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# Improving the institutional structures for disseminating energy efficiency in emerging nations: Energy agencies in South Africa\*

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## Abstract

Emerging nations are typically characterized by high energy intensities. Dissemination of energy efficient technologies is far below expectations despite significant potentials for their adoption. Successful energy efficiency strategies are closely connected to institutional efficiency to increase access to information and finance. However, capacities of government are limited, and transaction cost are high. As a tool to improve dissemination of energy efficient technology and innovation we suggest to improve the institutional setting by implementing a network of central and decentral energy agencies (EA). Experience from Europe – but also from some emerging nations such as Mexico – suggests that EAs allow to cut energy consumption significantly by strengthening the links between energy policy, financing and implementation, and the final consumer.

In a case study for South Africa, we examine to which extent the suggested concept can be transferred to emerging nations. After a theoretical discussion of the underlying incentive problem, based on new institutional and evolutionary economics, the paper reflects experiences from a consultation project in South Africa, based on a co-evolutionary approach: Successful projects need more than “theoretical” designs, in particular an implementation process which empowers local stakeholders to implement the project.

*Keywords:* Energy agency, South Africa, emerging nation, energy efficiency, transaction cost, new institutional economics, innovation dissemination, co-evolutionary processes

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# 1 Introduction

Energy plays a key role in all economic development strategies. The world's annual energy consumption is estimated to double by the year 2025. The bulk of this projected increase will occur in developing countries. The IEA expects that by the year 2030 about 43 % of global primary energy demand (as compared to 30 % in 2000) will come from developing countries and emerging nations. World electricity demand will double until 2030, of which the biggest share comes from developing countries.<sup>1</sup> At the same time, emerging nations are typically characterized by higher energy intensities of their economy as compared to OECD countries, despite the fact that energy consumption per capita is usually well below OECD levels (table 1).

	<b>TPES per capita</b>	<b>TPES/GDP</b>	<b>TPES/GDP (PPP)</b>
	toe / capita	toe / ,000 1995 US\$	toe / ,000 PPP 1995 US\$
<b>South Africa</b>	<b>2.51</b>	<b>0.63</b>	<b>0.29</b>
Africa	0.64	0.86	0.32
South Korea	4.10	0.31	0.30
Indonesia	0.69	0.70	0.25
Non-OECD	0.96	0.74	0.28
OECD	4.78	0.19	0.22
<b>World</b>	<b>1.67</b>	<b>0.30</b>	<b>0.24</b>

**Notes.** toe = tonnes of oil equivalent, PPP = purchasing power parity, GDP = Gross domestic product, TPES = Total primary energy supply.

Table 1. Energy indicators for 2000 (IEA 2002)

It is not only for ecological reasons or climate change mitigation that a growing energy demand can cause problems in developing countries and emerging nations. Except in oil and coal exploring countries, any growth in energy consumption immediately implies an increase in the national energy bill, and growth in electricity consumption is linked to substantial capital requirements for new power generation plants. This often entails a further increase of the countries debt and dependence on foreign capital. At the same time, higher energy efficiency is often associated with higher productivity due to the link between the deployment of modern

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<sup>1</sup> IEA, 2003.

technology and energy-cost savings. These aspects need to be considered when designing energy policies. Appropriate energy policies imply setting the right incentives for consumers to use energy efficiently through a favourable regulatory and political framework.

The above thoughts have been proven many times. They triggered a large number of efficiency-oriented energy projects in many developing countries and emerging nations. In recent years, numerous programmes for development aid or technical assistance have been focussing on improving access to sustainable energy, many of them with impressive results. Apart from success stories, however, experience also shows that positive appraisals of many projects evaporate after completion and withdrawal of the implementing expert team. Altogether, the diffusion of sustainable technologies with higher energy efficiency and renewable energies for cooking, heating, lighting, electrical appliances and building insulation in developing countries has been slow.

Energy efficiency and renewable energy programmes could be more sustainable, and pilot studies could be more effective and stimulating if the entire policy and implementation process was considered and redesigned from the outset. New financing and implementation processes are needed, which allow to reallocate financial resources and thus enable countries to achieve a sustainable energy infrastructure. The links between the energy policy framework, financing, organizing and implementation of renewable energy and energy efficiency projects have to be strengthened. Besides, capacity building efforts are required.

In this paper we argue that reasons for non-sustainable efficiency programmes are related to high transaction cost and lack of capacity, and that the implementation of innovative institutional structures in the form of an energy agency can help to improve the situation. Based on the experiences from the project “Sustainable Energy Policy Concepts” (SEPCo), a consultation project for South Africa, Mexico and Cuba (08/2001 - 12/2002), we examine the validity of this thinking for the case of South Africa as an emerging nation. Following the SEPCo project focus, this paper will primarily concentrate on energy efficiency and sustainable energy for private households.

In chapter 2, we develop the underlying theoretical thinking and explain the design of the case study. We then summarise experiences from Germany and Mexico regarding important aspects to be considered when designing an energy agency. Then we describe and assess the process of

the SEPCo project as carried out during the 1.5 years duration of the South Africa case study. The last chapter gives some concluding remarks.

## **2 The case for energy agencies: Theoretical framework**

### **2.1 Institutional and informational barriers to energy efficiency**

In this section, we develop the theoretical framework for explaining the modest success of energy efficiency programmes and, more general, of sustainable energy policies. On the background that efficient energy technologies are often more than cost-recovering over their life-time cycle, the standard model of economic theory would suggest that any cost-effective measure is being implemented. Empirical research, however, shows that this is often not the case: Many energy saving measures with high rates of return on capital are not being realised, a phenomenon commonly labelled as “efficiency gap”.<sup>2</sup>

The theoretical framework of *New Institutional Economics (NIE)*<sup>3</sup> adds a set of useful explanations for the efficiency gap. NIE explain market results in the context of the surrounding institutions and as a consequence of transaction cost. Starting from the observation of incomplete information and uncertainty, there are costs for companies and consumers which are not immediately reflected in market prices for goods and services.<sup>4</sup> From this perspective, the following barriers for energy efficiency can be identified:<sup>5</sup>

- *Informational barriers:* Information is expensive, or does not exist, or is not available to an extent that would permit an efficient investment decision. Understanding and valuating information presumes a certain level of skills. Asymmetric information causes distrust and conservative behaviour. These barriers are particularly relevant on the level of the individual households. Combined with the uncertainty about the real savings the originally “expensive” energy technology (such as efficient light bulbs) promises to deliver, the eventual decision will often be to stay with conventional energy appliances.

