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CONSEIL MONDIAL DE L'ÉNERGIE

Assessment of Energy Policy and Practices

World Energy Council 2008

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



Assessment of Energy Policy and Practices

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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 White 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.

Executive Summary

The modern industrial world exists by virtue of its command over energy production, supply, transport and use. Energy 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. 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 energy 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 will 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 move now at a very quick pace—under considerable uncertainty, and much faster, 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 increase 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 world-wide.

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

- ▶ 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.

We recognise that 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, with the following key dates:

- **September–November 2008.** Collation and analysis of feedback generated by this white paper and other outreach activities, the results of which feed a preliminary assessment of 11 countries.

- **December 2008.** Launch of the preliminary version of WEC's Assessment of Energy Policy and Practices in time for the UN COP-14 summit in Poznan. WEC will take additional opportunities to present this work.
- **December 2008–November 2009.** Work begins on the first full assessment, covering some 50–60 countries, with the report available for COP-15, to be held December 2009 in Copenhagen.

We very much welcome comments. If you have any suggestions for the improvement of the methods discussed, please contact us at assessmentstudy@worldenergy.org.

Introduction

Emerging energy transitions are creating a turbulent environment for the energy industry that is testing governments, from the local level to the international. Shifts in energy demand are taking place faster than expected, challenging existing infrastructure and suppliers, and is a significant driver of higher energy prices. 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 is 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, the majority of the world's population still lacks reliable and affordable access to modern energy. And although there is 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 doubled in price, with comparable increases in the prices of natural gas and coal.
- ▶ **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 increased inflation and economic slowdown, 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 work¹ 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 might 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 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, there is a gap that has to be bridged at a time when significant investments have to be made to ensure security of supply and to meet global environmental challenges. This Assessment can help to bridge the 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 the 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, will provide a valuable catalyst for finding answers to such questions and solutions to the 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

¹

http://www.worldenergy.org/documents/scenarios_study_online_1.pdf

are drawn from industry, government, academic, and non-governmental organisations. 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 country 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.

The assessment rests on an analysis of each country's performance in five areas, or **Supports**: institutions and regulatory framework, economy and markets, infrastructure and energy security, social capacity and equity, and environment and climate.

The first two enabling Supports (institutions/regulatory framework and economy/markets) are complemented by three Supports, each of which addresses performance in meeting one of WEC's 3 A's: accessibility, availability, and acceptability. Note that the 3 A's (see box below) have been the basis for WEC's work since 2001 — and they also underpin the analysis in *Energy Policy Scenarios to 2050*.

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 will be facilitated by WEC member committees, through alliances with international institutions, such as the International Energy Agency, and local 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 main components:

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

The national assessment work 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 and be the subject of a subsequent white paper.

Methodology

The methodology used in the assessment of a country consists of a three-part process:

- 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, and
- A **comparison** of country assessments examining comparable countries.

