Sustainable Energy Briefing 4: Integrated Energy Planning

South Africa is currently embarking on a second phase of integrated energy planning, as required by the 1998 White Paper on Energy Policy. This briefing explores what integrated energy planning is[1], what it should include, and reports on progress made by the Department of Minerals and Energy in undertaking IEP II.

What is integrated energy planning?

Put very simply, integrated energy planning involves estimating how much energy all the different consumers (e.g. industry or households) will need in the future to deliver certain services; and then identifying a mix of appropriate sources and forms of energy to meet these energy service needs in the most efficient and socially beneficial manner.

Integrated energy planning is much more than just energy planning. Energy planning has traditionally been done by energy companies to work out their company strategy. Since this was aimed at increasing their share of the market and making profit, energy planning only considered the economic benefits to the company, without taking into account the nature of users' real needs, nor the macro-economic[i], social and environmental consequences of different options.

In contrast, ***integrated*** energy planning allows for a departure from business as usual, and has three key requirements:

- The inclusion of all energy service needs and supply side options, including energy savings and efficiency interventions
- The inclusion of all costs and benefits (economic, social and environmental), including long-term benefits and costs and macro-economic impacts (e.g. economic competitiveness in 20 years) in describing possible futures (scenarios) for the entire energy sector
- Setting goals for the future, based on a description of the most desirable situation at the end of the planning horizon, that embrace the whole energy system and its impacts

Why do integrated energy planning?

The objective of integrated energy planning is to decide how to meet energy service needs in the most efficient and socially beneficial manner, keeping control of economic costs while also serving national imperatives such as job creation and poverty alleviation. It also allows for consideration of substitution between energy carriers, e.g. reducing electricity demand through mandatory introduction of solar water heating or fuel switching away from imported oil.

Phases of integrated energy planning:

There are three main phases to integrated energy planning:

Phase 1: Reference Energy System and how it evolved

The foundation for energy planning is a comprehensive description of the whole energy system for the country (or city, or region), as it exists at present. This is known as the reference energy system (RES). Due to the challenges of data collection and processing, the RES will generally be two or three years in the past

[i] For example scarcity value – as a resource e.g. coal becomes scarcer, so it becomes more expensive.

by the time it is completed. The core of the RES in an 'energy balance' that records, in a standard energy unit (e.g. Gigawatt hours), all:

- primary energy supply (e.g. oil, coal, hydro; including imports and exports);
- transformation to secondary energy (electricity generation, oil refining, coal to gas and liquid fuel etc.);
- transport and distribution (including a reflection of system losses) &
- final consumption, per sector (e.g. iron & steel, mining and quarrying, rail transport, residential).

This information is presented for all the energy carriers, both primary sources: coal, oil, natural gas, nuclear, hydro, solar, geothermal, wind; and secondary carriers: petroleum products, electricity, manufactured gas and heat. A complete energy balance will reflect losses in transformation, such as approximately 65% of energy lost in thermal electricity power plants (coal and nuclear), energy used in mining coal and consumed by utilities, as well as losses in distribution.

The RES should also take account of the modes of final consumption, in other words differentiate between **final energy**, as delivered to customers, (electricity, petrol, gas) and **useful energy**, i.e. the energy output (light, heat, movement) of the end-use appliance (e.g. lamp, stove, geyser, pump or car). This is important because the ultimate objective of the energy system is to deliver energy services (e.g. heat for cooking, water heating and industrial processes or mechanical power for processing, manufacture and transport).

In addition to this 'snapshot' of the energy system, we need information on the trends and dynamics that led to the current situation (the video as well as the latest snapshot). This will include data showing the drivers of supply and demand (including economic growth, international markets and political agendas) and how they interacted – for example if rising oil prices led to increased energy efficiency, as in the USA in the early eighties, or high prices and sanctions leading to an emphasis on energy security in South Africa, sufficient to justify massive subsidies for coal to liquid fuel and electricity plants.

Phase 2: Energy forecasting and scenarios

Energy forecasting involves using the snapshot and video taken in phase 1 to map possible evolutions of the energy system. The first step is to choose a time horizon for the planning exercise. The energy forecast must then describe the evolution of the reference energy system from the base year to the horizon year. In doing this, the energy forecast consists of two parts:

- Future energy demand
- Future energy supply to meet that demand (from sources through to useful energy)

Energy forecasting does not simply mean predicting the future based on business as usual. It should also take account of 'suppressed demand' (needs that are not expressed through purchasing power e.g. services for the poor) and the potential for changes in market conditions e.g. commodity prices and pollution charges. Thus forecasting will indicate a range for future energy demand under different assumptions.

Scenarios then examine the conditions under which future energy demand can be met in ways that are most beneficial socially, economically and environmentally. By considering which systems would be best for the future, and not simply assuming business as usual, we can then decide what policies (for example increasing the current renewable energy target of less than 1% by 2013 to 20% by 2020) and strategies (once off subsidies versus feed-in-tariffs to support the introduction of renewable energy into the power market) are needed to transform the energy system to best serve the needs of society as a whole, rather than simply increasing sales or profits for business on the supply side.