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<sup>2</sup> For empirical studies on this phenomenon, see DeCanio 1993; Blumstein et al. 1980; Fisher & Rothkopf 1989; Koomey 1990, Levine et al. 1995, Stern & Aronson 1984, Bhattacharjee 1993 and references therein.

<sup>3</sup> Williamson, 1985; North, 1990.

<sup>4</sup> Coase, 1960.

<sup>5</sup> See Praetorius, 1996 for an overview.

- *Financial barriers:* Many consumers will not make investments in energy efficiency because they lack capital to buy new energy-efficient equipment or make the required retrofit in their installations. A certain investment may be very cost effective, with fast payback, but it will not be implemented unless the consumer can meet the up-front capital costs.
- *Technological barriers and infrastructure:* Several opportunities to produce and to conserve energy depend on new technologies that may not be available in some countries or regions. Also, many new and efficient technologies incorporate electronic components which rely on good quality power to operate. Voltage fluctuations and frequent power failures – a common problem in emerging nations – will shorten the equipment’s designed lifetime.
- *Bounded rationality:* Consumers do not always behave “perfectly rational” in the sense of economic theory. The related notion of “bounded rationality” is closely linked to the first barrier above, i.e. information cost: Based on his/her experience, it may at least seem (or even be) rational to avoid further information cost and to take a “satisficing” rather than a theoretically optimal decision.<sup>6</sup>
- *Discrepancies in discount rates:* Innovative energy efficiency investments or programmes often involve a number of actors with different perceptions of costs and benefits, risks and uncertainties. Utilities, large consumers and government can more easily afford investments with longer pay-back periods: They may have an easier access to low-cost capital, can spread the risks of individual investments across a broad range of different investments, and thus apply a lower discount rate compared to private households.
- *Diversity of investment criteria and limited resources:* Even when a certain investment in energy efficiency is cost-effective, it may not be the first investment criterion. For instance, a consumer considering the purchase of a new refrigerator may prefer a less efficient model if it is available in the colour he prefers. Also, inconveniences may be related to new energy technologies, for example a change in cooking traditions, and the necessary investment may therefore be declined. An industrial customer may prefer to

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<sup>6</sup> Wilson, 1987.



spend capital on a new line of products rather than consider a retrofit in existing installations.

Many of the above listed barriers and transaction costs for disseminating energy efficiency show characteristics similar to fixed costs: The more often the same information is being used, the less the individual user must pay for it, at least in theory. The categories of NIE also help to understand the *dynamics* of emergence and diffusion of innovation such as energy efficiency technologies. Here, the framework of *evolutionary economics* offers helpful theoretical concepts. Evolutionary economists describe innovation as a search and a learning process which depends on a number of exogenous and endogenous determinants and technological paradigms.<sup>7</sup> The paradigm (and its potential change) depends on factors which are usually located outside the sphere of economics. The specific path (trajectory) that is being followed within the paradigm, however, depends on innovation activities on the level of the individual company. Innovation implicates uncertainty and transaction cost, and experience with specific innovations are not a public good but in the hands of the innovating organisation. Successful innovation often depends on capacities to innovate in the past and on capacities to continue search processes and to collect experience in the future. Therefore, a certain path (trajectory) is likely to be followed, and “good” innovations may need a long time to succeed.

The above analysis of the underlying reasons for the existence of the efficiency gap offers a number of starting points for recommendations to improve the situation. *First*, risks can often be diversified when a large number of smaller risks is bundled. *Secondly*, technology or innovation diffusion can be promoted by disseminating information on pilot studies or projects and by large-scale programmes. *Thirdly*, successful and innovative energy efficiency policies are also connected to an appropriate and efficient *institutional* setting. In particular, efficient pricing is needed, in order to signal the accurate value of resources being consumed. *Regulatory* encouragement is therefore important with respect to tariff setting, the environmental aspect, and investment decision-making criteria. Moreover, *organisational* efficiency is needed, i.e. structures which increase access to information and affordable financing and providing incentives for the development and dissemination of innovative energy efficient technologies and strategies. However, the capacities of government to improve the context for innovative and

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<sup>7</sup> See, for example, Nelson & Winter, 1982; Nelson, 1998; Dosi, 1988.

sustainable energy policies are limited, the efficiency of government organisations is often low, and the related transaction costs are high. This is true for industrialised countries, and even more so for developing countries and emerging nations.

## **2.2 Conclusions for the case study**

Based on these considerations, we suggest that information and innovation dissemination in developing countries and emerging nations should be institutionalised in a better and more efficient way. We advocate the implementation of independent *energy agencies* (EA) as an appropriate tool and institutional innovation. This would lead to lower transaction cost for energy efficiency and thereby improve the sustainability of existing and future energy policy programmes and development aid projects. Experience from Europe suggests that, by strengthening the links between energy policy, financing and implementation and the final consumer, EAs allow to cut energy consumption significantly and to improve the efficiency of energy generation.

At the same time, an appropriate *design* of such an EA is crucial for success. Experience with the implementation of energy agencies in other countries suggests that institutional innovations have to be designed cautiously in order to avoid failure. Lessons that can be learned from other countries are valuable. However, they have to be assessed in the respective national context. Successful energy projects do not need “theoretical” designs – they need an implementation process which empowers local stakeholders to establish it.

