APPENDIX G: FUTURE ENERGY DATA COLLECTION

Summary

This work has identified clear potential energy efficiency 'interventions' which may have a positive effect in terms of key government objectives, including:

- minimising the cost of the energy system ,
- decreasing environmental pollution, and therefore health impacts,
- improving job creation prospects,
- and decreasing water consumption.

It is important that policy discussions are based on sensible up to date information. The subject of the following discussion is the development of a national energy database system. This study has focussed on, amongst other things, developing an indicative analysis of energy efficiency interventions. Future work can now be focused on developing key quantitative figures to be used to develop a national energy efficiency strategy. In order to justify such programs a national energy database is needed. The following steps are suggested:

- A dynamic database for the DME's information be constructed, information could initially be drawn from the current IEP database,
- training of DME staff to maintain this database,
- an evaluation of existing local data sets to migrate into the database, including, their maintenance and update,
- participated of the DME in current data collection and reporting by organisations such as Statistics South Africa this includes the compilation and reporting on current energy auditing and other government surveys, annual reporting of companies, and the imports, exports and production of local equipment stock,
- the setting up of a steering committee to provide and review this data,
- a simple to use interface for easy maintenance and updating,
- based on the data collection, tools available should be refined to estimate quantitative data in order to establish with the use of existing modelling techniques
    - the cost saving of the measure to be implemented,
    - the environmental and health effects,
    - effects on job creation,
    - effects on the macro economy,
    - social indicators, such as access to clean energy.

There are essentially three elements to consider when constructing a national energy data base. These are:

- The database format
- The collection and compilation of currently available data
- And the Collection of new data sets.

The following section discusses:

- The construction of an energy database,
- Currently available data,

- Residential data issues,
- Possible future data-collection methodologies, and
- Suggested steps forward.

Energy use database construction

The structure of the national energy database must be such that meaningful data can be generated with the limited datasets currently available, and that this can be updated and automatically refined as new data becomes available for entry. The following points are pertinent in terms of constructing a database for national use within the Department of Minerals and Energy.

- Ease of use must be ensured in order to facilitate continuous updates. Current energy databases systems such as
    - ENIS in the MESAP [IER 2002] model,
    - LEAP and MARKAL databases have been developed (very preliminary data sets in the case of ENIS) for South Africa, however these are time intensive, and could be customized in order to facilitate easy use. A custom program could be written using available MS office software.
- The database should be flexible in order to accommodate:
    - shifts in information output for planning and reporting
    - new data sources, there may be data that has not been considered during the database construction
    - continual information updates. The database must be designed to:
        1. allow for limited projections so that where historical data only is available, this may be projected to give current estimates of energy use
        2. allow projections to be replaced by new data and to either interpolate between new and historical data or flag discrepancies, between entered data and extrapolated data.

      Currently, with some effort and a good working knowledge some of this can be done in the LEAP energy model. However, the time required to capture this data can be significantly reduced with a custom built database.
- There are essentially three types of data sets which are needed in order to clearly define future energy efficiency programs. These include:
    - Energy use segmented in the following tiered system, which should be catalogued both by time and location (Such a system is used by the ENIS database of the MESAP energy modeling system [IER 2002], and a similar approach has been suggested by Cooper [Cooper 1998]):
        1. Total national requirements
        2. Sector
        3. Sub-sector
        4. Individual users
        5. Process – thermal, mechanical etc.
        6. Equipment – physical characteristics
    - Energy using equipment stock information. This is necessary in order to estimate interventions at an appliance level, and should include:
        - Quantity of item (or class of item) available in the South African market

        - Average operating characteristics of the current stock.
    - Socio economic data used for the projections of historical data in order to derive current data estimates. (For example, denominators for benchmarked data should be concurrently noted, together with fuel statistics.)

- It would be sensible for the outputs of this database to be in a form which facilitates quick migration of the datasets into IEP models. This can generally be done by generating outputs in a specified MS Excel format.

- It is suggested that a user friendly interface be developed for a database. If this is done locally, support can be offered on an ongoing basis.

It would be necessary for training and review of the database that manuals be made available to the DME.

