DPRK NGO 'Pyongyang International Information Centre [*sic*] of New Technology and Economy' (PIINTEC) was founded, and it was with this organisation that EEMP engaged. Negotiations over site monitoring, conditions assessment and financing between PIINTEC and EEMP continued through 2004, culminating in plans for an initial trial scheme involving five windmills (Liu, 2004).

The potential role of PIINTEC as a conduit for future sub-state level engagement opportunities is considerable. Its aim is:

> 'to provide an opportunity for exchange and cooperation in the fields of economy, technology and science between universities, research institutes, enterprises, individuals and NGOs of the DPRK and other countries.' (DPRK Delegation, 2004b)

PIINTAC is now the principal organisation with which EEMP engages, and presumably will be for future NGO engagement activity in this area too.

3.3 Nautilus involvement

The Nautilus Institute for Security and Sustainability was formed in 1992 and was the first cooperative engagement for development between the DPRK and a US NGO (Von Hippel and Hayes, 2001). Nautilus' mission is:

> 'to improve global problem solving by applying and refining the strategic tools of cooperative engagement to fundamental problems undermining global security and sustainability.' (http://www.nautilus.org/admin/mission.html)

In 1997, Nautilus toured a DPRK delegation through energy workshops around the US. At the end of the visit they agreed to establish the 'US-DPRK Pilot Renewable Village Energy Project' with the aim 'to meet humanitarian energy-related needs in rural end uses such as household lighting, medical clinic energy needs, agricultural water pumping, and food processing energy needs' (Nautilus, 1999). Seven US-made wind generators were installed which support sixty households, a school and a clinic in the village of Unhari. Finding available DPRK national energy demand and supply datasets to be inadequate, Nautilus has collaborated with the ROK's Korean Energy Economics Institute (KEEI) to produce the necessary surveys, part funded by the US Department of Energy. These are open-access and offer unparalleled insights into the DPRK energy sector.

Since the collapse of the Agreed Framework in 2002, Nautilus has moved away from applied capacity building projects with the DPRK, and towards engaging with the DPRK in international conferences and workshops.[9] Examples of these are the Asian Energy Security forums and energy grid workshops, both set up by Nautilus. DPRK delegations have made significant presentations at these events, and they have provided an invaluable opportunity for DPRK experts to engage with their international counterparts on a professional and personal basis.[10]

3.4 The benefits of NGO engagement

Because NGOs can be independent of state-political motivations, they are able to continue engagement even when state-political relations turn sour. For example, despite the Bush doctrine and the 'Axis of Evil' accusation, and the collapse of the Agreed Framework and regional tensions over DPRK nuclear weapons, the UNDP, Nautilus and EEMP continued building positive relationships and developing energy cooperation with the DPRK. Meanwhile, the ambitious KEDO Light Water Reactor (LWR) project ground to a halt, because it was dependent on continued cordial state relations.

While states are obliged to limit the development of personal relationships to the progress of inter-state relations, NGOs have a freer hand. In working on the Unhari project, Nautilus invited their DPRK colleagues to the US in 1997 for a two-week tour of workshops and meetings. On this tour the DPRK delegation met with a variety of energy professionals and Department of Energy officials, and were briefed by the World Bank on renewable energy programmes. This was the first meeting between a DPRK delegation and the DOE and the World Bank.[11] Whilst the tour undoubtedly improved DPRK-US relations, it would have been difficult for the US state to arrange

such a visit because of the inseparability of official state positions and inter-state relations.

The development of these personal relationships can be crucial to improving long-term state relations. Lankov argues that such experiences 'help to end the demonization—and contribute to the demystification—of foreigners in the eyes of North Koreans', as well as exposing to North Koreans 'the prosperity and freedom they are deprived of at home', a process he links to the rise of Gorbachev and the reformers in Soviet Russia and believes could be at least partially replicated in the DPRK (Lankov, 2006).

The final strength of NGO engagement with the DPRK energy sector is its tendency to illustrate what is possible. All three NGOs which have significant experience in this area—the UNDP, EEMP and Nautilus—have tried to set up new projects that illustrate the potential for sustainable development and engagement to both the DPRK and external actors. In part this may be due to budgetary constraints: the largest project so far has not had more than a few million dollars of funding, which is best spent on small, innovative projects. However, the independence of the NGOs and their non-partisan motivations has enabled them to be more creative and flexible in their engagement projects. Surveying the experiences of these three organisations in the DPRK, one sees that they may be providing an illustrative model for other, more well-resourced actors to follow. Indeed, the World Bank notes a similar phenomenon in the Kenyan photovoltaics market, where NGO-installed demonstration systems led to large-scale uptake by private companies and the state (Hankins, 2000).

4. Regional involvement: motivations and prospects

> *'The combination of the correct policy of the DPRK is to establish an efficient, stable and sustainable energy system. If we were to combine our people's steady efforts with the international co-operation with Northeast Asian countries should get good results'* [sic]. (DPRK Delegation, 2004a)

Section 3 outlined some of the benefits that NGOs can bring to engagement with the DPRK. However, when one compares the sub-five million US dollar budget of the largest NGO collaborative project (UNDP support for the Greater Tumen Initiative) with the budgets of regional state collaborative efforts, one can quickly see the importance of the latter to rehabilitation of the DPRK energy sector.[12] Because the sustainable development path can be pursued on a step-by-step basis at relatively low cost with immediate benefits, it seems perfectly suited to engagement strategies with the DPRK.

Countries engaging with the DPRK in the area of sustainable energy development each have differing strengths, motivations, and goals. To assess likely engagement

paths for each country this section will examine: respective countries' existing engagement practices with the DPRK; their general aims in engagement; and their current conceptualisations of (and importance placed on) sustainable development.

4.1 Russia

I. Background to engagement

The end of the Soviet Union brought with it the demise of one of the DPRK's most important, and favourable, trade partnerships. Overall trade fell from 3.5 billion USD in 1988 to under 100 million USD by 1995 (Moltz, 2003).[13] In part, this was due to the economic difficulties experienced by the former Soviet Union in the 1990s. Without the shared ideological heritage as a foundation for a close relationship, when improvements in relations eventually came they were led by pragmatic economic considerations.[14] Such measures paved the way for an improved political relationship, heralded in July 2000 with Putin's visit to P'yŏngyang (the first for either a Soviet or Russian Federation President) and Kim Jong Il's return trips to Moscow in 2001 and 2002. At these summit meetings, both sides confirmed their mutual friendship, their respect for each other's sovereignty, and their intentions for economic cooperation (KCNA, 2000). This has expressed itself most recently in the agreements made between the ROK, DPRK and Russia for the latter to provide an electricity transmission line supplying limited energy to Northeast DPRK, and Russia's November 2006 decision to write off eight billion USD of debt owed to the Soviet Union by the DPRK (CRS, 2007).

