WORLD ENERGY COUNCIL
CONSEIL MONDIAL DE L'ÉNERGIE

Assessment of Energy Policy and Practices

1 December 2008

World Energy Council

Promoting the sustainable supply and use of energy for the greatest benefit of all

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Published 2008 by:

World Energy Council
Regency House 1-4 Warwick Street
London W1B 5LT United Kingdom

ISBN: 0 946121 32 X

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Foreword

The crucial topics of global energy production and consumption have received a vast amount of much-needed attention in the past several years. Scholarly and professional studies abound and the work of organisations such as the IPCC has made us fully aware of the global threat of climate disruption. Given this important and ever-growing body of work, the world community stands well-equipped to evaluate the state of the energy landscape and to identify what actions need to be undertaken.

Energy is one of the most important levers in human development, and, as such, acts as a key factor in determining the economic development of *all* countries. It is clear that the growth in global demand for energy has played a key role in causing prices to rise dramatically. We also know that this rise in demand has led to a 25% increase in greenhouse gas emissions since 1990 and that biodiversity, water and air quality are at risk. In addition, the inequality within and across countries between those who have access to energy and those who do not is on the increase.

Thus, the key issue confronting us today is no longer where we stand or where we might be heading, but rather how to devise the best solutions to these problems in a highly-complex global arena involving multiple stakeholders: governments and citizens of course, but also NGOs, scientists, academics and industrialists.

Faced with the economic, social and environmental stakes that are at play regarding energy provision, we already possess the technical and industrial means to more effectively exploit fossil-fuel reserves, to develop competitive carbon-free production, and to improve energy efficiency, for instance regarding housing and transportation. We can also be comforted by the fact that promising new technologies are in development.

Yet, all of these routes involve major investments that will only be possible in a favourable institutional environment in which all decision makers are well-informed and empowered to act, and in which the "acceptability challenge" can be overcome by fostering public awareness and debate. It has thus become increasingly clear that well-researched and effective public policies are critical for the future. The aim of sound public policies should be to lead to investment in appropriate technology and help to enact regulatory measures, acceptable to all stakeholders, which reconcile economic growth and environmental protection. Appropriate public policies also provide the only means to a future in which economic growth can take place alongside an actual reduction in inequality in individual countries as well as globally.

Due to this pressing need for effective public policies, the World Energy Council (WEC) has decided to launch a comprehensive comparative study that takes into account broader national frameworks. The study will analyse economic and institutional circumstances of clusters of countries with similar profiles and measure their energy, social and environmental capacities.

This paper, presenting WEC's *Assessment of Energy Policy and Practices*, represents a first step in an on-going, multi-year study exploring which kinds of public policies will best serve particular countries. It is our hope that this initiative will foster a large-scale exchange of ideas among the main stakeholders governing public policy, NGOs, and citizens with the aim of facilitating the best solutions to meeting each country's energy needs.

Our goal is to produce studies that will lead to concrete action.

Pierre Gadonneix, Chair World Energy Council

Executive Summary

The modern industrial world exists by virtue of its command over energy production, supply, transport, and use. Consumers around the world expect energy supply to be affordable, secure, clean, and available for all—as encapsulated in the World Energy Council's (WEC's) 3 A's (see page 6 for a description). This is desired by most local and regional jurisdictions, and especially by national governments, which implement them through a range of supporting energy and energy-related policies.

Of equal importance is the evolution of a complex energy industry to meet the many and diverse needs of energy consumers. The industry, which has supported the extraordinary economic growth of the last two centuries, is facing a number of profound transitions:

- A major shift in demand towards Africa, Asia, Latin America, and the Middle East.
- A possible "peaking" of conventional oil in the coming 10–20 years, and of conventional natural gas before 2050.
- An urgent need to restrict the production of greenhouse gases and handle regional air pollution.
- The need for the rapid development of low-carbon and/or carbon-free energy supply.

These transitions, which need to be completed in one to two generations, will employ a wide array of technologies, some new, and will need enhanced policies.

To accomplish this, the energy industry needs to now move quickly, under considerable uncertainty and with greater risk than it is used to.

WEC believes that relentless improvement of governments' energy policy and industry's practices are needed, and that this can lead to a material improvement in their capabilities to effectively handle these energy transitions.

To enable this rapid change, WEC is launching a comprehensive multi-year Assessment of Energy Policy and Practices, facilitated by the WEC's unique structure of national member committees worldwide.