The outputs of the database would include:

- national energy balances,
- benchmarks,
- sector and sub-sector energy consumption,
- provincial data, and
- detailed household information

This would be constantly, and consistently updated in house as information is brought on line.

The database could be shared with, and partially managed by regional offices, and offer data for publications and websites.

Data that is currently available

While there is a lack of certain data, there is much data and expertise available in order to populate and develop the database. The following points are pertinent:

- While not yet in a very user friendly form, the current Integrated Energy Planning models used by the DME contain a preliminary database, which could be migrated into the database suggested.
- International data sets for equipment efficiencies and energy service requirement per process are available, these need to be carefully evaluated, and can be used as defaults while local data is not available.
- Two local data sets which are of particular interest in terms of future database construction include:
    - LEAP work initiated by Trollip [Trollip 1994], currently a private consultant, contained information of different housing types, their location and energy consumption patterns. This work would take about six months to update, and break down into the detailed end-use analysis structure currently required by the IEP models, and then migrated into the models. This can be updated using household survey databases, which were in turn initiated by, amongst others, Trollip.
    - Statistics South Africa has useful energy use data following national census projects. These are currently only available as totals. However this data could be broken down further by Statistics South Africa in terms of region, income and household type.

It is also important to note that synergies exist between the proposed database and other national initiatives such as the Basic Electricity Support Tariff program, being undertaken by the DME and ESKOM. There may be much gained by the 'cross pollenisation' of such work.

Residential data to be collected

There are several data sets to be collected. It has been noted that a particular point of concern is the lack of integrated residential data. During this work the specific requirements for collection are needed. Because the sector is diverse in terms of social preferences, poverty, climate and building type, interventions in this sector need to be well analyzed and properly targeted. A single 'intervention' would have a different effect by household type.

Data required

The following represents a list of data which is necessary for modeling interventions, and may act as a guide for developing future questionnaires. This data has not been collected regularly, as household survey questionnaires have not been aimed at developing an energy end use database.

Important data to determine energy consumption includes:

- The device used, i.e.
    - lighting:
        - CFL's
        - Incandescent
    - Cooking what do you have and how much do use it compared to other appliances
        - Mbawula etc.
- The quantity of fuel used for different activities,
    - Cooking,
    - Heating,
    - Lighting,
    - Water heating,
    - And other.
- The cost of the fuel,
- The location (in order to get degree day information),
- The house type (in order to determine thermal properties),
- The fuels that are available,
- And income profile.

In order to use this data for extrapolation the following is also required:

- Sample size,
- Household number,
- Population,
- Income group (perhaps use quintiles?),
- Electrified / non-electrified.

This assumes that the income group, (weighted by) sample size, electrified/non and location can simply be extrapolated.

Some of this information can be extracted from the last census of statistics South Africa and could be extracted from Statssa at nominal cost to them. It would be sensible, to begin with to limit macro-locations to provinces. This would also help develop planning capacity for regional energy offices which the DME is setting up.

It should be noted that there are complications associated with collecting the above data through the route of questionnaires. Very briefly these include:

- One device is often used for more than one purpose,
- The person who answers the questionnaire, if they are not controlling the energy bills is not always aware of the full costs,
- Cost of fuel use for communities has several elements that are not always considered, these include, in particular, transport and collection costs for wood and other fuels:
    - Is the fuel bought at a shop and
        - taken home on foot (what time is used for this?)
        - taken back by taxi in which case there is an additional cost (Done with large LPG storage.)
        - Is it delivered?
    - Of the fuel bought how much is re-sold and how much is used for non-energy purposes, i.e. Paraffin is often used for manufacturing fuel polish!

Other possibilities for data collection include Electricity sales organizations such as:

- ESKOM,
- Municipalities, and
- Load research programs

The rural off grid power program, RAPS, may prove to be a useful source of information.

Possible Methodologies for Future Data Collection

Current end-use work carried out by the national energy database program of the DME is useful, and could be incorporated into a future database. This work, if continued, should also include a regional dimension.