II. Motivations behind engagement

According to Moltz (2003), Russia's aims from economic cooperation with the DPRK are to be viewed in relation to its goals for the region: namely the reduction of regional tensions, the re-establishment of Russia's presence in the region (it was not included in the 1994 Agreed Framework, for example), and the development of the Russian Far East (RFE).[15]

Russia sees DPRK stability as key to regional stability. As G. Toloraya, Deputy Director-General of the First Asian Department, Ministry of Foreign Affairs of Russia notes:

> Helping North Korea survive and providing it with both security guarantees and the minimal subsistence level for its population is the key to stability in Korea (Toloraya, 2000).

In order to achieve this stability, Russia sees international energy assistance as key:

> Military and political security does not mean much without economic security. The

> urgent task is to prevent economic decline in North Korea—providing food and energy assistance (ibid.).

Engagement with the DPRK also enables Russia to maintain its political presence in the region. Initially left out of bilateral and trilateral negotiations in the 1990s despite its enviable knowledge and understanding of the DPRK situation, Russia has made concerted efforts to improve its position in the region, for example by engaging in shuttle diplomacy in an attempt to resolve the Agreed Framework breakdown. Moltz (2003) argues that Russian efforts in that instance failed primarily because with bilateral trade at just 115 million USD, Russia still lacked adequate leverage over the regime.

Finally, the potential for DPRK involvement in the development of the RFE is significant, not only in the form of DPRK forestry teams and as a market for Russian military equipment (Cho, 2004), but also in terms of the access it can provide to the ROK and Japan. Such access is chiefly concentrated around two possibilities: the extension of the Trans-Siberian Railway to the ROK (and potentially Japan if a ROK-Japan rail materialises) through the DPRK, and the creation of gas pipelines to the ROK and Japan. Not only would such scenarios increase the export markets for the RFE, but it would also make investment in the RFE more attractive to the ROK and Japan.

III. Attitude to sustainable energy engagement

Sustainable development is not currently addressed as a priority policy area for the Russian Federation, indeed it may even conflict with Putin's vision of a doubling of Russia's GDP by 2013 (IEA, 2004a). Combined with Russia's stated interest in developing the hydrocarbon resources of the RFE, it seems unlikely that Russia will be proactive in initiating sustainable development projects in the DPRK energy sector. However, Russia has signed up to the Kyoto protocol and as such will need to incorporate environmental considerations into its energy development choices. It has also confirmed its support for engagement and the provision of energy assistance to the current DPRK regime in order to stave off hardships for the DPRK people and the collapse of the DPRK state. If Russia continues to place importance on following international environmental measures such as Kyoto, then it can only serve to reinforce the DPRK's sense of obligation for meeting its responsibilities under its FHCCC commitments. Furthermore, despite its enthusiasm in the development of its hydrocarbons, Russia has significant experience of renewable energy projects. For example, cooperation with Denmark has resulted in the setting up of a demonstration wind farm in Kaliningrad, which generates 900,000kWh per year, with another farm producing 8,200,000kWh a year, and plans for extensive off-shore development (IEA, 2004b). Although Russian motivation of developing the RFE may mean that

it doesn't initiate renewable energy projects in the DPRK energy sector, if there is an international consensus towards this then Russia will not want to be left out, and would be capable of bringing significant implementation experience with it.

4.2 China

I. Background to engagement

As the DPRK's major trading partner, DPRK-Sino economic engagement is extensive and the two enjoy cordial relations in public, with three summit meetings since 2001. Recent examples of economic engagement include the Chinese provision of a glass factory to the DPRK *gratis* from July 2004, and the joint construction of the Pyongyang International Business Complex (Oh, 2005). The DPRK's reliance on China's energy exports increased after the US withdrawal of its annual provision of 500,000 tons of Heavy Fuel Oil (HFO) in 2002, with imports in the first half of 2005 up 45.5% from the previous year to 295,000 tons of crude (Zhang, 2007).

Chinese businesses also have an unparalleled position in the DPRK economy (Li, 2006). In October 2005 the first Joint Venture outside a DPRK special development zone was established, with the Chinese Minmetal Corporation investing in Dragon Lantern Coalmine, the largest open-face coal mine in Asia, and with many more DPRK-Sino partnerships following suit (Zhang, 2007). The Chinese government seems increasingly keen to conduct economic engagement with the DPRK through non-governmental Joint Ventures, and the extent to which the government is supporting domestic companies to do so is not clear.[16] In any case, the importance of China—whether the government or business—to the DPRK economy is considerable. Swanström (2004) writes that 90% of DPRK energy needs and 40% of its food requirements are met by China, whilst Scobell (2004) has China as supplying three-quarters of DPRK's petroleum and food imports. Trade volume for the two countries reached 1.7 billion USD—10 times the DPRK's trade volume with Russia (CRS, 2007).

Important as China is to the DPRK, the DPRK represents a smaller export market to China than Bulgaria, Egypt or Hungary, and a smaller import market than Gabon, Peru, or Belgium (CRS, 2007). This imbalance in the relationship is telling, and points to claims that whilst the DPRK needs China economically, China needs the DPRK in other ways. As Shen (2006) shrewdly notes:

> There is no altruism in international relations, including those between China and North Korea. By providing aid to North Korea, China is in essence helping itself.

II. Motivations behind engagement

Shambaugh (2003) provides analysis of one way in which aid to the DPRK serves Chinese interests: 'because collapse would have enormous tangible human and

economic consequences for China, not to mention the intangible political impact of another failed Communist state'. This analysis is similar to suggestions for reasons behind Russia's support of the DPRK regime. Shen (2006), however, argues that economic support for the DPRK not only reduces the humanitarian risks of collapse, but also enables the DPRK to sustain itself as a buffer for China against the US military in the ROK. Furthermore, faced with a nuclear DPRK with an army which, when including reserves, numbers around 7 million, the US military may be wary of overstretching itself with military intervention over Taiwan. An irony not explored by Shen is that although the DPRK may be a buffer to US forces, it is the strongest justification for a continued US military presence in the region and the extension of the US missile defence shield, something China (like Russia and the DPRK) is ardently against. Scobell (2004) argues that consequently, China seeks to maintain the stability of the DPRK regime whilst using its influence to discourage DPRK actions that will antagonise the US.