This paper lays out the basic approach that WEC is employing along with illustrative examples. Its purpose is to elicit constructive comment from the energy community that can be incorporated in the development and execution of the methodology. The current approach employs a three-stage process:

- Examining the overall capability of a country to develop and implement energy policy and practices.
- Identifying the most effective specific energy policy and practices within a country.
- Examining for comparable countries the relative capability and effectiveness of their energy policy and practices.

The focus of energy policy and practices within a country depends on its level of economic development and available energy resources. Thus, energy-rich, higher-income countries, such as Norway, have quite different concerns and aims than energy-poor, lower-income countries, such as Senegal. Equally, a higher-income, energy-poor country, such as Japan, will focus its policy differently from a lower-income, energy-rich country like Nigeria. Thus, comparisons are best made between countries with a similar set of energy aims and resources.

The Assessment will be implemented in the coming year. Before COP-15 in Copenhagen, a full Assessment is planned using the methodology in this paper for over 60 countries, drawing conclusions useful for the conduct of energy policy and practices to address climate change.

Comments on this paper are welcome and should be directed to *assessmentstudy@worldenergy.org.*

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Introduction

Emerging energy transitions are creating a turbulent environment for the energy industry that is testing governments from the local to the international level. Shifts in energy demand are taking place faster than expected, challenging existing infrastructure and suppliers, and driving energy price volatility. This is exacerbated by concerns over possible longer-term supply constraints to conventional oil and gas supplies, and the geographical distribution of these resources.

Rapid industrial growth and urbanisation are creating regional air pollution problems. These are solvable, but take time and money. Looming over the industry is the increased urgency attached to tackling greenhouse gas emissions, the major driver of climate change. This requires a rapid shift to carbon-free and low-carbon technologies over the coming decades.

Also, a large portion of the world's population still lacks reliable and affordable access to modern energy. Despite a considerable effort to address this, there is still much to do.

The cumulative effect of these challenges underscores a number of observed phenomena:

- **Energy price flaring**. In the last year, crude oil has more than doubled in price and subsequently declined in price to less than half its peak.
- **Deep concern among energy consumers**. In many countries, the high cost of energy has caused strong reaction by consumers.
- **Possible economic dislocation in countries**. Higher oil and gas prices have severely affected the budgets of the poorer oil-importing countries, in some cases leading to political difficulties. High energy prices are a major contributor to inflation, putting particular pressure on the energy poor.
- **Greater emphasis on energy security**. The uncertainties around future energy supply, in a world of higher energy prices, have raised security of supply concerns in many energy-importing countries.
- **The increased role that governments have in relation to energy**. The global nature and magnitude of these transitions, with increased annual investments estimated as high as one trillion USD, has highlighted the essential role of governments in providing adequate frameworks for energy decision-making and action. For example, governments need to enable, and even fast-track, new investments in energy infrastructure and facilities in the face of public local and regional groups who do not want these facilities on, or to pass across, their lands.

Why an Assessment is needed

There is an urgent need to explore, understand, and communicate the components of successful energy policy. At the same time, as WEC's recent energy scenarios work[1] concluded, it is important to remember there is no one ideal policy or suite of policies.

Energy policy is strongly shaped and influenced by particular national or even regional situations. Thus, lessons from a country's energy policy and practices should prove less useful, by themselves, in formulating policy for other countries, and indeed the entire globe. But, *not* attempting to learn from the practice of others and develop more effective energy policy, bearing in mind the scale and speed of the needed energy transitions, is irresponsible. This line of thinking is consistent with the call in

[1] http://www.worldenergy.org/documents/scenarios_study_online_1.pdf

WEC's energy scenarios for unprecedented levels of cooperation and integration.

There is an urgent need to explore, understand, and communicate the components of successful energy policy.

The list of critical questions requiring answers is daunting. How should policy-makers best balance their responses to today's energy challenges with those of tomorrow's? How can the private, public, and citizen sectors work together more effectively to respond to these challenges—and keep driving forward the necessary changes? And what are the best working models of public policy, regulation, market mechanisms, business strategies, and financial instruments needed to create energy supply and demand patterns that meet the goals of eliminating energy poverty, ensuring energy security, and achieving energy sustainability?

Energy businesses are increasingly global in nature, requiring that investment decisions and technology choices be made with a global perspective, but energy policies are predominantly made at the national level. Thus, a gap has to be bridged at a time when significant investments need to be made to ensure security of supply and to meet global environmental challenges. This Assessment can help bridge this gap by contributing to more consistent and coherent energy policies across nations, and ensuring that energy businesses receive timely, clear, and stable policy signals from governments to invest in new technologies, infrastructure, and products. Governments and their constituents need assurances from business and financial markets that security and sustainability challenges can be realistically met, while maintaining healthy regional and global economies.