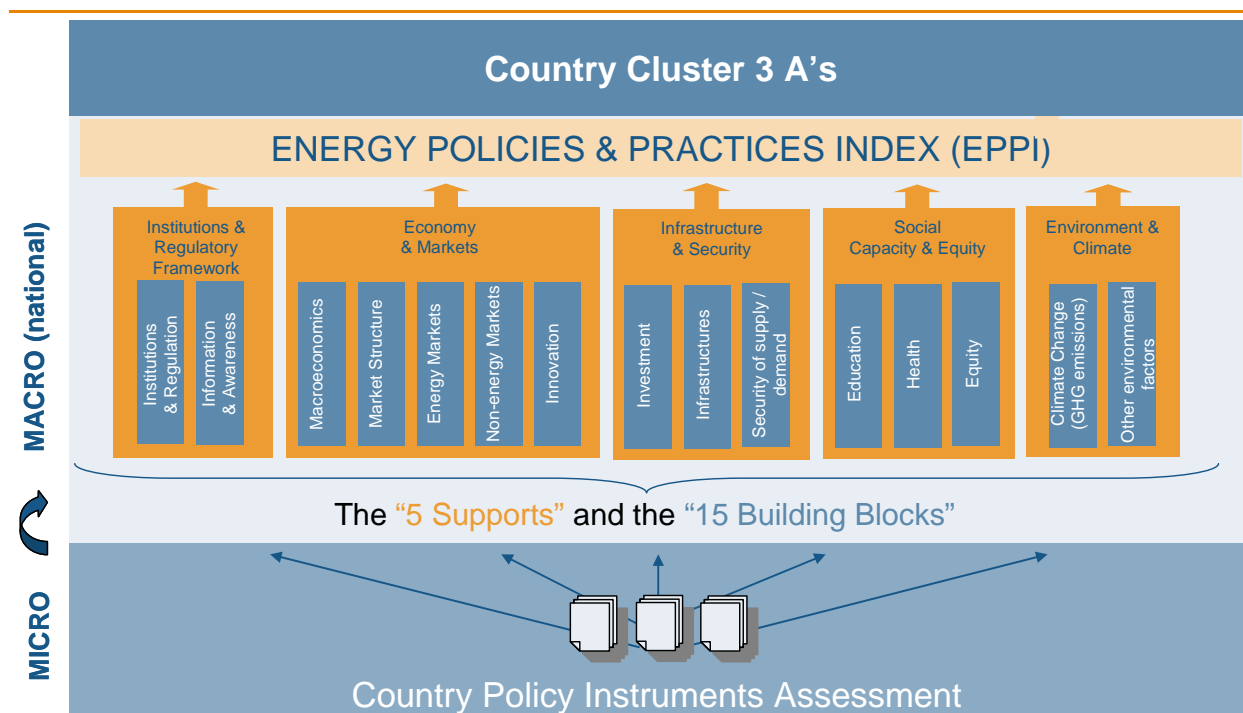
Macro Assessment

Central to the macro assessment is an index 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 five Supports previously listed. The first two are general, measuring the capacity of a country to design and implement high-quality policy and practices. The latter three relate to current performance in meeting the 3 A's with respect to the present status and needs of the country.

The Supports, outlined in *Figure 5.1 on page 8*, are composed of a number of Building Blocks:

1. **Institutions and Regulatory Framework**, composed of institutions and regulation, and information and awareness.
2. **Economy and Markets**, composed of macroeconomics, market structure, energy markets, non-energy markets, and innovation.
3. **Infrastructure and Security**, composed of investment, infrastructures, and security of supply/demand.

Figure 5.1
Country Assessment Framework



4. **Social Capacity and Equity**, composed of education, health, and equity.
5. **Environment and Climate**, composed of climate change (GHG emissions) and other environmental factors.

Each Building Block is defined by a set of relevant indicators (see Annex 1). Some are based on quantitative statistical data and others on more qualitative information. The data will be retrieved from international institutions, national statistical organisations, national energy institutes, and a questionnaire enabled by WEC's world-wide network of member committees.

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. For each country, the macro assessment and micro analysis will then be integrated. An example of such integration for a country is shown in the next section.

Comparison of Country Assessments

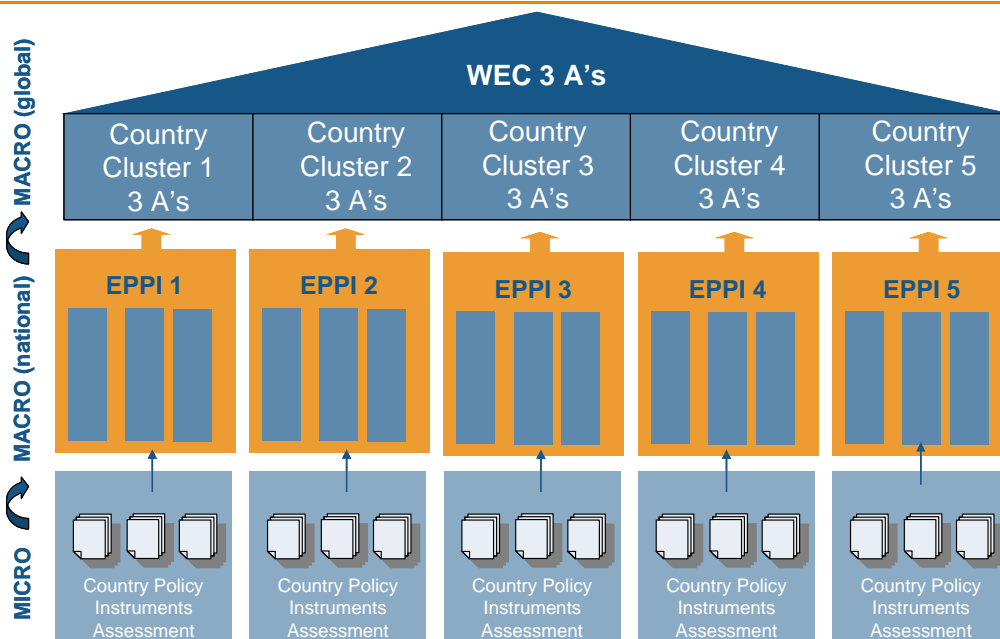
The approach to a comparison of country assessments is outlined in *Figure 5.2* on page 9.