III. Attitude to sustainable energy engagement

It is not clear whether China would be pro- or anti-future engagement with the DPRK for the promotion of sustainable development in the energy sector. On the one hand, China has made important commitments to the sustainable development of its own energy sector. It is keen to continue and export the technological advancements it is making in the cheap wind-turbine sector and, by 2015, aims to have 20%–30% of families using solar water heaters, and several thousand medium to large biogas plants recycling animal waste (Gu and Liu, 2000). By 2020, it hopes to have increased the share of renewables in the energy mix from 7% to 15% (Zhang, 2007). Combined with the close economic penetration that China has achieved within the DPRK, China seems opportunely placed to both encourage and assist the DPRK in implementing mass, cost-effective renewable energy solutions.

On the other hand, it is difficult to see possible Chinese motivations for initiating such solutions in the DPRK. As outlined earlier, for China the DPRK is a very sensitive and complicated political dilemma that must be carefully managed. Currently, Chinese businesses are earning good favour with the DPRK through their development of DPRK coalmines, and it would seem counter-intuitive for the Chinese government to intervene and discourage this positive engagement experience. Moreover, as China desperately tries to improve its social and environmental record by switching away from coal (which is getting increasingly harder and more damaging to mine), it may find it favourable to outsource the associated 'social ills' (such as environmental degradation and dangerous working conditions) by developing and importing DPRK coal as a substitute for its own. Whichever way China does decide to go, it seems likely that it will continue to separate the political from the economic where possible, and conduct future economic engagement by proxy through Joint Ventures with Chinese companies.

4.3 Japan

I. Background to engagement

Japan has been one of the most important trading partners with the DPRK and is one of the few countries with which the DPRK runs a trade surplus, despite the two countries not sharing diplomatic relations. A large group of pro-North ethnic Koreans live in Japan and provide not only a market for DPRK imports but also hard currency in remittances to the DPRK (CRS, 2007). Japan has provided significant amounts of humanitarian assistance to the DPRK since the 1990s, and played an important part in KEDO. It has promised several billion dollars of 'economic aid' upon normalisation of relations (as it did with South Korea in 1965), but North Korea's missile threats, North Korean denuclearisation, and the Japanese abduction issue all need to be resolved before this can happen (Cha, 2001).[17] Japan has used economic engagement with the DPRK to encourage normalisation talks and discourage isolationism and belligerence, and seems likely to continue doing so in the future.[18]

II. Motivations behind engagement

Japan's goals are primarily to ensure its security through the DPRK's dismantlement of its nuclear weapons programme, and reliable DPRK commitments to desist with missile threats and appropriately account and apologise for abducting Japanese citizens in the past (CRS, 2007). It believes it is best able to achieve these goals through DPRK commitments under normalised relations, and that the DPRK will see the accompanying 'economic aid' as more beneficial than continued belligerence and isolation.

III. Attitude to sustainable energy engagement

Japan is proactive on sustainable development, particularly on issues related to climate change, carbon dioxide reduction, sustainable use of marine resources, food production, solid waste management, and environmental taxation (CSD, 2006).[19] Its firms 'have become world leaders in the production of pollution-control equipment', and 'the principles [sustainable development] embodies have slipped smoothly into the lexicon of official thinking and policy drafting' (Grainger, 2004). Japan established a governmental Council for Sustainable Development in 1996, and was instrumental in formulating the 1997 Kyoto Protocol. As we will see with the ROK, however, the extent to which reality matches official proclamations of commitment to sustainable development can be questioned. Central government-led large construction works took precedence over sustainable development even up to the 1990s recession, and much of the 'greening' of its economy has been due to its outsourcing of its heaviest and most polluting industries to neighbouring countries (ibid.).

Of all the regional powers, Japan seems most likely to support sustainable

energy development in the DPRK, and indeed such support may be financed by the several billion USD economic aid package it is offering for normalisation of relations. Trinidad (2007) has shown how Japan has taken leadership initiatives in Southeast Asia through Official Development Assistance (ODA) in the past. If the DPRK removes the barriers to these normalisation talks and provides Japan with the security assurances it needs, and Japan is able and willing to potentially break with US policy on the DPRK, then Japan may be willing to use its ODA to once again take regional leadership initiatives.

4.4 ROK

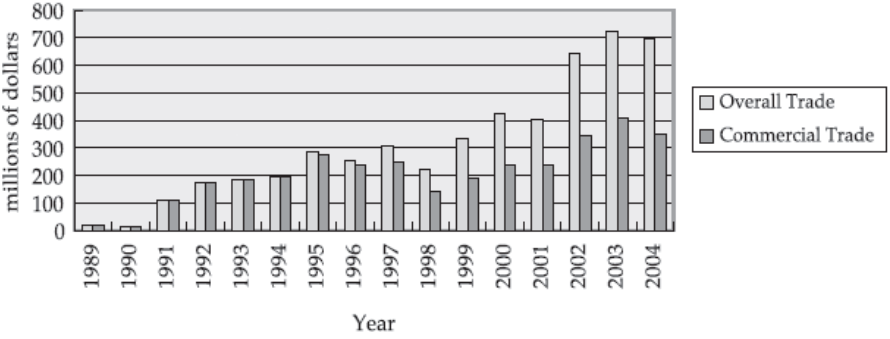
I. Background to engagement

Although the ROK government has granted ROK companies licences to engage with the DPRK since 1988, it has only been since the summit meeting of 2000 that inter-Korean trade has taken off. This is shown in Figure 1, which details the levels of inter-governmental and commercial trade activity between 1989 and 2004:

Commercial activity has mostly been limited to the importing and exporting of foodstuffs, textiles, forestry items and some processing operations, and does not involve significant development of the DPRK economy.[20] Many ROK businesses suffer from being overly enthusiastic about the prospect of trading with the DPRK and overlook feasible business models, resulting in an ultimately unsuccessful experience and damaged DPRK confidence in the sincerity of ROK enterprises. It is primarily to this reason that they attribute the decline in businesses operating with the DPRK from 536 in 2000 to 462 in 2004 (Yoon and Yang, 2005).