WEC believes that a new approach to the assessment of national energy policy and practices, built around an appropriately designed index, provides a valuable catalyst for finding answers to such questions and solutions to emerging energy transitions.

Why WEC is uniquely qualified

WEC is the world's foremost multi-energy organisation. Established in 1923, it covers all types of energy - coal, oil, natural gas, nuclear, hydro, and renewables, as well as energy carriers such as electricity, and end-uses. WEC has member committees in nearly 100 countries, including the largest energy-producing and energy-consuming countries. These countries cover the widest variety in terms of resource endowment, constraints, energy systems, level of industrialisation, and institutional and governance forms. Many of the member committees have a longstanding practice of collaboration at the regional and continental level. Thus, WEC member committees collectively have a unique understanding of energy policy and practices and a tradition of sharing results. WEC's member committees reflect the thinking of people working in policy-making and implementation worldwide. They are drawn from industry, government, academic, and non-governmental organisations (NGOs). In line with WEC practice, this Assessment is a bottom-up exercise, drawing on WEC's country committees and their members, ensuring an on-the-ground foundation for the Assessment. WEC members are at the forefront of formulating and implementing energy policy and practices in their countries, and have major responsibilities in finding new pathways for the energy industry.

Scope of Work

Many examples of national assessments focus on the relative effectiveness, attractiveness, or competitiveness of a nation's policy and practices in specific areas. For successful assessments, a number of requirements are paramount:

- A compelling and thoughtful structure to the analysis and assessment.
- A recognition that factors indirectly shaping performance (foundational or enabling factors), are as important to outcomes as those factors that directly shape performance.
- Adequate identification and collection of new primary and available secondary data.
- Sufficient quality assurance of the analysis and assessment.
- Transparency and wide communication of results, and engagement with all those interested in the Assessment.

In WEC's Assessment, each country's performance is analysed according to four areas, or Supports: institutions, economy, social capacity and equity, and environment.

The 3 A's Defined

Accessibility means that a minimum level of commercial energy services (in the form of electricity, stationary uses, and transport) is available at prices both affordable (low enough to meet the needs of the poor) and sustainable (prices reflect the full marginal costs of energy production, transmission, and distribution to support the financial ability of suppliers to maintain and develop these energy services). Getting access to the 2 billion people in the world without reliable commercial energy of any kind is key.

Availability relates to the long-term continuity of supply as well as the short-term quality of service. Energy shortages disrupt economic development, so a well-diversified portfolio of domestic or imported (or regionally) traded fuels and energy services is required. Keeping all energy options open is key.

Acceptability addresses public attitudes and the environment, covering many issues: deforestation, land degradation or soil acidification at the regional level; indoor or local pollution (such as that from the burning of traditional biomass fuels, or because of poor quality coal briquettes or charcoal production); greenhouse gas emissions and climate change on a global scale; nuclear security, safety, waste management, and proliferation; and the possible negative impact of large dams or large-scale modern biomass development. Clean technologies and their transfer to developing countries are key.

Data collection is facilitated by WEC member committees, through alliances with international institutions, such as the International Energy Agency and national energy institutes.

Quality assurance will be strengthened by a Committee of Experts and WEC member committees working with the study teams.