To help determine what is viable (within given constraints such as resource availability) and how policy instruments are likely to impact on the energy system and beyond, many models are available. These models produce different scenarios or possible futures. While these models are very useful in energy forecasting, they are not perfect. Rather they're tools to test the impacts of possible strategies and policies.

Phase 3: Planning

With these different future energy scenarios in mind, the actual plans to reach the best possible future can be drawn up. It's important that policy makers are involved in this phase, as they are the people responsible for ensuring that the good of South Africa's society as a whole is prioritised over sectoral interests. So for example, policy makers may well decide to pass laws to support the introduction of renewable energy because thousands of jobs will be created, even if in the short term this choice is more expensive than business as usual. Similarly parliament may call for mandatory standards for energy efficiency and conservation.

Integrated energy planning in South Africa

South Africa has recently undertaken a first round of integrated energy planning. The Department of Minerals and Energy published the first Integrated Energy Plan for The Republic Of South Africa in March 2003. Unfortunately, IEP I is at best an Energy Plan, rather than an ***Integrated*** Energy Plan – as it makes forecasts about business as usual. To its credit, IEP I does recognise this, and identifies eight significant gaps, including that IEP I:

- Failed to consider the impact of legislation that would "facilitate the expansion of renewable energy and energy efficiency measures."
- Did not include "Environmental Externalities." South Africa currently has the cheapest electricity in the world because the price paid for coal-generated electricity includes less than half of all the costs incurred in producing it. Externalised environmental costs that are not integrated in the sales price include the impacts of air pollution and greenhouse gas emissions . When these externalities are included, coal generated electricity becomes much more expensive, and renewable energy options become more competitive.
- Did not consider the trade off between least cost energy production and other factors such as job creation and social development – despite both of these being priority areas for South Africa
- Did not include the effects of certain interventions, for example environmental funding in the modelling "because policy regarding national environmental taxing/funding is not yet resolved." Yet the whole purpose of modelling is to model the effect of such interventions, rather than waiting for them to be in place. By modelling interventions you are able to see their effect, and so decide whether you do actually want them.
- Did not include all stakeholders.
- Traded off developing optimal models for future scenarios against the need to speed up results.

Clearly, IEP I was undertaken with good intentions, though as the process progressed, DME officials realised that the project was much bigger than anticipated, requiring far more data and resources than was allocated. Instead of being a planning document, IEP I ended up being a discussion document of the different components of the energy system.

In recognition of these shortcomings, IEP I concludes, "The gaps listed above are scheduled to be addressed in Phase II of the integrated energy planning programme."

Officials responsible for energy planning in the Department of Minerals and Energy report that IEP II is underway, with the DME in the process of:

1. Updating energy data
2. Reviewing the gaps of IEP I
3. Arranging for a workshop, scheduled for March 2005, where stakeholders can give guidance on the most important issues to be included in IEP II.

In addition, DME officials made available a 14- step outline resulting in the completion of IEP II at the end of 2006 (see Appendix 1). Two points need to be made with regards to this outline:

1. The DME still needs to develop a Workplan. It's critical that this allows for meaningful stakeholder input, including public participation to strengthen the process. For example, public participation in step 9 (present [reference] scenario to stakeholders), would:
   - Ensure that the reference scenario is integrated – that it includes the whole energy sector, as well as social, economic and environmental issues
   - Help shape the scenarios or forecasts that will be developed and modelled in steps 10 and 11, again ensuring that they are integrated
2. It's critical that policy makers are part of the stakeholder group that the findings are presented to in step 13, as they must be involved in step 14 – developing the final plan. This is because policy makers are best suited to ensuring that an energy plan for South Africa is based on the overall good of the country, rather than avoidance of short-term costs. This plan will not be a prescriptive blue-print, but rather provide guidelines for future energy development, for example, it could stipulate that all new coal-fired power generation must have an efficiency of no less than 45%.

Appendix 1: DME's 14-step process leading to the completion of IEP II:

1. Current work, which includes:
   - Updating IEP data
   - Reviewing IEP 1 gaps
   - Arranging for a stakeholder workshop, which has been planned for March 2005. The purpose of the workshop is to review and to get the experts guidance on what they see as most pertinent issues in the South African energy economy and what should be the focus for IEP2.
2. Based on the inputs received from experts and government priorities the scenarios will be decided upon.
3. Develop strategy and the Work plan
4. Present the work plan
5. Contractual and Legal arrangement for consultants
6. Data collection
7. Build model
8. Develop a reference scenario
9. Present scenario to stakeholders
10. Develop scenarios
11. Evaluation of modelling results
12. Translate analysis result into conclusion and policy recommendations
13. Present Findings to Stakeholders
14. Develop final plan

[1] In developing this Briefing, two articles were referred to. These are: Reddy, A; D'Sa, A and Sumithra, G – International Energy Initiative and Balachandra, P. – Department of Management Studies, Indian Institute of Science **Integrated energy planning: Part 1. The DEFENDUS methodology** and Laponche, B. (2002) **Appendix 1: Energy Planning**: RENEUER Circle. ICE.