We also believe that a co-evolutionary understanding and design of any *implementation process* is needed: Any successful innovation needs a surrounding „configuration that works“.<sup>8</sup> To this end, any consulting project should involve a broad range of relevant actors in the country in question, i.e. project developers, energy regulators, local and national administration and politicians, non-governmental associations, consumer associations, companies, financing institutions, non-governmental and the like.

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<sup>8</sup> Rip & Kemp, 1998.

### **3 Learning from experience: Energy agencies**

On an international level, a range of industrialized nations established national energy agencies in the aftermath of the oil crises in the mid 1970's. Their initial duties ranged from technology development and know-how transfer of energy saving activities and resources management, to the development of national primary energy sources up to law enforcement duties for nuclear facilities in the case of Switzerland. Energy-related activities are often embedded in environmental protection activities, as in the case of EPA (Environmental Protection Agency) in the United States or of the French ADEME (Agence de l'Environnement et de la Maîtrise de l'Énergie). In Germany, a broad range of energy agencies were implemented since the mid-80s. The major lessons learned are summarised below. We then take a closer look at energy efficiency agency activities of another emerging nation, i.e. Mexico.

#### **3.1 The German experience with a network of independent energy agencies**

The context for energy policy in industrialised countries usually differ significantly from emerging nations so that it is not straightforward to learn from these experiences. Nevertheless, our feeling was that substantial and valuable input to the development process of the South African energy agency initiative could be extracted from the practical know-how gained in Germany, in particular regarding the interaction of focus areas, organisational and funding aspects.<sup>9</sup>

In Germany, a long-standing experience with different kinds and organisational forms of EAs with mostly loose links exists. They operate on different territorial levels as regional, local or national energy agencies. Latest counts yield roughly 30 agencies, including the Deutsche Energie Agentur (dena), the new German national energy agency, founded in 2001. Energy agencies (EAs) act as links, mediators and as realizing organizations between governments, enterprises and financing institutions. Their aim is to promote three general objectives of energy policy: security, economic viability and an environmental soundness of supply. Two major types of EAs can be distinguished, although in reality, there is a flowing transition between the two groups:

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<sup>9</sup> For a more detailed description of activities of EA's see Bleyl, 2003

- Information and motivation (I&M) oriented agencies, including local and SAVE energy agencies;
- Agencies with a strong entrepreneurial focus, which sell consulting services and/or act as energy service companies (C&E EAs).

Regarding their *legal status*, EAs are usually a company with limited liability (Ltd), with only few exceptions. The organisational structure mostly depends on the degree of its commercial orientation. The more an EA is oriented towards commercial profits, the more it is likely to be organized as a Ltd. The Ltd status is also generally preferred for liability reasons. Smaller EAs are often organised as associations. All legal structures include a supervising or steering committee (a supervising committee, a supervisory board or a board of heads of the association) to involve their shareholders in strategic questions and controlling. On the operational level, the management of the EA usually acts independently.

The *financial* structure of German EAs varies from agency to agency. Only few agencies focus to a high degree on profits. They all work strictly cost-oriented and need to stay within their budgets. Corresponding to the two types of EA mentioned, there are basically two ways of financing:

- Complete or partial funding from public sources. Such financing is generally restricted to I&M EAs. However, a one hundred percent financing from public sources is the rare exception.
- (Project) Financing by way of orders. Commissioners are enterprises, utilities, municipalities, states and ministries or real estate owners in the case of energy supply services. Most EAs have to acquire commissions in order to financially survive.

For the implementation phase, an initial financial support turned out to be unavoidable. It can take the form of lost government grants, accumulated deficits, loans and advances, or allowances from EU support programmes. This period typically lasted two to four years. Even after this period the activities of I&M EAs could hardly be financed through self generated income. Such EAs will remain dependent on continuous financial support even after the implementation and set-up phase. Here the shareholder structure finds its clear reflex in both its financial structure and in the fields of activity.

### **3.2 The Mexican experience with national energy efficiency agencies**

Mexico belongs to the group of large oil producing countries in the world. Today, oil exports account for about one third of government revenues. In 1985, 55.2 % of the extracted oil was exported, in 1992 it was only 14.3 %. This was due to the fact that the national demand skyrocketed and even exceeded production. This trend was recognised by government, which decided to institutionalise energy efficiency policy. In 1989 the National Commission for Energy Conservation (Comisión Nacional para el Ahorro de Energía , CONAE) was founded to implement energy saving and efficiency measures. Also, in 1989 the National Utility CFE established the Energy Savings Program for the Electricity Sector (PAESE) and in 1990, the Commission for Electricity Conservation (Fideicomiso Para el Ahorro de Energía Eléctrica, FIDE) was established with funds coming from CFE to support PAESE's activities through financing energy-efficiency programs directed to CFE's users. FIDE promotes the efficient use of electricity, whereas CONAE is responsible for energy efficiency in general and for promoting renewable energy.

Regarding the institutional setting, CONAE initially had close ties to the energy ministry (Energy Secretariat, SENER). CONAE has always had a close working relationship with CFE (Comisión Federal de Electricidad), one of the two major electricity companies in Mexico as well as with the National Oil Company (PEMEX). In 1999, CONAE became an autonomous entity of the SENER. Today, it is being backed by a broad number of stakeholders. So far, CONAE has completely been funded through SENER. CONAE's budget for 2002 is around US \$ 8 million with an average of about 150 employees.

Starting in 1995 the first three mandatory energy efficiency standards entered into force. Today, Mexico has a regulatory framework of 20 compulsory efficiency standards. It has been estimated that energy consumers saved US \$ 24.2 million from using energy efficient products in 2001, while the country saved the equivalent of the residential electricity consumption of the states of Oaxaca and San Luis Potosí (692 GWh). More than 6 million products entered the market every year with higher efficiencies, including refrigerators, electric motors, AC units, water-pumping equipment and so on. In 1991, a first household energy efficient lighting programme started, and in 1995, the ILUMEX project for energy efficient lighting started on a large scale. To communicate with end users, CONAE has set up over 100 small offices (ports of attention, PAC), that cover the complete national territory. The PACs are entities of technical assistance.