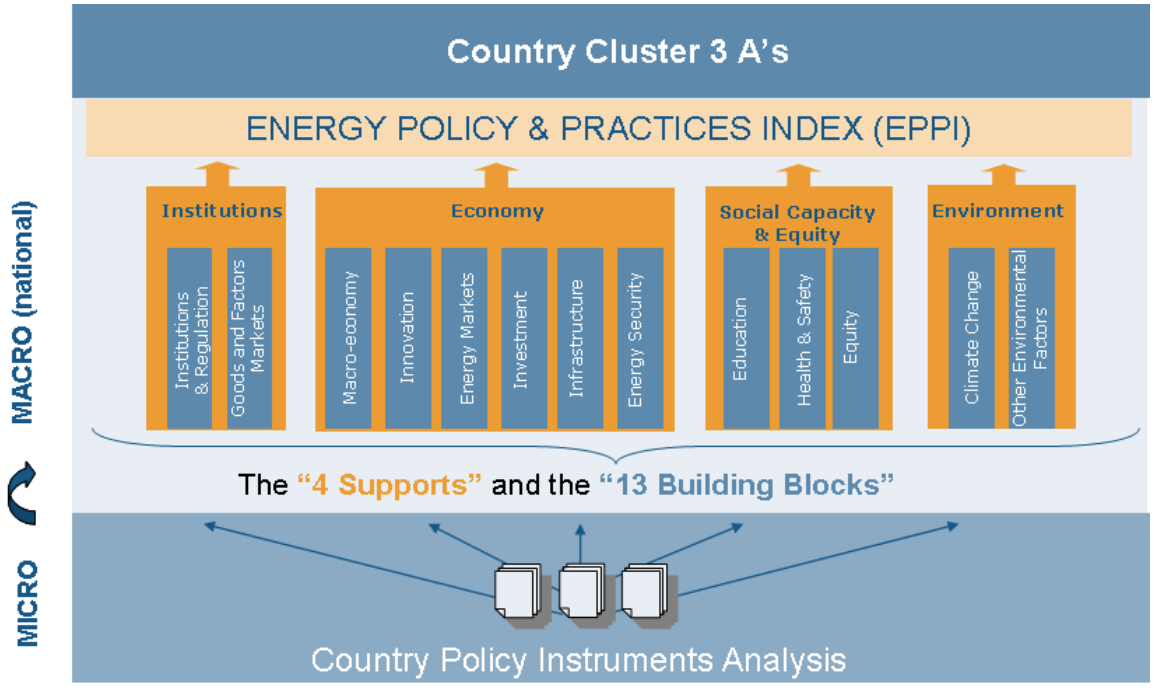
Overall, the aim is to produce a fully transparent assessment and ensure widespread engagement with all relevant stakeholders, including the public.

This Assessment process has two principal components:

1. A periodic assessment of national policy, regulations, and standards and their effectiveness in achieving the 3 A's.
2. An analysis of the vulnerability of an energy system, in particular to human resource availability, manufacturing bottlenecks, water needs, and logistics capability.

The assessment of national policies focuses predominantly, but not exclusively, on the present and interprets historical developments. The vulnerability analysis is more anticipatory in nature and aims to clarify existing and emerging vulnerabilities for decision-makers. This latter work will be expanded upon in a subsequent white paper.

Figure 1
Country Assessment Framework



Methodology

The methodology used in the assessment of a country consists of a three-part process (Figure 1):

- A **macro** assessment examining the overall capability of a country to develop and implement energy policy and practices.
- A **micro** analysis identifying the most effective specific energy policy and practices within a country.
- A **comparison** of country assessments examining comparable countries.

Macro assessment

Central to the macro assessment are indicators measuring the extent to which a country has the necessary attributes in place to achieve the 3 A's. This **Energy Policy and Practices Index (EPPI)** is built around the four Supports and the Building Blocks in Figure 1. The first support measures the capacity of a country to design and implement high-quality policy and practices. The second support predominantly measures the strength and flexibility of the economy, supplemented by the ability to implement energy security (Availability). The final two relate to current performance in addressing different elements and characteristics of the remaining two 3 A's, Accessibility and Acceptability.

The four **Supports**, illustrated in Figure 1 above, are composed of 13 **Building Blocks**:

A. **Institutions** is composed of Institutions and Regulation (A1) and Goods and Factors Markets (A2).

B. **Economy** is composed of Macro-economy (B1), Innovation (B2), Energy Markets (B3), Investment (B4), Infrastructure (B5), and Energy Security (B6).

C. **Social Capacity and Equity** is composed of Education (C1), Health and Safety (C2), and Equity (C3).

D. **Environment** is composed of Climate Change (D1) and Other Environmental Factors (D2).

Each **Building Block** is defined by a set of relevant indicators (see Annexes 1 and 2 for details on both building blocks and indicators). All of the data are sourced from international institutions, national statistical organisations, and national energy institutes. All data are then validated by the individual member committees.

Once the data for the indicators are collected, the results are aggregated through weighting to obtain an index.

The weighting reflects the relative importance of the factors shaping a country's overall energy policy and practices.

In this Assessment, a Principal Components Analysis (PCA)[2] is used to estimate the weighting to be applied, a common tool in other index studies. However, using such a statistical technique has its limitations, and going forward we will review other approaches which may lead to revision of weightings. A working list of weightings is presented in Annex 2.

Micro Analysis

The micro analysis consists of a detailed review of country energy policy instruments aimed at identifying those which contribute most to the effectiveness of a country's energy policy and practices. The goal is to be able to inform the debate over whether certain types of policies allow countries to achieve relatively high scores in the index, and thus hasten achievement of the 3 A's. Japan's Top Runner Programme is an example of such a policy (see box).