There are currently three major economic cooperation projects between Seoul

Figure 1: Inter-Korean Trade Values for Commercial and Inter-Governmental Trade, 1989–2004 (Yoon and Yang, 2005).



and P'yŏngyang: the development of the Kaesŏng Industrial Complex (KIC), the re-opening of rail and road links across the DMZ, and the Mt. Kŭmgang tourist resort. In terms of cooperative energy projects, the ROK clearly recognises the developmental need for improvements in the DPRK energy sector and has shown solid support for initiatives in this area. Principal energy projects it has supported have been the (disbanded) KEDO implementation of two LWRs in the DPRK, supply of electricity to the KIC, and proposals of major electricity transmission lines to the DPRK.

Total trade value between the ROK and DPRK increased from 403 million USD in 2001 to 1,350 million USD in 2006, making the ROK set to overtake China as the DPRK's main economic partner in the near future (CRS, 2007). There are some similarities between the ROK and China in terms of their economic relations with the DPRK: in both cases much of the trade is actually aid to maintain DPRK stability (for the ROK this is mostly food and construction materials), and in both cases trade with the DPRK makes up a very small proportion of total national trade (exports to the DPRK represent less than one percent of the ROK's total exports whilst DPRK exports to the ROK represent around a third of its total exports, despite the ROK operating a trade surplus with the DPRK).

II. Motivations behind engagement

There are significant and varied goals in the ROK with regards to its relationship with the DPRK. A primary national security goal is the reduction of the military threat the DPRK poses. There are cultural goals of reunification of some form, and economic hopes for an alliance of the high-tech capital of the ROK with the cheap workforce of the DPRK to bolster Korea's standing in the region. Since the 1990s there has been a growing feeling that the best way to achieve these goals is through engagement with the DPRK, and from this the building up of trust and mutual confidence in the mid- to long-term. Although policy specifics vary, there is now a broad political consensus that this approach should be maintained.

In recent years there has been a new motivation behind engagement with the DPRK: that of perceived competition with China. Such perceived competition is not new; there is an ongoing struggle to resist Chinese claims over the identity of ancient northern cultures such as Koguryŏ, for example, and perceptions of economic competition as the Chinese economy advances into direct competition with the ROK over shipbuilding, and chip technology. This sense of competition has extended to engagement with the DPRK, an area that many in the ROK feel should be rightfully dominated by the ROK for nationalist reasons. Yoon and Yang (2005) cite a 2005 KDI study that found 49.7% of surveyed businesses engaging with the DPRK feeling a competitive pressure with China, and 91.3% of surveyed 'experts' feeling the same. More recently, former ROK president Kim Dae-jung spoke out on this issue, saying:

'I believe we should expedite our entry into North Korea so as to attain balance against China' (*The Korea Times*, 27 September 2007).

As Yoon and Yang note, ROK-initiated infrastructure development in the DPRK is not merely aid or a simple expense, but is rather 'preservation of Korean wealth for the time when the two Koreas unify'. There is a general consensus in the ROK that the per capita GDP of the DPRK needs to increase considerably if any reunification schemes are to be successful. Newly inaugurated President Lee Myŭng-bak has called for the DPRK's GDP per capita to reach 3000 USD before unification, and has announced plans for a 40 billion USD fund for DPRK development to this end.[21] Sustainable development of the energy sector would not only help the DPRK's economy grow, but would do so in a relatively equitable manner by diffusing access to energy and control over energy resources across the population. The most immediate benefit of this would be to improve agricultural capacity, and thus directly raise the living standards of the DPRK rural (i.e. majority) population (Williams et al, 2000).

III. Attitude to sustainable energy development

The ROK has publicly committed itself to pursuing sustainable development policies: in 2000 the Presidential Commission on Sustainable Development was set up; on World Environment Day, 2005 President Roh announced the Vision for National Sustainable Development, aiming to build 'an advanced nation where the economy, society and environment progress simultaneously'; and in July 2007 the ROK committed itself to pursuing 20-year goals and creating specific policies with the passing of the Framework Act on Sustainable Development.

These sustainable development policy goals have extended to the energy sector. The First National Energy Plan (1997–2006) focused on reducing the energy usage of the steel, petrochemical and cement industries (which accounted for 78.4% of all energy demand in the manufacturing sector in 1997), privatising public-owned energy enterprises, and improving energy efficiency.[22] However, the Second National Energy Plan (2002–2011) is a self-described 'paradigm shift' away from the first. It says:

> Due to changes of basic conditions, such as demand for higher quality energies and growing concern for the environment, *the energy policy must pursue a new goal of 'sustainable development' which takes the factors of economic growth, environment, and energy security all into consideration* [emphasis added] (KEEI, 2007).[23]

The government's proclamations are not backed up by its actions, however. In 2001, new and renewable energy occupied just 1.2% of the ROK's energy mix, with 94% of this figure coming from municipal and industrial waste incineration (Kim, 2002). The government is aiming for 5% of its total energy supply to be met by new and renewable energy by 2011, a very small increase from the 2.2% 'business-as-usual'

forecast and still very low when compared with other OECD countries (such as Spain's 30.3% target by 2010). One reason for this discrepancy may be the influence of the large, powerful energy companies in the ROK which, having only recently and partially been denationalised, still retain important connections within government and sit on policy bodies such as the National Energy Committee (personal interview with Paul Cheong of the Sustainability Strategy Institute, 19 August 2007).

The ROK can certainly be expected to maintain engagement with the DPRK as one of its most pressing national policies. Its experience of significant energy cooperation proposals with the DPRK and its stated commitment to sustainable development of energy suggests that the ROK may be proactive in pursuing this path in future. However, powerful ROK businesses have been closely involved with every major DPRK collaboration to date, and the representation of their interests in ROK domestic energy policy choices suggests that their interests will continue to be represented in future ROK-initiated cooperative energy projects with the DPRK. As such, it is likely that the ROK will continue to promote large-scale energy projects involving significant contracts for ROK construction companies, rather than small-scale energy efficiency measures or renewable energy implementation. As improvement of relations with the DPRK is an important issue for ROK voters, it is possible that the ROK government will be more concerned with making such projects high-profile and domestically popular than with ensuring the projects correlate with the DPRK's most pressing developmental priorities for its energy sector. However, since the ROK has stated commitments to sustainable development, it has a well-developed policy structure to accommodate any proposed cooperative projects.

4.5 USA

I. Background to engagement

With no peace treaty between the USA and DPRK, US firms are restricted in economic relations with the DPRK under the Trading with the Enemy Act. The paucity of US-DPRK economic relations is shown in Figure 2 (most of the US exports shown in the years from 2000 are agricultural products in the form of humanitarian assistance).