To conduct the overall country assessment, a translation of the 3 A's for each country cluster is made.

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 in these "country clusters" can be reasonably compared. After all the country assessments have been completed, there is an opportunity for realistic country comparison within clusters. Five broad groups of countries serve to facilitate this process (*Figure 5.3* on page 10).

Figure 5.2
Comparison of countries within Country Clusters



Next, an assessment of all countries in the cluster is performed as follows:

- conduct the macro assessment and compute the EPPI for each country within a cluster,
- identify, with the micro analysis, the policy instruments which relate to relevant performance in one or more building blocks.

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

Implementation of Assessments

In addition, each assessment report will contain a set of supporting papers.

In the first full assessment in 2009, covering some 50–60 countries, the intention is to cover a detailed explanation of the methodology, emerging policy issues, and cross-country best policy and practices. There are many possible applications of the country assessment framework, for example:

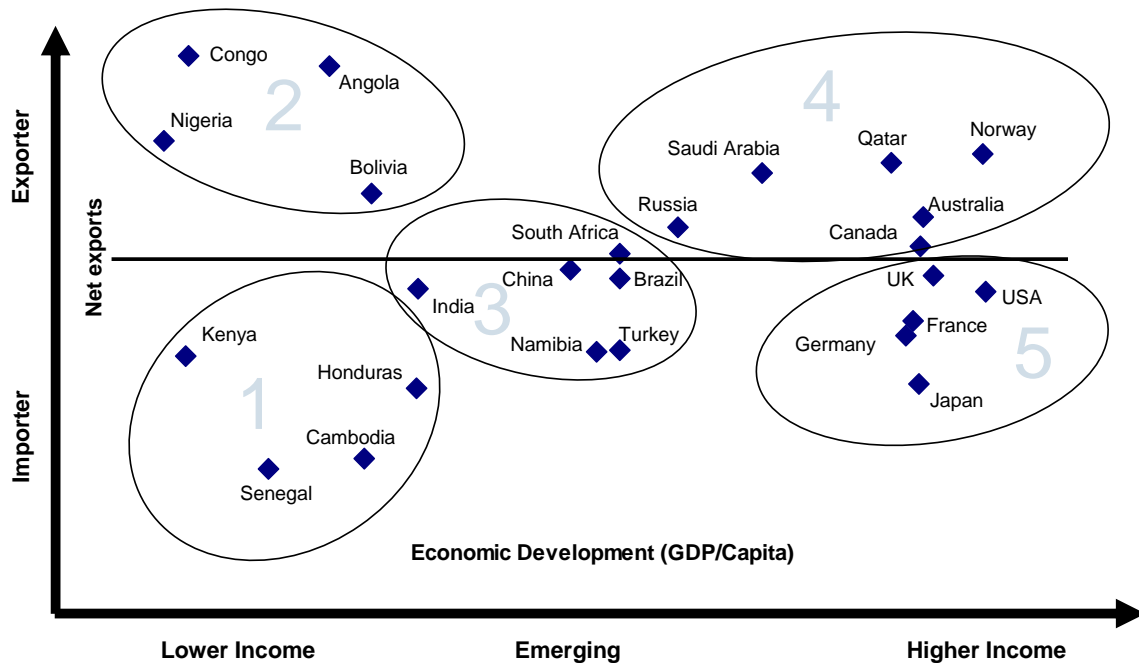
- Identification of best country policy and practices, within a country cluster,

- 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 views on what would be most helpful to policy-makers in international institutions, government, and business.

Figure 5.3
Country Clusters

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



Country Assessment Illustration

In this section, we illustrate how the methodology will be applied to an assessment of a country's energy policy and how it can be compared with other countries' performances.

The first step is to assess the country's relative economic development and energy resource situation that determine which country cluster is appropriate for the country.

Example of country analysis

Japan, one of the most highly developed economies relying on imports for most of its energy, is used as a country example. Japan is an example of a country in cluster 5 (see *Figure 5.3*).

Once the position within a cluster is identified, the assessment proceeds in three steps for each country:

1. Calculation of the Energy Policy and Practices Index (EPPI)

The EPPI is built around five Supports, which in turn are composed of fifteen Building Blocks.

Each Building Block is defined by a number of indicators. Many of the indicators are based on published data, others on more qualitative information from questionnaires. Take, for example, the climate change Building Block. Indicators under consideration are the absolute volume of carbon emissions; overall carbon intensity (CO₂ per unit of GDP); the carbon intensity of electricity generation, and/or the share of generation from non-fossil fuels technologies. The provisional list of indicators is in *Annex 1*.