Top Runner Programme in Japan

One of the successful energy policies implemented in Japan is the Top Runner Programme. The Top Runner Programme was introduced to save energy in the commercial, residential and transport sectors, where the energy consumption has risen continuously even after two oil crises.

This Programme is a maximum standard value system. Under this system, the targets are set based on the value of the most energy-efficient products on the market and require gradual improvement in energy efficiency. The Programme places the requirement on manufacturers to meet the targets, and includes the display of an Energy Saving label.

The implementation of this policy has exceeded expectations as demonstrated in Table 1 on page 9.

Currently, there are 21 products that have specified targets established through the Top Runner Programme.

For further detail, please see the website, http://www.eccj.or.jp/top_runner/img/32.pdf.

The analysis of policy instruments is also important to highlight and understand the 'trade-offs' between the different objectives and elements of energy policy. In fact, effective energy policies will have to simultaneously reconcile economic, social, environmental, and institutional objectives, as well as deal with regional considerations. These various dimensions, however, might not always be compatible. For example, addressing climate change may have cost implications which can lead to higher energy prices, with consequences on economic growth and social cohesion. To investigate this critical issue, those policy instruments that allow for an examination of the trade-offs between and among the different components of the macro assessment (EPPI) must be considered.

[2] PCA serves to link indicators through measures of co-variance, and by a statistical estimation process apportions weights systematically. See James I Kenkel (1996) Statistics for management and economics, ISBN 0-534-20370-1

Table 1
Some results of Japan's Top Runner Programme

Product category	Energy efficiency improvement	
	Result	Initial expectation
Room air conditioners	67.8% (FY'97→'04)	66.1%
Electric refrigerators	55.2% (FY'98→'04)	30.5%
Gasoline passenger vehicles	22.8% (FY'95→'05)	22.8%
Fluorescent lights	35.6% (FY'97→'05)	16.6%

In this context, the development, implementation, and impact of a variety of energy policy instruments are important, for example:

- market-based policies;
- fiscal policies;
- regulation and standards;
- voluntary agreements;
- public information and awareness; and
- RDD&D support/grants.

For each country, the macro assessment and micro analysis may then be integrated. However, the type, quality, and implementation of such policy instruments are likely to differ between countries. For this reason, a detailed analysis of the various policies and the lessons learned from it are more likely to be conducted among similar countries (within a Cluster) where a more robust comparison can be made between countries that have similar levels of economic development and indigenous energy resources.

Country Clusters

Differing economic development and resources make comparing countries difficult, in part, because countries require different efforts to reach their specific 3 A's objectives in relation to their current status and needs. However, many countries are broadly similar and such countries within a cluster can be reasonably compared. After all the country assessments have been completed, there is an opportunity for realistic country comparisons within clusters. Five broad preliminary groups of countries serve to facilitate this process (Figure 2 on page 10).

The assessment of countries in a cluster is performed by:

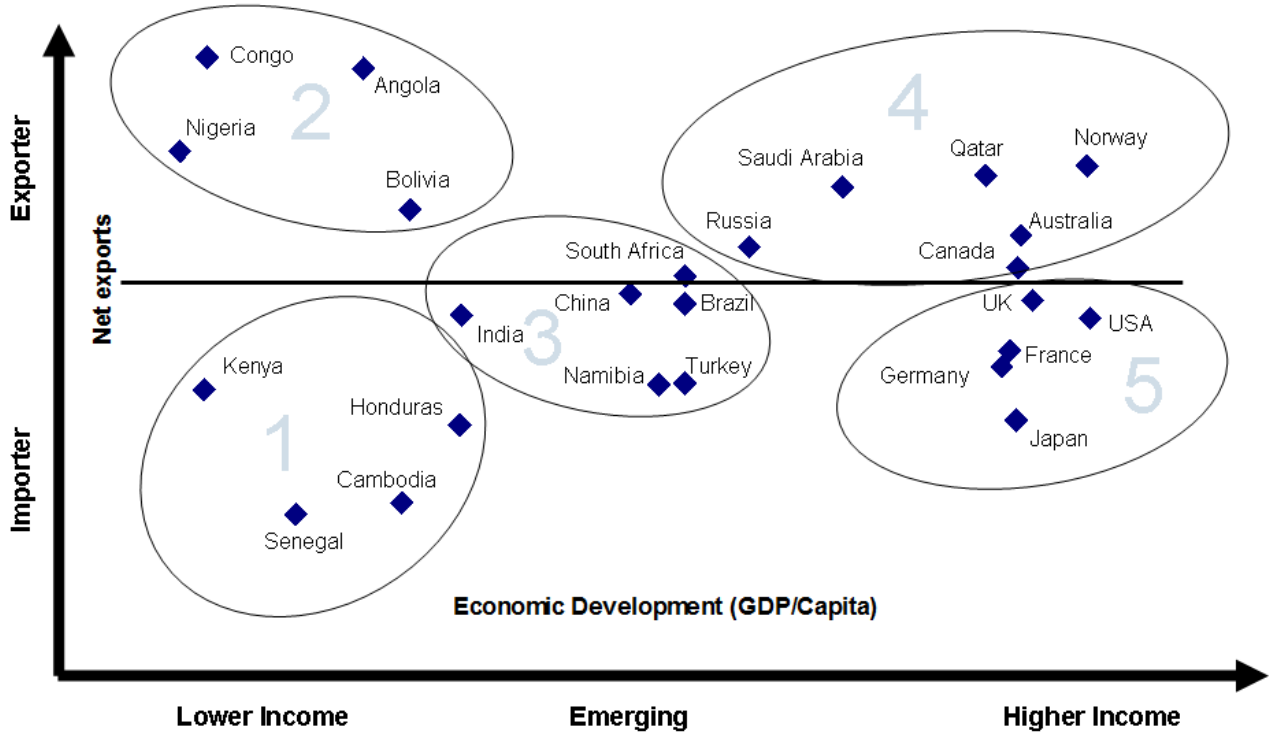
- conducting the macro assessment (and computing the EPPI) for each country within a cluster;
- identifying, using the micro analysis, those policy instruments which relate to relevant performance in one or more building blocks.

Then, countries may be ranked or grouped in performance bands, either for overall performance or for selected Supports. High-scoring countries, and especially policy instruments that support their success, can then be highlighted.

Figure 2

Examples of possible Country Clusters

1 – Lower income - energy importers
2 – Lower income - energy exporters
3 – Emerging (fast growth) moving toward energy importers
4 – Higher income - energy exporters
5 – Higher income - energy importers



Implementation of the Assessment

Each assessment report contains a set of supporting papers. The intention is to explain in detail the methodology, emerging policy issues, and cross-country indications of best policy and practices. There are many possible applications of the country assessment framework, for example:

- Identification of best country policy and practices within a country cluster;
- Highlights of the most effective policy instruments;
- Understanding policy priorities and options across all countries;
- Development of an overall understanding of the principles underlying effective energy policy and practices.

Through this paper, WEC is seeking to collect and share the most helpful practices with policy-makers in international institutions, government, and business. In this way, the goal of accelerating the achievement of the 3 A's will be accomplished.

Table 2

Initial Results of selected countries (unnamed) ranked by performance in the four Support areas, highest at the top

Institutions	Economy	Social capacity & equity	Environment
A	C	B	D
B	B	D	K
C	D	C	I
D	A	A	A
E	H	G	C
F	E	L	B
G	L	K	L
H	G	H	J
I	F	E	E
J	K	F	F
K	J	I	H
L	I	J	G

Cluster 1
Cluster 2
Cluster 3
Cluster 4
Cluster 5

Some initial results of the macro analysis are presented for illustration in Table 2, showing the relative ranking for twelve countries, selected from all Clusters, against the four Supports. The letters A through L denote specific countries. The relative ranking is based on publicly available data using the methodology outlined above. The actual countries are left unnamed, pending full validation of the results by WEC member committees. The shading corresponds to the five clusters in Figure 2, with the lightest shading in Table 2 representing Cluster 1 and the darkest Cluster 5.

Next Steps

How WEC will develop the Assessment of Energy Policy and Practices

The dual purposes of this paper are to introduce WEC's work and invite stakeholders to engage in the process of further refining and improving the results.

A full assessment is planned before COP-15 in December 2009.

Comments are welcome. If you have suggestions for improvement, please contact us at *assessmentstudy@worldenergy.org.*

Annexes

Annex 1
Description of Building Blocks

A. INSTITUTIONS

A1. Institutions and Regulation: energy systems require capital intensive investments which can be made possible only if investors have a strong expectation that expropriation is not likely. This requires that the government be able to guarantee that rule of law is enforced, property rights are respected, a high level of security is ensured with low levels of corruption; and that private arrangements be facilitated by providing the right "checks and balances" in the economy such as minority shareholder's protection, auditing standards, and the ability of courts to equitably settle disputes.