As the DPRK remains on the USA's list of state sponsors of terrorism, the US Treasury is not allowed to support any international financial institution's assistance to the DPRK (Babson, 2003). Furthermore, the US is able and willing to impose restrictions on financial institutions that it believes are assisting the DPRK as a state sponsor of terror, as shown by its freezing of DPRK funds in Banco Delta Asia. In response to the DPRK's 2006 nuclear test explosion, the US rallied regional support for wide-ranging sanctions on the regime, including the right to stop and search all DPRK-registered ships. Despite such aggressive and punitive economic actions, the USA has also, at times, provided considerable economic support to the DPRK. As

Figure 2: US Merchandise, Exports, Imports, and Trade Balances in thousand USD with North Korea, 1990–2006 (CRS, 2007).

Year	U.S. Exports	U.S. Imports	Balance
1990	32	0	32
1991	484	10	474
1992	83	0	83
1993	1,979	0	1,979
1994	180	0	180
1995	11,607	0	11,607
1996	541	0	541
1997	2,409	0	2,409
1998	4,454	0	4,454
1999	11,265	29	11,236
2000	2,737	154	2,583
2001	650	26	624
2002	25,012	15	24,997
2003	7,977	0	7,977
2004	23,750	1,495	22,255
2005	5,757	3	5,754
2006	3	0	3

part of the 1994 Agreed Framework the USA provided large amounts of financial, technical and political assistance for the KEDO's provision of two LWRs, as well as shipping 500,000 tonnes of HFO annually until the collapse of the framework in 2002. Economic support resumed in 2007 when the DPRK promised once again to abandon its nuclear programme.

II. Motivations behind engagement

The USA clearly and openly uses economic relations, or the promise of such relations, as both a carrot and a stick to maximise its influence over the DPRK regime. Its goals with respect to the DPRK are:

1. to halt or eliminate North Korea's development of nuclear or other weapons of mass destruction;
2. to curtail illegal and questionable activities by North Korea to include illicit sales of missiles, dealing in illegal drugs, counterfeiting of currency, and proliferation of weapons of mass destruction, particularly to terrorist groups;
3. to reduce the threat of war on the Korean peninsula;
4. to ensure that North Korea does not participate in international terrorist activity;

5. to induce economic, political, and societal change in the country that could bring about favourable changes in the Kim regime, in governance, in the standard of living of its people, and in attitudes toward the United States, and
6. to enhance the security of South Korea and Japan with respect to the DPRK (CRS, 2007).

Whilst China, the ROK and Russia encourage domestic companies and institutions to engage with the DPRK in order to increase the amount of influence of the respective country, the USA conversely seeks to limit not only the economic engagement of US organisations with the DPRK, but also the organisations of other countries (through sanctions and usage of the Patriot Act on financial institutions like Banco Delta Asia), as its chief means of influencing the DPRK. These two strategies are wholly different and help account for the difficulty the USA faced in persuading the ROK, China and Russia to impose sanctions on the DPRK after its 2006 nuclear test.

The USA is willing to develop bilateral relations with the DPRK, conditional on the complete, verifiable and irrevocable dismantlement of the DPRK nuclear programme. Following that, there are signs that the USA is willing to engage very proactively with the DPRK: on 13 January 2007 US Assistant Secretary of State James Kelly said:

> Once we get beyond nuclear weapons, there may be opportunities with the US, with private investors, with other countries to help North Korea in the energy area (ibid.).

Extensive US economic engagement with Vietnam and China are precedents for such a possible shift in US engagement policy. State Department and United States Agency for International Development officials visited the DPRK in November 2007, and announced US support for DPRK hospitals with a $4 million funding for electricity provision. Details are still not clear, but the US will provide the aid through four international NGOs.[24]

III. Attitude to sustainable energy development

The USA is one of the world's most extensive polluters, and has proven hostile to international efforts limiting hydrocarbon consumption (Grainger, 2004). In terms of national sustainable development policy, the USA does not compare favourably to other countries in the OECD. However, the size and breadth of the US economy harbours advanced technological expertise in the field of renewable energy and significant funding opportunities.

Whilst the US government may therefore not choose to initiate sustainable energy development projects in the DPRK, it has enviable expertise in the field that would be of great benefit to such projects. In addition to this it has the power to greatly affect the capability of the DPRK to access international financial institutions, not

just negatively (through freezing accounts under the Patriot Act) but positively by supporting DPRK applications to the World Bank and IMF (Babson, 2003). While development assistance from such organisations may not be critical for development of the DPRK energy sector (alternative funds could, for example, come from the normalisation package promised by Japan) they would most likely be essential for sustained development in other areas of the economy.

4.6 Regional benefits of a nuclear-free energy future

As described in section 3, nuclear energy could not be included in the energy-mix of a DPRK that was serious about developing its energy sector, or doing so sustainably.[25] Sailer (2004) argues that the absence of nuclear reactors in the DPRK would bring great benefits to the region, something that is a priority issue for every major regional power (CRS, 2007). Sailer notes the crossover potential of nuclear energy between civilian programmes and military programmes, as happened under both the Pakistani and Indian nuclear programmes. If efforts were made again to develop DPRK nuclear energy capacity, it is most likely they would be in the direction of the Light Water Reactors (LWR) part-built by the failed Korean peninsula Energy Development Organisation (KEDO). Though such reactors limit direct military applications, they would still produce an estimated 500 kilograms of plutonium in spent fuel every year, which would provide an ample source for weapons development if the DPRK restarted its enrichment programme (Albright and Higgins, 2000). North Korean technicians would also gain experience in handling fissile materials, calculating fissile processes, and handling neutron sources, which are essential for successful military applications and which would be considerably more difficult to achieve if there were no nuclear reactors in the country.[26] Even if the DPRK had neither the intention nor actual capability to produce weapons-grade material from civilian nuclear programmes, the very suspicion of these alone would produce the same reaction in the DPRK's neighbours:

> Every state that has nuclear energy can be accused of secretly working to use it for military purposes. The use of nuclear energy thus increases the potential for tension between states. Such tension can worsen international relations, lead to destabilization, and—in extreme cases—even lead to armed conflicts (Sailer, 2004).

The DPRK has recently been accused of conducting illicit nuclear transfers with Syria. Whether or not the allegations are true, the mere possession of nuclear technology and materials exposes the DPRK to claims of non-compliance with the Non Proliferation Treaty that, whether substantiated or not, promote the belief that the country is a 'rogue regime' and consequently damage its international standing.