Their basic function is to help energy users to identify their general saving potentials and the economic feasibility of some particular measures. Further they give information on the efficient use of energy. In 1996, Mexico started with a daylight savings time programme (DST). The DST has resulted in energy savings of more than 6,000 GWh in six years of application. During the time period of 1995 to 2000 the programmes of CONAE saved around 21,900 GWh, which is the equivalent of US \$ 1,024 million in economic savings. The related reduction of about 1,000 MW peak demand also allowed to avoid enormous investments in power generation capacity. Environmental benefits were the avoidance of 18 million tons of pollutants.<sup>10</sup>

To summarize, Mexico has had success in energy efficiency because it set up institutions which design, implant and operate programs. CONAE and FIDE substantially contributed to energy saving in Mexico. Their policies and measures to improve energy efficiency resulted in an impressively decreasing growth rate of electricity demand: They developed numerous energy saving programmes, which resulted in an avoided consumption of about 41 billion kWh by the end of 2000, plus a reduction of the growth of peak demand which avoided about 2,470 MW of new plant capacity. Investment in the agencies was about a factor 50 lower than the related economic savings.

### **3.3 Lessons learned**

As can be seen from the German and Mexican experiences, there is no single organisational model that served as a standard for any newly founded agency. Each energy agency has its own profile and design which fits to the respective specific goals and framework. In addition, the specific national framework requires a careful adoption process. Nevertheless there are a number of generally applicable success factors that need to be considered for a successful implementation process. The following focus areas and questions summarise the German and Mexican experience and served as guidelines for the case study in South Africa as described in the following chapters:

- *Focus areas:* The EA needs a clear outline of tasks and goals. Shall the agency be responsible for public interest programmes, for information and motivation campaigns, work on a regulatory level and develop national efficiency standards or is it supposed to run independent and economically viable projects?

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<sup>10</sup> CONAE website; see <http://www.conae.gob.mx>.

- *Geographical scope:* A national EA needs a different setting up as compared to a regional EA or a local energy centre. Therefore, a careful assessment of the envisaged fields of activity is necessary. To handle local Agenda 21 topics a local energy centre with good community relations and public access suits best. If the EA is intended to support and handle energy-related policies and programmes, it needs a corresponding structure on a national level.
- *Business plan:* A carefully drafted financial business plan is crucial for the success of an EA: What are the financial requirements for the envisaged fields of activity? What revenue can be gained and what is the forecast for salaries, rents and material costs etc? What legal status suits best for the envisaged fields of activity?
- *Funding:* Funding needs are directly related to the chosen focus areas of an EA. An EA with a focus on information and motivation activities will need continuous financial support from government or other sources.
- *Strong partners and Shareholders:* Successful energy agencies need strong partners in their background: Which important societal stakeholder shall be gained as partners and as shareholders?
- *Composition of Partners:* The shareholders of the EA have a strong impact on its fields of activity. A diverse and broad membership structure, preferably a public-private-partnership of three to five partners suits best to guarantee independence, continuity, flexibility and development potentials. To rely on one single partner entangles the risk of political dependence. A very close relationship to government organisations bears the danger to get caught in their bureaucracy.

## **4 Case Study: South Africa**

### **4.1 Design of the SEPCo project**

Based on the above considerations, the SEPCo project team tested an innovative approach: Instead of another pilot study or another information or technical teaching workshop, the SEPCo objective was to identify the “missing links” between existing initiatives, institutions and actors. The ultimate aim was to develop solutions for strengthening the links between energy policy, financing and implementation. All SEPCo case studies were therefore designed in a way to

empower local stakeholders, while taking into account the experience and know-how of local actors and stakeholders. The workshop approach was to balance consultations between local stakeholders with capacity building inputs from abroad. Local actors were invited to participate in the project through a series of workshops, meetings, discussions as well as an internet-based discussion forum. Also, by conducting these workshops in the countries themselves, the project team learned about actual problems and was thus able to redefine the focus of the projects and to develop applicable suggestions for improving access to sustainable energy.

The SEPCo project case studies consisted of three steps. During the *first* phase, a number of initial short studies on potentially relevant projects and programmes was conducted. Their purpose was to examine existing structures in the three case study countries (South Africa, Mexico, Cuba) with respect to energy policy and institutional contexts that stimulate or obstruct the projects and programmes to become sustainable. The goal was the identification of critical parts of the overall financing and implementation processes. The initial studies comprised a variety of project forms such as rural off-grid electrification by means of renewable energies and energy efficiency, DSM programmes for households in urban low-income areas etc. They also formed the basis for a first round of local workshops. The following *second* phase was dedicated to elaborating solutions and suggestions for these issues. Finally, in the *third* phase, potential solutions and suggestions were presented during a second workshop series, and activities at the local level to overcome the barriers and problems were initiated. The international experts were supposed to support this process (but not through prescription) in the respective areas.

The following sections elaborate this approach for the case study of energy agencies for South Africa, based on previous experience and research on the South African energy sector, its governance and institutional structures.<sup>11</sup> The project resulted in two South African initiatives for action and with a number of recommendations to both the South African and the German governments, pointing to necessary subsequent support and next steps.

#### **4.2 Background to the South African case study: Energy sector and energy efficiency**

South Africa has an estimated population of 45.5 million people.<sup>12</sup> The gross national income per capita amounted to US \$ 2,900 in 2001.<sup>13</sup> According to World Bank categories, the country

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<sup>11</sup> See for example Praetorius & Fritsche, 1998; Praetorius, 2000, Praetorius & Fecher, 2002.