A2. Goods and Factors Markets: energy systems do not work in isolation from other parts of the economy. They require the use of other goods and services, of capital and the employment of workers. As a consequence, efficient goods and services, financial and labour markets are key enablers of effective Energy Policies.

2. ECONOMY

B1. Macro-economy: energy is an essential element of economic growth and development. One of the major achievements of effective energy policies is their ability to sustain growth. On the other hand, a strong and stable economy, namely low cost of capital and low inflation rates provide a positive support for the implementation of business policies, not least in business. These policies facilitate the mostly highly capital-intensive investments of the energy sector.

B2. Innovation: Innovation is very important to support the continuous development of new solutions to the ever changing challenges emerging in the energy sector, as companies and governments struggle to find new energy resources and new ways to use existing ones in a sustainable, efficient and safe manner. This requires an environment that is conducive to innovative activity, supported by both the public and the private sectors.

B3. Energy Markets: Efficient energy markets are a key result of effective energy policies. This building block measures the efficiency of energy markets (in particular the presence and effectiveness of price signals) by looking at the level of subsidies and the share of the energy spending in the economy. The share of FDI in energy investments is also a potential indicator of the openness of a national energy system.

B4. Investment: Investments are critical in ensuring that the right quantity and quality of infrastructure is in place to guarantee the availability of energy. This is measured by the proportion of gross fixed capital formation to overall country wealth and by the level of investment in the energy sector.

B5. Infrastructure: The existence of a high-quality infrastructure is critical for ensuring the efficient functioning of the energy system - economies depend on electricity supplies (and other sources of energy) that are free of interruptions and shortages, to ensure that businesses and factories can work unimpeded. High-quality infrastructure also helps ensure that households receive reliable energy at affordable prices. Energy systems depend also on many other key infrastructures: roads, rail, ports to transport the fuels or the materials, telecommunication networks that enable modern and reliable management of the system, etc.

B6. Energy Security: Secure supplies of energy are critical for the efficient functioning of economies. At the same time, secure and predictable foreign demand for energy resources is critical for energy rich countries. Security of supply/demand is also essential to avoid extreme price volatility of energy resources with consequent negative economic. Energy security, in that perspective, has two main dimensions:

- Long-term security measures the risks of demand (or supply) shocks and disruptions. It is measured by the diversity of supply/demand (a more diverse supply/demand is more resilient to shocks) and the energy intensity of the economy (energy consumption/GDP) – the less an economy is "dependent" on energy, the less it is exposed to potential shocks.
- Short-term security: measured by the existence of spare capacity or reserves (e.g., in the form of oil stocks, gas storage or spare electricity generation capacity)

C. SOCIAL CAPACITY AND EQUITY

C1. Education: A high standard of education is an important pre-condition for a skilled labour force and for sustaining a robust rate of innovation. It is thus important to help guarantee investment in and the efficient functioning of the energy system. This building block measures the quantity and quality of education in the general population, the training of professionals and the availability of engineers and scientists.

C2. Health and Safety: Investments in health services and in safety are important not only for the wellbeing of the society (and therefore the capacity/flexibility to adjust to changes), but also for the performance of the economy and its energy sector as it helps ensure a more productive workforce.

C3. Equity: Balanced distribution of income and access to services (including energy) are important elements for the development of a country and the creation of a productive environment in which policies, including energy policies, can be implemented. Policies must play a role in the avoidance of social tensions within a country by preventing an inordinate level of inequalities (e.g., access to affordable energy).

D. ENVIRONMENT

D1. Climate Change: This building block measures the performance of a country in terms of its policies to reduce greenhouse gas emissions (measured as CO_2 (equivalent). This is measured for example by considering emissions per capita but also emission per unit of economic output; by looking at the share of low-carbon technologies in the generation mix; and by measuring the cost of policies (marginal costs of avoided emissions).

D2. Other Environmental Factors: The environmental performance of a country's energy policy is also measured through a factor connected to its levels of air and water pollution, and water stress.

Annex 2
Indicators and Weights

The table below shows the indicators used in the Macro assessment, the sources used, and also contains the preliminary weights that are applied based on Principal Components Analysis. (see footnote, p. 8)
In reading this table:

- Each building block is composed of a number of indicators. The numbers in the brackets represent the weighting of each indicator in a given building block. The weightings for the indicators sum to 100% for each building block.
- Each support is composed, in turn, by a number of building blocks. The numbers in the brackets represent the weighting of each building block in a given support. These weightings sum to 100% for each support.
- At present all supports are weighted equally within EPPI.