The indicators are then weighted and aggregated for each Building Block. The Building Blocks results are then weighted to produce a sub-index for each Support. Once all Supports have been calculated, then the overall EPPI can be produced. (see *Table 1* on page 12)

2. Review of a country's energy policy and practices

At this stage, the analysis identifies specific energy policy instruments that have helped a country to score high (or low) in one or more Building Blocks. Various types of policy instruments are considered: market-based policies; fiscal policies; regulation and standards; voluntary agreements; public information and awareness; and RDD&D² support/grants. However, the type, quality, and implementation of such policy instruments are likely to differ between countries belonging to different clusters since they have somewhat different specific objectives.

Japan has a well-developed and robust energy RDD&D programme, to which significant government resources are consistently devoted. In Japan, energy public energy R&D was 0.08% of GDP in 2005, while in most other IEA countries, it was below 0.03%. The government is expected to continue R&D investment in the environmental and energy sectors, injecting about 30 billion USD (about 0.15% of GDP) into these sectors over the next five years. This policy of RDD&D support has created a positive environment for higher investment in energy infrastructure, which has led to high performance in Building Block's for infrastructure and security, but also to a diversified energy mix with a high share of low carbon generation technologies.

3. Comparison of country assessments

Finally, countries' performances are compared, based on individual assessments, in the cluster:

- Using the EPPI scores, countries are ranked or grouped within clusters in performance bands such as high, medium or low performance.
- The scores in each Building Block or Support, within a cluster, are analysed, enabling the WEC team to highlight and identify potentially valuable policy instruments that have led one country to score high in one or more Building Blocks.

Cluster 5 contains countries such as France, Germany, UK, and the US. The effectiveness of Japan's policy and practices will be compared with these countries.

A fully-fledged application of the country assessment framework, which will include Japan, will be undertaken for the eleven-country assessment later this year.

² Research Development Demonstration and Deployment

Table 1: Indicators for the Calculation of EPPI for Japan (selected examples)

Notes: 1) Index value (index from 0 to 10) – source: World Bank

2) Index value (index from 0 to 10) – source: WEF

3) Average annual rate between 1990–2005

4) Source: Fraser Institute

5) Source: Datamonitor

6) Source: World Bank

7) Source: IEA

8) Source: US DOE-EIA

9) Index value (index from 0 to 1.94) – source: IEA

Where not specified source is United Nations (Human Development Indicators)

Institutions & Regulatory Framework		Economy & Markets		Infrastructure & Security		Social Capacity & Equity		Environment & Climate	
Institutions & Regulation	Rule of law: 8 ⁽¹⁾	Macroeconomics	Growth of GDP: 0.8% ⁽³⁾	Investment	Gross capital formation (% of GDP) 23% of GDP ⁽⁶⁾	Education	Education (secondary school enrolment ratio) 100%	Climate Change	tCO ₂ per capita 9.9 ⁽⁷⁾
	Protection of property rights: 9 ⁽²⁾		Wealth: GDP/capita, USD 33,800		Share of energy R&D spending 0.84% of GDP ⁽⁷⁾		Government spending on education 3.3% of GDP		tCO ₂ per unit of GDP 0.36 ⁽⁷⁾
			Energy consumption: 532 mtoe ⁽⁸⁾						Power sector CO ₂ intensity tCO ₂ /MWh 0.42 ⁽⁷⁾
Information and awareness	TBD	Market Structure	Level of subsidies and transfers: 18.4% of GDP ⁽⁴⁾	Infrastructures	TBD	Health	Public health spending 6.3% of GDP	Other environmental factors	TBD
			Government share of investment/ total investment: 13.1% of GDP ⁽⁴⁾				Life expectancy 82.3 years		
							Infant mortality n/a		
		Energy markets	TBD	Security of Supply/demand	Diversity of supply (Shannon Wiener index) 1.4 ⁽⁹⁾	Equity	Global inequalities: Gini Index 2.49 ⁽¹⁾		
			Energy Intensity of GDP 0.15 (mtoe/mil USD) ⁽⁸⁾		Access to electricity 100%				
			Spare Reserves Oil stocks 113 days of consumption ⁽⁸⁾						
		Non-energy markets	Goods markets: 5 ⁽²⁾						
			Financial markets: 5 ⁽²⁾						
			Labour markets: 5 ⁽²⁾						
		Innovation	Spending on R&D (public and private) 3.14% of GDP						
			Patents (per million people) 272 ⁽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. Major dates for the assessment are as follows:

- **September–November 2008:** Collation and analysis of feedback generated by the white paper and other outreach activities. The results will feed the preliminary assessment of 11 countries, whose details are included in Annex 2.
- **December 2008:** Launch of the preliminary version of the WEC Assessment of Energy Policy and Practices in time for the UN COP-14 summit in Poznan. WEC will take additional opportunities to present this work.
- **December 2008–November 2009:** Work begins on the first full assessment, with the report available for COP-15, to be held in December 2009 in Copenhagen.