<sup>12</sup> Statistics South Africa, 2002 ([www.statssa.gov.za](http://www.statssa.gov.za)).



belongs to the group of upper middle income countries. Socio-economically, the country is divided into a small, sophisticated “first-world” part with well-developed structures, and a large “third-world” part which shows the characteristics of poorly developed countries. Analogously, South Africa disposes of a sophisticated and well-developed energy supply system on the one side. On the other side, despite an immense and successful electrification programme, a large part of the urban and rural low-income households still does not have any access to electricity and other forms of “clean” or sustainable energy sources. Energy supply is largely based on the abundant coal reserves of the country. In 2000, the total primary energy supply (TPES) in South Africa amounted to 4,298 PJ of which 73.7 % stem from coal and another 16.6 % from crude oil. The share of natural gas (1.4 %) and nuclear energy (3.1 %) is smaller than the one of renewables – mainly biomass – including waste (5 %). Total final energy consumption amounted to 2,193 PJ of which electricity accounts for 26 % (577 PJ).

Due to the cheap and abundant coal reserves, electricity in South Africa is amongst the cheapest in the world. In 2001, the average price for electricity sold to industry was 1.2 EURO c/kWh, while commercial customers paid 1.8 EURO c/kWh, and residential customers paid an average of 3.1 EURO c/kWh.<sup>14</sup> In the run-up to the 2000 local government elections in South Africa, President Thabo Mbeki announced that low-income consumers would be entitled to 50 kWh of electricity free of charge on a monthly basis (the so-called poverty tariff or Electricity Basic Support Services Tariff, EBSST).

The electricity sector is dominated by Eskom, a single, vertically integrated state-owned utility and *de facto* monopolist. In 2001, Eskom generated 182 TWh (95 %) of total electricity generation in South Africa. It owns, operates and maintains the national transmission grid. In contrast, the electricity distribution industry is highly fragmented. A restructuring process to liberalise the electricity market started in the early 1990s and is still ongoing. Since 1995, the electricity sector is regulated by the National Electricity Regulator (NER).

During apartheid, access to electricity and other forms of commercial energy for black, low-income households was limited, in particular in rural areas and townships. Since the demise of apartheid, an ambitious electrification programme has been carried out as part of the

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<sup>13</sup> In current USD, Atlas method. In Purchasing Power Parities, the GNI per capita amounts to USD 9,510. Source: World Development Indicators Database, April 2002 ([www.worldbank.com](http://www.worldbank.com)).

<sup>14</sup> All data in this paragraph from Eskom, 2002.

Reconstruction and Development Programme (RDP), the ANC's government programme after the first democratic elections in 1994. As a result, the level of household access to electricity is estimated to have risen from about 36 % to around 70.4 % between 1991 and 2000. In urban areas, 84 % of households have access to electricity, whereas the figure in rural areas is at around 50 %.<sup>15</sup>

In international comparison, South Africa's economy is *energy intensive* (table 1). A major reason is the synthetic fuel production. According to the energy balance, 654 TJ of coal plus 65 TJ natural gas were converted by the Sasol and Mossgas synthetic fuel plants into 339 TJ synthetic oil in 2000, the difference reflecting the related enormous transformation losses.

Significant energy saving potentials also exist in the field of household space heating. It has been estimated that the installation of an insulation-integrated ceiling in low-cost brick houses would save 90 per cent of energy consumed for heating during winter and be cost-effective over time. However, the up-front cost for this ceiling represent a major barrier to this simple measure.<sup>16</sup> Appliances such as lighting face similar problems (see below).

*Awareness* of efficiency potentials at *government* levels is low. Energy is cheap and efficiency is not perceived as necessary. The political priority is delivering energy services rather than on doing this in an energy efficient or sustainable way. Only few information campaigns took place, but with little impact. In 1996, the DME launched an „Energy Efficiency Business Plan“ which identifies the rationale for promoting energy efficiency in terms of its potential contribution to economic growth, environmental sustainability and reduced energy bills. It included the idea to establish an energy efficiency agency. Later on, a pre-feasibility study for such an agency was compiled. However, the whole initiative failed. To date, DME is commissioning a small number of energy efficiency projects and campaigns to external consultants because it lacks the capacity to manage these programmes internally. On the *local government* level, municipalities also have only limited capacities and awareness for the benefits of energy efficiency.

In the electricity industry itself, *Eskom* recognises the benefits of demand-side management, with the aim to reduce the typical demand peaks in the mornings and evenings. In the course of accelerated electrification and growing electricity demand per household, this effect becomes

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<sup>15</sup> NER Electricity Regulatory Journal, June 2001.

<sup>16</sup> Mathews & van Wyk, 1996.

more pronounced. According to medium growth forecasts, additional generation capacity will have to be in operation in the year 2007. However, investments in generation capacities are progressively more risky in an environment of increasing competitive pressure, which is a result of the current restructuring process towards a liberalised electricity market. In 1996, Eskom started with developing internal Integrated Electricity Plans (IEP), an approach that was recently transformed into a National Integrated Resource Planning (NIRP) process under the auspices of the NER, with a first NIRP finalised in June 2002. In this context, a study of 32 potential energy efficiency programmes revealed significant peak load reductions at lower life cycle cost than those of an equivalent power station. A cumulative total of 4,808 MW installed capacity to be saved from demand-side measures (DSM) over 25 years were estimated.<sup>17</sup>

South Africa also takes part in an international *Efficient Lighting Initiative* (ELI), a 3 years programme conducted by Bonesa, an Eskom subsidiary, and co-funded by Eskom and the Global Environment Facility (GEF). According to Bonesa, lighting with conventional light bulbs makes up 80% of the demand in newly electrified homes. Compact fluorescent lights (CFL) save up to 80 % of the energy consumed by a conventional light bulb and last 6-15 times longer. The potential for replacing conventional light bulbs has been estimated to 31.5 million bulbs. Over a 15-20 year period, savings in peak load are estimated to up to 810-820 MW of new power generation capacity. Bonesa also suggested to supply each home with two free energy-saving light bulbs as an alternative to the poverty tariff. Pilot studies are underway.<sup>18</sup>

There are few other promoters (mostly NGO) of energy efficiency worth to be mentioned. One private initiative is the US-funded International Institute for Energy Conservation (IIEC). Since 1996, IIEC conducts projects to foster energy efficiency in a couple of pilot studies such as energy efficient housing and a programme of so-called eco-home advisors. IIEC also promotes energy star computers and green buildings for Africa and supports the Efficient Lighting Initiative ELI. Other NGO initiatives such as Earth Life Africa and the Sustainable Energy Society of South Africa (SESSA) focus more on renewable energy technologies than on energy efficiency. A number of independent consultants and project developers such as Sustainable Energy Africa (SEA, who runs the SEED programme, see below) or the Energy and

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<sup>17</sup> NER, 2002.