Index	Support	Building block (weight)	Indicator (weight)	Source
EPPI	Institutions (25%)	Institutions & Regulation (55%)	Rule of law (20%)	World Bank Governance Indicators
			Protection of property rights (20%)	Fraser Institute – Economic Freedom of the World Index
			Level of corruption (20%)	Transparency International
			Regulatory quality (20%)	World Bank Governance Indicators
			Private institutions (20%)	World Economic Forum – Global Competitiveness Report
		Goods and Factors Markets (45%)	Goods markets (30%)	World Economic Forum – Global Competitiveness Report
			Financial markets (25%)	World Economic Forum – Global Competitiveness Report
			Labour markets (22.5%)	World Economic Forum – Global Competitiveness Report
			Ease of business (22.5%)	World Bank Development Indicators
	Economy (25%)	Macro-economy (21%)	GDP growth rate (18%)	International Monetary Fund
			Inflation rate (19%)	International Monetary Fund
			Long term interest rate (20%)	Global Insight
			GDP per capita (21%)	International Monetary Fund
			Car ownership/capita (tbd)	*Not available at this stage*
			Industry share of GDP (22%)	World Bank Development Indicators

Index	Support	Building block (weight)	Indicator (weight)	Source
EPPI	Economy (25%)	Innovation (12%)	Total R&D expenditure/GDP (33%)	United Nations Human Development Index
			Energy R&D/GDP (33%)	International Energy Agency
			Patents per capita (33%)	United Nations Human Development Index
		Energy Markets (12%)	Energy sector size per unit of GDP (tbd)	*Not available at this stage*
			FDI in energy sector (tbd)	*Not available at this stage*
			Energy subsidies/total energy spending (tbd)	*Not available at this stage*
		Investment (12%)	Investment/GDP (50%)	World Bank Development Indicators
			Energy investment/Total investment (50%)	*Not available at this stage*
		Infrastructure (21%)	Quality of infrastructure (general) (50%)	World Economic Forum – Global Competitiveness Report
			Reliability in energy networks infrastructure (distribution losses on networks) (50%)	International Energy Agency
			Development of energy infrastructure (tbd)	*Not available at this stage*
		Energy Security (21%)	Diversity of supply (31%)	International Energy Agency
			Energy intensity (19%)	International Energy Agency
			Spare capacity: capacity margin (electricity), strategic stocks (oil, gas) (15%)	US Energy Information Administration
			Level of import/consumption (for net energy importers) (35%)	International Energy Agency
			Diversity of imports/exports (HHI index) (tbd)	*Not available at this stage*
			Export Revenues/GDP (for net energy exporters) (tbd)	*Not available at this stage*

tbd – weighting to be determined

Index	Support	Building block (weight)	Indicator (weight)	Source
EPPI	Social capacity and Equity (25%)	Education (30%)	Enrolment percentages (for primary, secondary, and tertiary education) (50%)	United Nations Human Development Index
			Number of engineers and scientists per capita (50%)	United Nations Human Development Index
		Health and Safety (40%)	Health spending/capita (33%)	United Nations Human Development Index
			Life expectancy (33%)	United Nations Human Development Index
			Infant mortality (33%)	United Nations Human Development Index
			Safety in the energy sector (tbd)	*Not available at this stage*
		Equity (30%)	Gini index (50%)	United Nations Human Development Index
			Access to modern energy (% of population) (50%)	United Nations Human Development Index
			Energy spending/Households income (tbd)	*Not available at this stage*
			Low-income households supports (tbd)	*Not available at this stage*
	Environment (25%)	Climate change (45%)	CO_2(eq) emissions per capita (25%)	International Energy Agency
			CO_2(eq) emissions per unit of GDP (37.5%)	International Energy Agency
			Emissions intensity of power sector (37.5%)	International Energy Agency
			Emissions intensity of transport sector (CO_2(eq)/pkm) (tbd)	*Not available at this stage*
		Other Environmental Factors (55%)	Air pollution (30%)	Yale – Environmental Performance Index
			Water quality (30%)	Yale – Environmental Performance Index
			Water stress (40%)	FAO – Aquastat database
			Biodiversity (tbd)	*Not available at this stage*

tbd – weighting to be determined

Annex 3
Study Group Membership

Assessment and Vulnerabilities Study Group Members

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Study Director: Angela Wilkinson (UK)

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