A sustainable development plan for the DPRK's energy sector could not include plans for the redevelopment of nuclear energy, and this would bring crucial 'peace

dividends' to the region particularly to Japan (which is very concerned about the possibility of a nuclear threat from the DPRK) and to the ROK (where nuclear suspicions impede desired engagement and cooperation) (Uriu, 2003; Yoon and Yang, 2005). Ostensibly, the USA is also keen for denuclearisation of the North, despite supporting the development of LWRs before the collapse of the Agreed Framework in 2002. However, the US undoubtedly benefits from fears over the DPRK's nuclear capability and security threat, as it increases Japanese and ROK dependence on security alliances with the US (Berkofsky, 2003). Threats from the DPRK have promoted US arms sales to the region, and provided legitimising cover for extending the Missile Defence Shield to include China.

4.7 The potential of the clean development mechanism (CDM)

Under the Kyoto Protocol, Annex I (industrialised) countries are permitted to invest in projects that decrease greenhouse gas emissions in developing countries as substitution for decreasing their own emissions. Of the regional powers looked at in this paper, only Japan and Russia are Annex I countries (the USA has not ratified the Protocol), with China and the ROK receiving CDM investment (149 and 16 projects to date, or 17% and 2% respectively of total CDM projects to date). Whilst Russia has not invested in any CDM projects to date, Japan has financed 96 projects, or 13% of total CDM projects. Japan recently announced plans to purchase a portion of China's carbon allowance as part of its strategy to meet its Kyoto Protocol commitments (*Yomiuri Shimbun*, 3 January 2008). Sustainable energy development projects in the DPRK are likely to meet CDM criterion, and would allow Russia and Japan to achieve foreign policy goals whilst meeting their emission obligations. As with other forms of economic assistance, Japan is likely to delay CDM investment in the DPRK as a carrot for normalisation talks.

5. Potential problems associated with regional energy engagement

> *'Economics is not the sole reason for undertaking projects in the region'* (Ivanov et al, 2002).

Engagement for its own sake may neither benefit DPRK energy sector development nor improve regional relations. There is a clear case for careful consideration of the potential problems that may come with regional energy engagement with the DPRK.

5.1 Project progress needs to be independent from political progress

When economic projects are linked to political relations, problems in one area can quickly sour the other.[27] China and the ROK have recognised this maxim and are

moving to separate the two processes: China by encouraging joint ventures, and the ROK by continual official assistance under the Sunshine Policy. An example of this recognition was their reticence in joining the US-led economic sanctions after the DPRK's nuclear test explosion.

It is easier for China, the ROK and Russia to separate political developments from economic because, as considered in section 4, sustained economic engagement is an important means for them to achieve their goals with the DPRK. For the USA, however, the development of economic relations is used more clearly as a varied tool in the construction of political relations, and as such it is harder for it to separate the two. For example, when the USA failed to deliver the DPRK's Banco Delta Asia funds within 30 days as promised, it very nearly derailed all that the Six-Party talks had achieved since the 2006 nuclear test. Likewise, political relations and trust between the DPRK and the USA soured over slow implementation of the KEDO LWRs, and the whole economic project collapsed as punishment by the US after the DPRK reneged on political agreements. However, even with the USA's overtly political approach to economic engagement it is possible to prevent one from adversely affecting the other through honesty, openness, and an empathic understanding of the other's position. This lesson was learned well in the Banco Delta Asia fiasco, where US representative Christopher Hill was in very regular behind-the-scenes meetings with DPRK counterparts. The respect earned by his efforts ensured that improvements in political relations were not thrown away by technical problems in economic relations.

5.2 Business goals may not meet development needs

Industries and businesses have their own goals when engaging the DPRK, which may tend to see the DPRK primarily in terms of what the largely unpenetrated market with rich mineral resources and a disciplined workforce can offer the company, rather than how long-term DPRK energy development needs can best be met. Examples of such goals include the profit that would be earned by Russian energy companies from gas pipelines traversing the DPRK to the ROK and Japanese markets, and the calls from US agriculture representatives for access to the DPRK market (Paul, 2001). Provision of the LWRs under the Agreed Framework, a 4-billion US dollar construction agreement, saw large contracts going to the ROK's sole electricity provider (Korea Electric Power Corp., of which 51% is owned by the ROK government) and to engineering company ABB, one of whose directors (Donald Rumsfeld) may have had vested interests upon taking office in George W. Bush's government (*Fortune*, 12 May 2003). There is nothing wrong with this *per se*, but if political awareness of business goals (and their efforts to influence policy) is not acute then it may result in engagement projects being diverted away from areas of high political and

developmental priority, and towards areas of large profit for non-DPRK companies and industries.

5.3 Countries may vie to achieve influence with the DPRK

KEDO's delivery of two LWRs may have failed, but that the respective countries were able and willing to cooperate in concert through a proxy institution is undoubtedly a success and offers hope for similar joint actions in energy development for the future. It is also promising that the Six-Party mechanism has endured and borne such fruitful negotiations, despite intermittent crises. Indeed, KEDO and the Six-Party talks stand out as good examples of cooperation in a region which is notable for its lack of major cooperative bodies.

There remain many signs that the respective countries are not willing to cooperate with each other, and more worryingly that they may even develop competitive policies in energy engagement with the DPRK (something which has many historical precedents on the Korean peninsula).[28] The danger of such competition is that, like unchecked business interests, it may skew assistance given to the DPRK away from the developmental needs of its energy sector and towards projects aimed at least partially at ingratiating the assisting country with the DPRK regime vis-à-vis others. For example, the reputed 500 million USD paid to the DPRK by the ROK/Hyundai for agreeing to the 2000 summit was criticised for the possibility that it was used to sustain the DPRK military, and for being used to win domestic support for the ruling ROK party. Similar criticisms have been made over the ROK's direct food donations to the DPRK, instead of going wholly through the World Food Programme (which, it is claimed, is better able to ensure aid goes to areas where it is most needed, rather than straight to the military) (Moon, 2005). Development assistance needs to be done openly and with clear anticipated results in order to reduce the legitimacy of such charges.

5.4 Projects need to be feasible

Yoon and Yang (2005) have argued that the enthusiasm of ROK enterprises to conduct business operations with the DPRK pushed aside appropriate consideration of the financial viability of such projects, and that the ultimate failure of those projects damaged the DPRK's perception of ROK sincerity whilst contributing little to DPRK development. Similarly, numerous authors have slated the KEDO LWR project as being economically and technically unviable; a project that was not born of a measured assessment of DPRK energy needs, and little more than a temporary political solution.[29] Both of these cases have been analysed as damaging longer-term political relations with the DPRK. By contrast, successful joint ventures with China and the rapidly developing Kaesŏng Industrial Complex show DPRK

the benefits of engagement with its neighbours, as well as illustrating to the DPRK successful business models for a world in which centrally planned production has little relevance.