<sup>18</sup> Bredenkamp, 2002a.

Development Group (EDG) as well as the Remote Areas Power Supply (RAPS) programme are acting on the local level, with a focus on development and delivery. Their potential involvement and their interest in promoting energy efficiency is high, their capacities however are small.

To summarise, significant potential for the adoption of energy efficient technologies exists, but often has not been realised, namely because of market barriers and failures. In the current political context, the South African government still does not perceive energy efficiency to be of high priority. Therefore, it is important to underline that energy-saving measures not only help avoid environmental impacts, but also reduce energy bills on both individual and societal levels.

### **4.3 The project: An energy agency for South Africa?**

#### *4.3.1 Phase I and first workshop (November 2001): Stock-taking and initial case studies*

In November 2001, the first South African workshop took place in Pretoria. Its aim was to identify critical points within the existing energy efficiency and also renewable energy policy context. A small working group of selected experts from South Africa was invited to join the workshop sessions. Participants included the National Electricity Regulator, the national electricity company Eskom, a number of local NGOs representing energy efficiency, renewable energy, green and local development initiatives, government representatives from the Department of Minerals and Energy (DME), energy and policy research institutes, technology companies and project developer.

These participants were considered to be potential actors and key players, and at the same time target group for the messages of the workshop. To summarise the results, the initial hypothesis of a missing link between policy and strategy was confirmed. Moreover, the implementation processes are not well integrated. Although there are some initiatives to improve and facilitate this situation, the institutional framework is still weak. The complexity of the issue requires involvement and engagement by all stakeholders. In general, there is a perception that many projects and activities are taking place in isolated ways, and without sharing the information about it. This results in lost opportunities and projects going wrong because information is missing and isolated solutions fail (example: insulation of houses helps reducing moisture and keeping a constant temperature, which gives a better physical environment for energy efficient light bulbs to last for longer). Many projects thus take place and disappear without sharing the experiences and learning effects or using them for improving future project implementation

designs. As a conclusion, the following starting points for more in-depth activity within the SEPCo project were identified:

- Supporting the process of policy formulation through information

South Africans expressed strong interest in receiving comments on South African policy papers and bills in progress, such as the Energy Bill and the Renewable Energy Act as well as the White Paper on Renewable Energy. These comments shall be given in an informal way. Participants also asked for in-depth information on codes and standards for efficiency as well as on international experiences with incentives for sustainable energy technologies.

- *Improving institutional structures for information collection and dissemination*

Participants expressed great interest in learning how to improve the institutional and informational structures around sustainable energy projects, and articulated a need to empower existing or new institutions. Participants underlined that this should rather build on existing structures instead of creating completely new institutions. There are some existing information initiatives from the side of SESSA, the Minerals and Energy Centre (MEPC) and Earthlife Africa. However, it was also suggested that founding a new, independent institution (NGO) might be useful because it would be regarded as neutral. Such an energy agency would need the backing of a broad stakeholder structure. The White Paper on Energy Policy in South Africa (WPEP)<sup>19</sup> mentions the need for an energy efficiency agency.

- *Fostering South-South co-operation*

Participants expressed interest in exchanging experiences with other developing countries, such as Mexico and Cuba. The European perspective is perceived as sometimes biased towards industrialised countries. It might be useful to also learn from other developing countries which experience similar situations. Also, information flows between developing countries are not yet institutionalised. The workshop participants therefore support an internet-based exchange of information between these and other developing countries.

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<sup>19</sup> WPEP, 1998.

#### *4.3.2 Phase II and second workshop (November 2002): Fostering the implementation of a “South African Energy Agency” (SA EA) Initiative*

For the second phase of SEPCo, the results of the first phase were condensed to two key policy measures which were of crucial interest to the South African project partners: First, regulations to promote renewable electricity generation, and secondly, improving the institutional structures for both renewable energy and energy efficiency by means of an energy agency. The first one refers to the first bullet point in section 4.3.1. This paper only focuses on the second measure, which refers to the second and third bullet points.

South African Experts who are working in information dissemination, project implementation and capacity building were invited to give inputs to the workshop. As an input from abroad, and in order to benefit from the experience and expertise from Germany and Mexico, two experts involved in energy agencies from these countries were invited to actively participate in the workshop. They talked about experiences in implementing national, regional and local energy agencies in different contexts, and helped to identify critical issues and possible solutions to these problems.

As in the case of the first workshop, and in order to assure continuity, the second workshop was also attended by participants from the government, the energy regulator, researchers, policy and engineering consultants, project developers, NGOs, the energy industry and international organisations. The aim of the workshop on energy centres and agencies in South Africa was to discuss and develop institutional structures which are appropriate to support both energy efficiency and renewable energy technologies on all levels – national, regional and local, and would help to close the “missing link” between policy and strategy.