For buildings it is important to correlate location with energy used for heating and cooling. The need for heating and cooling is dependant on the location, access and affordability of this energy service, building type, and user preference. In order to properly account for the temperature effect, data can be obtained from the weather bureau. The measure of ambient temperature, relative to preferred temperature is approximated using ‘heating’ and ‘cooling degree days’. This degree day data can then be used to determine how much energy is used due to a heating and cooling requirement, and in turn help predict consumption as a function of region, building type, and possibly income level.

The following policies could be of use in order to generate data, which could be translated into a national database:

- Requirement that industrial and commercial energy audits have key energy data reported to the DME.
- Require reporting of energy per unit output in the annual reporting of industry and commerce.

- Include a list of specific questions and parameters to be reported by government funded questionnaires, including rural surveys and statistics South Africa.

This could be enforced, form part of a subsidized policy for energy audits/data programs or form part of voluntary program.

Suggested next steps

- Define clearly a list of pertinent policy questions to be addressed by the energy database.
- Establish an easy to use computer based database to assimilate available data and proposed new data to be housed within the DME
- Include regular training and updates for officials
- Request a disaggregated breakdown of energy use per household type, income level and region from Statistics South Africa.
- Initiate a six month program to update and incorporate the residential energy LEAP model developed by Trollip into the existing IEP models and proposed energy database.
- Develop a program (perhaps a small subsidy) to obtain pertinent data sets from current energy auditing.

Suggested Terms of Reference for data collection system and database

The aim of the terms of reference is to determine information useful for various planning and monitoring objectives.

The components of the TOR are as follows:

(1) Determine the objectives of the data collection in terms of the planning and policy requirements of the DME including the indicators / data needed
(2) Scan the energy/demographic/economic data available
    (a) Once off studies, which may need updating
    (b) Re-occurring studies
    (c) Determine the data missing per objective
(3) Determine the data which can be captured from re-occurring studies for the database system
(4) Determine extra data which can be captured will little effort from studies
    (a) For government studies these should be included in the terms of reference.
    (b) For non-government studies examine methods of extracting the key data. For example:
        (i) Subsidies[1] or legislation for energy audits/surveys to include reporting to the DME key data
    (c) Should include: Standard questions for:
        (i) Household surveys
        (ii) Woodland and biomass surveys (to establish biomass resource)
        (iii) Industrial energy audits / surveys / company annual reporting
        (iv) Commercial energy audits / surveys

[1] This could be used to encourage energy auditing and indicate the extent of the activity.

(d) A note to bear in mind is that the import, production, export and efficiencies of key energy consuming devices should be included in this analysis.
(e) Initiate a six month program to update and incorporate the residential energy LEAP model developed by Trollip into the existing IEP models and proposed energy database.

(5) Examine and determine options and costs of collecting and reporting key data requirements
(6) Design the data-capturing system
    (a) Include regional resolution for the data base allowing
        (i) for 'estimates' from the central database to determine regional balances
        (ii) for replacement of regional values of higher certainty, which may under appropriate circumstances, replace 'central database' information.
            - This can in turn be configured to allow for regional data collection exercise to be used to populate the national database.
        (iii) for regional energy offices to have access to data for local needs
    (b) Include data certainty / uncertainty for sources data, and therefore indicators or key data produced by the database
        (i) This should include confidence levels for use in policy analysis / monitoring
    (c) Include limited forecasting ability where data is extrapolated,
        (i) This should the adverse affect confidence levels due to possible changes over time
(7) Calibrate the model based on existing data
(8) Determine the most appropriate extra data collection measures based on steps (1), (5) and (6). An iteration of the database structure may be needed at this point.
(9) Initiate data collection steps (5)
(10) Run the data collection system for a trail period and tweak the system
(11) Design a user friendly interface for use within the DME
(12) Install the system within the DME and establish remote internet access for
    (a) DME central staff, regional offices and key stakeholders
    (b) And allowing for different levels of access for each
(13) Train DME staff to run the system
(14) Provide one year of support
(15) Produce a detailed manuals for
    (a) Users
    (b) And programmers (should future work be awarded to other contractors.)

General comments

- Review of the process should be held regularly, and
- The project should be compiled over one and a half years.

New references

IER, Institute for the rational use of energy, University of Stuttgart, http://www.ier.uni-stuttgart.de, 2002.