6. Concluding remarks

'There is no altruism in international relations' (Shen, 2006).

The DPRK energy sector has not moved away successfully from its reliance on the once-forthcoming hydrocarbons and technical assistance of the Communist bloc and this is restricting attempts for economic recovery. The DPRK has shown that it is keen to redevelop its energy sector according to sustainable development principles but, lacking adequate expertise and funding, it openly admits it needs international assistance in this task. Such assistance would not only benefit the DPRK but would also bring important benefits to the region, not least advancing the prospects of a denuclearised Korean peninsula.

The DPRK has already received international assistance in sustainable energy development from various NGOs. These engagement experiences have been significantly successful. They have demonstrated the feasibility of renewable energy implementation in the country, and helped set up communications and relationships between DPRK energy experts and officials with their counterparts in other countries. Despite their successes, NGOs lack the funding necessary to take such development beyond demonstration projects. The regional powers, however, which include three of the world's four largest economies, could provide the funding necessary for comprehensive sustainable development of the DPRK energy sector. These countries all have engagement with the DPRK as a high priority, and all have unique qualities that they could bring to sustainable energy assistance. Japan, for example, has promised considerable funds upon normalisation of relations and, as with the ROK, has advanced experience in improving energy efficiencies. The USA has strong technical expertise in renewable energy and can control the DPRK's access to international finance. China has knowledge of implementing renewable energy projects in conditions comparable to the DPRK's, and the ROK has committed itself to massive developmental assistance for the DPRK. The stage thus seems set for the regional powers to draw from the NGOs' experiences, to answer the DPRK's call, and to meet DPRK energy sector challenges. There is now, after all, a general agreement among the powers that a stable DPRK is in regional interests, and that this stability is dependent on an energy sector capable of recovering the DPRK's collapsed economy.

Yet, despite their capabilities and the benefits to be gained, such assistance is not being initiated by the regional powers. In each instance, complex motivations behind

engagement currently prioritise development paths that differ for each regional power, but that all point away from sustainable energy. Significant changes in these motivations do not seem imminent, although increased uptake of Clean Development Mechanism or a breakthrough in normalisation talks with Japan may alter this. If such changes are not forthcoming, however, the DPRK may have to compromise on its developmental engagement goals, and instead work on ways to shape sustainable energy engagement projects to meet the specific motivations of the regional powers and interests.

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Notes

1. For brevity the term 'sustainable development' is not explored here. The DPRK has cooperated with the UN in various projects in the area, and it seems safe to assume that DPRK authorities use a similar definition of the term as the UN-ratified Brundtland Commission's of 1987 (UNEP, 2003; WCED, 1987). For a discussion on ambiguities of the term see Dresner, 2004 and Peacock, 2003.
2. For example, Heavy Fuel Oil shipments to the DPRK as part of Six-Party negotiations. The USA has recently announced $4 million of funding for off-grid generators to be supplied to DPRK hospitals through four international NGOs.
3. The DPRK Delegation to the 2006 Asian Energy Security workshop noted, 'DPRK has not discovered its oil yet' [sic]. It has gone to apparently fruitless lengths to find and develop this oil in the Yellow Sea with China (1965–80); the Soviets (1986); the Australians (1988–90); the Swedes (1993); the Malaysians (1997); and the British (2004) (Calder, 2005).
4. Given such reasons for oil-aversion, it must be asked why the DPRK is so insistent on Heavy Fuel Oil (HFO) in Six-Party energy negotiations. One reason may be that although future reliance on this resource is undesirable, the severity of the DPRK's economic collapse was such that it has been unable to renovate or replace its old, hydrocarbon-dependent economic foundations. This possible reason is supported by the conditions of the 1994 Agreed Framework, which allowed for HFO shipments until the Light Water Reactors come on grid. Here the HFO was presumably intended to maintain the economy in 'business as usual' operation until it could be successfully substituted for another fuel, and this may be what is happening with current HFO negotiations. Hayes (2002) argues that HFO is of very little value to the DPRK, and that energy negotiations use it as a base unit for the sake of political expedience. 'Provision of HFO was never more than a sub-optimized, politically driven way for the DPRK and the United States to come to a working agreement. It had nothing to do with a rationally determined way to meet DPRK energy needs or energy development.' (Note: the 13 February, 2007 agreement allowed for the DPRK to be provided with one million tons of HFO equivalent in economic, energy, and humanitarian assistance, not necessarily HFO itself.)

5. For an exploration of the political reasons, see section 5.1 below. Technically, the safety concerns over DPRK operation of the LWRs is too high, and the DPRK grid is far too small to cope with the power generated by the reactors. See Von Hippel et al (2001). The reason why it is pushed at negotiations may be because energy technocrats have been under-represented at previous Six-Party negotiations, which are dominated instead by military and foreign affairs interests (Hayes and Von Hippel, 2007).
6. 18% of the land has average wind speeds of at least 4.5m/s, with many areas having average speeds of 10m/s (DPRK Delegation, 2006). Annual average solar irradiation is 1200kwh/m2, with 55–60% of days clear, and the west DPRK coast has very high tidal rises of between four and six metres (DPRK Delegation, 2004a).
7. Programmes it has supported in connection with energy-engagement are: Enabling Korea DPR to Prepare its First National Communication in Response to its Commitments to UNFCCC (1997); Preparation of Strategic Action Programme (SAP) and Transboundary Diagnostic Analysis for the Tumen River Area and Environs (1998); Renewable Energy Development for Rural Electrification Project (1999); Formulation of Documentation on Sustainable Rural Energy Development and Investment Plan (2002); Small Wind Energy Development and Promotion in Rural Areas (SWEDPRA) (2004); National Capacity Needs Self-Assessment for the Global Environment Management (2004) (UNDP, 2007). Of these projects, the Tumen River Strategic Action Programme (SAP) is the most significant, with several million dollars of funding. Its remit is to 'provide a common framework for the identification and formulation of strategies, programmes and projects, responding primarily to transboundary issues of environmental management'. It was built on previous UNDP-funded work that culminated in the 'Memorandum of Understanding on Environmental Principles' in 1995 between the ROK, the DPRK, China, Russia, and Mongolia—a historic agreement and the first sub-regional forum for the five countries. The SAP led to the creation of the Tumen River Area Development Programme (renamed the Greater Tumen Initiative in 2005), which aims to stimulate environmentally sensitive development in the area where Russia, China and the DPRK meet. In order to achieve this, the UNDP has promoted legislative harmonisation between the border countries, information sharing (including energy capacity-building training for DPRK officials in China in May/June 2006), and the creation of cooperative mechanisms. The UNDP's second SAP (2006–2015) is focusing on transport, energy, tourism and investment, with environmental concerns cutting across all goals (http://www.tumenprogramme.org).
8. Go to http://www.gefonline.org/projectDetails.cfm?projID=2397 for a Project Summary.
9. Personal communication with Scott Bruce of the Nautilus Institute, 28 August 2007.
10. For examples of such presentations see DPRK Delegation, 2004a, 2004b, 2005, 2006a, b.
11. 'DPRK Renewable Energy Delegation visits U.S.' The Nautilus Institute, 3 June 1999. See http://www.nautilus.org/archives/dprkrenew/visit9712.html
12. The ROK gave 229 million USD of material assistance in the year following the July 2006 floods alone, spent around 500 million USD in return for the 2000 summit meeting, and is seeking to increase the total amount of official government assistance from 500 million USD per annum to 750 million USD (*Dong-A Ilbo*, 11 July 2007).