#### *4.3.3 Assessment of recent developments in energy policy relevant to the case study*

In the course of the year 2002, since the first workshop, a number of political initiatives and programmes towards energy efficiency were initialised or continued in South Africa. They had to be taken into consideration for the second phase of SEPCo. On the level of political declarations, the Department of Minerals and Energy finalised the first part of a *Draft White Paper* on the Promotion of Renewable Energy and Clean Energy Development. On a concrete level, the DME started with an initiative to implement *Integrated Energy Centres (IEC)* on the local level. The objective of the IEC is to disseminate information regarding renewable energy

and the related technologies, and to educate households regarding energy efficiency. An underlying aim is to deliver clean energy services to the disadvantaged communities but also to address health, environmental, economic and other needs. The DME stated that the IEC shall encourage the development of cooperatives, and thereby enhance economic development activities. IEC are also expected to link energy with other needs, health, job creation, environment and tourism.

Some preliminary experiences with IEC as well as rural *energy stores* could be gained to date, as a small number of pilot locations have already been established. Ultimately, the aim is to implement about 20 IEC per year. They offer information on clean energy, on energy efficient appliances and materials for housing purposes. The stores are successful in helping people to receive hands-on information on clean and appropriate energy sources and technologies. First experiences with urban energy centres in the SEED (Sustainable Energy for Environment and Development) programme, a multi-year capacity building and advising project, were also collected; the focus here is on energy efficient housing.

At the same time, the *regulatory framework* for energy efficiency is in the course of major changes. By the end of 2002, DME asked the National Electricity Regulator (NER) to develop an Energy Efficiency and Demand Side Policy within South African Electricity Industry<sup>20</sup>. The draft version of this policy was published for comments in early 2003.<sup>20</sup> A major element of the NER suggestions is to delegate the implementation of energy efficiency measures to electricity distributors, i.e. mainly to the local level. The underlying idea is that municipal actors are closer to customers and thus have information about their needs. The municipalities are therefore expected to be able to identify and realise appropriate energy efficiency measures. A system of monitoring and verification for these measures is also under discussion.

At first sight, the above initiatives are on the right track: Knowledge about sustainable energy services is small on the level of the individual households, and marginal or non-existing in most of the rural and urban low-income areas. Therefore, institutionalising local activities in the form of energy stores and energy centres will help to improve access to knowledge and to sustainable energy technologies. This is an important step towards closing an information gap. However, a more in-depth assessment of the above developments leads to identify a number of potential

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<sup>20</sup> NER, 2003.

risks and shortcomings. Reports on lessons learned conclude that for a successful energy centre, a stable organisation is needed. However, continuity is difficult to be reached when funding is limited to a certain time period. Also, successful programmes should be attached to the respective local authority, and to be connected to a local energy strategy. Moreover, the situation in rural and urban areas differs significantly, so that a standardised approach to both kinds of areas is not appropriate. Last, but not least, although electrification is an ongoing political process in South Africa, a link to combining the implementation of energy centres and electrification has not yet been made, which represents a unique window of opportunity.

An important outcome is that there is a clear need for *national institutional structures* which enable and enhance existing and future initiatives. There is no doubt that local action and initiatives are an important and crucial element of an overall efficiency strategy (bottom-up). However, these local and decentralised initiatives need to be combined with regional and/or national institutional structures, and to gain support from government levels. Hence, as a complement to the bottom-up capacity building initiatives, a top-down link was considered crucial for a successful energy efficiency policy. The main reasons for this conclusion are as follows:

- There is a major lack of information on other initiatives and a lack of coordination of different activities. Many initiatives double their initial experience, i.e. they produce similar brochures which are published in small numbers etc. They would benefit financially from cooperation and information in many ways.
- Municipalities have little capacity and awareness of sustainable energy technologies and efficiency measures. Raising the level of capacity and awareness on the local governance level is thus a major challenge of a future energy efficiency policy.
- Another push for establishing new institutional structures for energy efficiency comes from the ongoing liberalisation of the electricity sector: Restructuring plans towards a more competitive market are underway. The national energy utility Eskom is therefore not motivated to continue its role in promoting public interest (non commercial) objectives. As a consequence, no independent driver and promoter of public interest projects can be identified.



#### **4.4 Results of the workshop: The “South African Energy Agency Initiative”**

The participants of the one-day seminar discussed the issues and problems listed above and assessed possible solutions. They eventually decided to follow the idea to create a “South African Energy Agency Initiative” on the national level. They also specified potential actors and stakeholders, the organisational and institutional structures as well as mandates, tasks and financial sources of such an energy agency. A strategy was formulated to put such an initiative forward, including an initial presentation to the Minister of Minerals and Energy, Ms Phumzile Mlambo-Ngcuka. The presentation and the formulation of a draft business plan or alike are to be prepared by a small task group which was founded during the workshop. At first, the following *criteria* which are crucial for the *success* of an energy agency in South Africa were identified.

1. Most importantly, government must take ownership of the idea. As long as the minister for energy does not support new institutional structures, they are bound to fail.
2. Private sector involvement and participation is crucial: Only when private partners support the energy agency with action, will the initiative be able to realise its plans.
3. Credibility and independence must be guaranteed. There are a number of existing initiatives whose credibility for different reasons is not considered to be high. All actors involved must be able to trust such an institution. It is also for this reason that founding a *new* institution was suggested by the South African project partners.

Regarding the issue of government taking ownership of the idea, participants collected multiple *motivations* for an SA EA which may also serve as reasons for an energy minister to support such an initiative: Energy saving allows for national benefits; there is a need to create an enabling environment to meet the objectives of the Energy / Environment White Papers and policies, and a coordination of pilot and research projects is necessary if the results of these projects are to be disseminated. SA needs an international counterpart institution for future international co-operations in energy and climate protection issues. Last but not least, the minister would gain easier access to the RE / EE players and stakeholders in South Africa ("one stop forum"), a point she was making recently.

In the following, the preliminary results of the process of specifying the design of an EA for South Africa are presented along the aspects learned from international experience:

- *Geographical scope*

For the location and level of activity of an SA EA, one must consider the different levels of awareness and capacity. On the local level, a number of initiatives already exists, but their capacities are limited and information about other parallel activities is low. Therefore, the need for a *national* institution was identified; it would allow to coordinate local activities, capacity building on local levels and to realise economies of scale.