We very much welcome comments. If you have suggestions for improvement on the issues and methods discussed, please contact us at assessmentstudy@worldenergy.org.

Annex 1

Working List of Indicators

Institutions & Regulatory Framework		Economy & Markets		Infrastructure & Security		Social Capacity & Equity		Environment & Climate	
Institutions & Regulation	Public institutions (rule of law, property rights, corruption, safety and security, ...)	Macroeconomics	Growth of GDP GDP/cap	Investment	Gross Formation of Fix capital/GDP	Education	Quantity and quality of education (primary, secondary and universities)	Climate Change	CO2 emissions/cap
	Private institutions (protection of minority shareholder's, auditing standards,...)		Energy Resources (toe)		Share of energy R&D spending		Government spending on education		CO2 intensity/kWh (power sector)
			Energy Consumption (toe)				Number of engineers & scientists/cap		Marginal price of avoided CO2 (power sector)
Information and awareness	Information campaigns spendings	Market Structure	Level of global subsidies and transfers	Infrastructures	Quantity and quality of energy infrastructures	Health	Health spending	Other environmental factors	Air pollution
	Eco-labelling		Government share of investment /total investments		Quantity and quality of non-energy infrastructures (rail, roads, telecommunications)		Life expectancy		Water quality
	Education and training of professionals						Infant mortality		Biodiversity
		Energy markets	Energy spendings/GDP	Security of Supply/demand	Diversity of supply/demand	Equity	Global inequalities: Gini index		
	Level of subsidies/Energy spendings		Energy Intensity		Energy spending/income				
			Reserves and capacity margins				Access to modern energy		
		Non-energy market	Goods markets						
			Financial markets						
			Labour markets						
		Innovation	R&D spending/GDP						
			Patents/GDP						

Annex 2

Countries to be assessed in 2008

A list of potential countries to be reviewed for the preliminary assessment

- **Brazil:** lower-income country (GDP per capita of \$8,603, with a rapidly growing economy – growth of 2.6% a year between 1990 and 2005 and expected to grow by 3.3% a year to 2020); net importer of energy (net imports of 37 mtoe, equivalent to 17% of energy consumption).
- **China:** emerging country (GDP per capita of \$4,078, with a rapidly growing economy – growth of about 10% a year between 1990 and 2005); net energy importer (net imports of 91 mtoe, equivalent to 6% of energy consumption).
- **France:** higher-income country (GDP per capita of \$30,492); relies on imports for about half of its energy needs (net imports of 149 mtoe, equivalent to 55% of energy consumption).
- **India:** emerging country (GDP per capita of \$2,156); net energy importer (net imports of 105 mtoe, equivalent to 28% of energy consumption).
- **Japan:** higher-income country (GDP per capita of \$30,315); relies on imports for most of its energy (net imports of 435 mtoe, equivalent to 82% of energy consumption).
- **Russia:** higher-income country (GDP per capita of \$11,832); one of the largest exporters of energy (net exports of 528 mtoe).
- **Saudi Arabia:** higher-income country (GDP per capita of \$21,236); one of the largest exporters of oil and gas (net exports of 444 mtoe).
- **Senegal:** lower-income country (GDP per capita of \$1,555); net importer of energy (net imports of 2 mtoe, equivalent to 95% of energy consumption).
- **South Africa:** emerging country (GDP per capita of \$8,488); marginally net exporters of energy (net exports of 24 mtoe).
- **UK:** higher-income country (GDP per capita of \$31,580); recent importer of energy (net imports of 30 mtoe, equivalent to 13% of energy consumption).
- **USA:** higher-income country (GDP per capita of \$41,969); relies on imports for about a third of its energy (net imports of 732 mtoe, equivalent to 31% of energy consumption).

Note: GDP data are from IMF (2005); net exports/imports data are from US EIA (2005).

Annex 3**Study Group Membership****Assessment and Vulnerabilities Study Group Members****Chair:** Thulani S. Gcabashe (South Africa)**Study Director:** Angela Wilkinson (UK)**Members:**

Rezki Si Bachir (Algeria)
 Boukhoulef Yazid (Algeria)
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