13. Imports from the former Soviet Union fell from 60% of the DPRK's total in 1988 to just 10% in 1994, lower even than imports from the ROK (Flake, 1995).
14. Moltz (2003): 'the new relationship with Kim is based not on Russian largesse, as in the past, but a new policy of 'pragmatism' on the part of Moscow'. Examples of this include the New Agreement on the Forestry Industry of 1995, and the Science and Technology Cooperation Plan of the same year.
15. This is supported by G. Toloraya (Deputy Director-General of the First Asian Department, Ministry of Foreign Affairs of Russia): 'Based on our 55-year experience of relations with DPRK, as well as our 10-year experience of relations with ROK we now see peace and stability in Korea as the primary objective of our policy in Northeast Asia' (Toloraya, 2000).
16. Its motives for such encouragement are also unclear, though there are several possibilities. One may be that China finds advantage in separating developments in economic relations from political relations. Another possibility may be that China wishes to support the 2002 reforms by showing how financially lucrative opening-up a state-controlled economy can be. Yet another possibility may be that China is trying to renegotiate its relationship with the DPRK away from the mutual political alliance as implied under the 1961 Agreement of Friendship, Cooperation and Mutual Assistance, and towards one based on economic pragmatism, as it has done with the ROK: by engaging with the DPRK through third-party businesses, the Chinese government is able to free itself politically from a DPRK alliance, whilst maintaining a strong economic foothold in the DPRK economy.
17. The DPRK abducted several Japanese in the 1970s and 1980s and has neither returned them nor acceptably accounted for them. Though the amount of aid has not been firmly decided, it is expected to range between five and ten billion USD. Hayes (2003) argues that the figure should be the latter. Any normalisation package offered by Japan is more likely to be understood in the DPRK as 'colonial reparations' (Cha, 2001), and is put in inverted commas here to reflect this ambiguity of naming.
18. For example, Japan imposed sanctions after the 1998 launch of Taepo-dong missiles over Japan, and lightened them prior to 1999 bilateral talks. As these talks developed into more formal proceedings for normalisation, Japan lifted a 3-year ban on food aid to North Korea and provided 100,000 tons of rice through the World Food Programme (ibid.). Japan has since resumed sanctions on the DPRK following its 2006 nuclear test.
19. For an alternative, more critical view of Japan's commitments to marine resources sustainability see Clover, 2004.
20. According to Yoon and Yang (2005), just 200 million USD was invested by ROK enterprises between 1996 and 2005 (apart from KEDO), a figure that is reduced to 50 million USD if one also excludes the Mt. Kŭmgang tourist resort.
21. 'Reunification of the nation will be possible only when the per capita income reaches US$3,000 in North Korea and $30,000 in South Korea. If the North gives up its nuclear programmes and opens its economy, the South will help the North so that its per capita income will rise to $3,000 within a decade' (Lee Myŭng-bak, 2007).
22. The Korea Energy Economic Institute (KEEI): http://www.keei.re.kr/web_keei/en_Issues01.nsf/frame.htm

23. KEEI (ibid.). Note that this interpretation is different from the UN's 'Triple Bottom Line' interpretation discussed earlier, by its substitution of 'energy security' for 'social development'.
24. The Eugene Bell Foundation, Mercy Corps, Samaritan's Purse, and Global Resource Action Center for Environment.
25. See, e.g., Lee and Ouellette, 2003: 'Considering the physically weak, highly fluctuating, and rapidly decaying electricity grid in the North, current total capacity of generation in the DPRK, and lack of reliable offsite power for coolant pumps in the event of a shutdown, the power generated by two LWRs could not possibly be used'.
26. Victor Gilinsky, holder of senior posts at the Atomic Energy Commission and the Nuclear Regulatory Commission, said on the subject of the nuclear material used in LWRs: 'Reprocessing the stuff is not a big deal […] you don't even need special equipment. The KEDO people ignore this. And we're still building the damn things'. Cited in *Fortune* Magazine, 12 May 2003.
27. For example, the DPRK was quick to mistrust the USA after slow progress with KEDO's installation of the LWRs, and the USA was quick to withhold funds for the LWRs after reports of a clandestine DPRK nuclear programme.
28. For example, Yoon and Yang (2005) cite a study finding that almost half of all ROK businesses engaging with the DPRK, and nearly all ROK experts on the DPRK, feel a competitive pressure with China. Analysis shows that China feels the need to retain strong pro-Chinese sentiments in the DPRK (Scobell, 2004); Russia is engaging with the DPRK in part to make itself a more prominent actor in regional negotiations (CRS, 2007); and Kim Dae-jung called for increased development assistance to prevent Chinese domination (*The Korea Times*, 27 September 2007).
29. See for example Lee and Ouellette, 2003; Babson, 2003; Hayes and von Hippel, 2007. Babson writes: 'KEDO was created not with the intent to solve these [DPRK energy] problems, but to manage cooperation with North Korea with regard to its nuclear program, and must be viewed in this light. […] If a proper energy sector development plan were to be prepared for North Korea, it is unlikely that nuclear power would even be part of the equation, when economic, technical, financial and environmental considerations were given proper weight'.

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