- *Focus areas*

The following tasks and major activities and services of a SA EA were identified: *First*, an EA would assist and advise in realising government policies, operate as a watchdog (with respect to monitoring, verification) of its programmes and policies, and administer and monitor earmarked public funds. *Secondly*, it would coordinate activities of national and local levels, act as a forum for collective bargaining and support government in creating an enabling environment for local energy centres and the like. *Thirdly*, its focus would be on public interest work such as to foster information dissemination, to establish and maintain an up-to-date, accurate and accessible energy-efficiency databank for South Africa, and to offer training for local and decentral institutions such as municipalities and local actors. *A fourth* focus could be to build awareness (through campaigns) and to create capacity, aimed at encouraging citizens, the public and private sector organisations to adopt energy efficiency practises.

- *Business plan*

The SA EA initiative will draft a business plan in 2003; earlier draft business plans would be taken into consideration. Another important aspect in the founding or continuation of an EA is proof of the economic advantages of such agencies. For instance, Mexico's CONAE was surprised this summer to be facing proposals to do away with the energy agency. Besides a number of important stakeholders who supported to keep CONAE alive, concrete cost-benefit analyses proved the benefits of the agency. Concrete results must be created to ensure that these agencies can continue working in the long term.

- *Funding*

Finding the balance between the two extremes of totally government versus totally private sector funded must be guided by the following considerations. Practical experience with similar organisations in South Africa indicates that national priorities might be neglected where an

organisation is dependent on the private sector for the major share of its revenue. On the other hand, there is a danger that the programme assumes a “budget commitment” (i.e. the implementing organisation becomes an end in itself) in the case where the government is the sole provider of funds for this initiative. For these reasons, an appropriate mix of public and private funding seems most promising. One suggestion for a realistic composition includes 30 % government base funding, 15 % government contracts, another 15 % from contracts with multi and bi-lateral funders, 15 % through energy audits, 15 % through seminars and capacity building activities, and another 10 % through other activities such as the sale of publications, demonstrations, and so on.<sup>21</sup> The SA EA would most likely have to start with initial external (international) funding, but would ultimately be mostly self-sustaining through a mixture of income-generating activities and different funding sources including consulting contracts with government and private partners.

- *Organisational form*

Regarding the organisational form of an SA EA, participants suggested to start with a national initiative combined with a steering board or committee. For a successful initiative, a private public partnership was considered to be most promising. Also, guaranteeing continuity of work and knowledge is an important aspect: Any successful initiative needs continuity and therefore permanent staff (at least 2-3 persons), in order to be able to benefit from experiences and learning.

- *Partners and shareholders:*

Successful Energy Agencies need strong partners in their background. Also, the shareholders of the EA have a strong impact on its fields of activity. A diverse and broad membership structure, preferably a public-private-partnership suits best for independence, flexibility and development potentials.

An important partner is the government, i.e. the respective ministries (for energy, the environment, and industry). Private partners could include Eskom, the Energy Intensive Users Group as well as the Development Bank of South Africa. Furthermore, international partners should be found, not only as a financier, but also in order to establish and reinforce international

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<sup>21</sup> Bredenkamp, 2002b.

links to existing energy agencies (e.g. in Mexico and Germany). Last but not least, NGOs also play a crucial role in establishing an SA EA.

- *Next steps*

The South African project partners suggested to start with establishing a "SA Energy Agency Initiative". For this purpose, a Task Group was created which will map out the initial ideas and the way forward. The workshop identified a person to start coordinating the initial steps of such an initiative and to prepare the initial presentation to the minister. Participants suggested to meet with the energy minister very soon and ask her for support and to appoint a counterpart within DME and to get DEAT involved.

To date, the initiative is coordinated by a person from the Minerals and Energy Policy Centre (MEPC). It thus is well-located in two respects, first within an independent policy consultant and education institution, set up by the ANC state, and secondly as an institution located in Johannesburg which is in the core of economic activities and close to the government departments in Pretoria (about 45 minutes driving distance to Johannesburg). At the same time, a process of stock-taking and understanding the lessons learned from existing initiatives would start. This would be followed by drafting a business plan including suggestions for an organisational structure. Moreover, the Task Group would start lobbying for funding as well for support from stakeholders.

## **5 Conclusions**

The co-evolutionary approach to the implementation process of an SA energy agency has so far proven to be appropriate and successful. The South African project partners used the occasion of the SEPCo workshops to discuss aspects crucial for the creation of an energy agency and to map out a feasible implementation plan for the agency. For this process, the experience of German and Mexican energy agencies was important and helpful, and a process of stocktaking and understanding the lessons learned from existing initiatives started.

The workshop led to the founding of a task force, the "SA Energy Agency Initiative". It will further develop the initial ideas and map out the way forward. Participants planned to ask the South African energy minister for her support and for appointing a permanent counterpart within the DME. A business plan will be drawn up, including suggestions for an organisational structure. Moreover, the task force will start lobbying for funding and support from stakeholders.

Once again a broad range of potential on site players proved being necessary for a successful process. The workshop participants saw the exercise as more than a one-day further education session and adopted the results as their own. A crucial point will be the availability of resources to the SA players in order to further drive the idea forward.

Regarding the underlying theoretical ideas, the case study in South Africa confirms our thinking that a major barrier to successfully implementing and disseminating energy efficiency technologies is the existence of transaction cost caused by information gaps and lack of capacity on all levels. Innovative institutional structures can be considered an appropriate tool to improve the situation.

Moreover, the approach to carefully select participants for the workshop with regard to their potential role in energy efficiency policies helped to create an enabling working atmosphere during the workshop and to address the issues which are at the core of the problem. The inputs from abroad helped sharpening the perspective. The outcome of the workshop reflects that participants took ownership of exactly those ideas which seemed appropriate to the specific situation in South Africa. Unfortunately, the electricity utility Eskom as well as the energy ministry did not show up; this was seen as a major insufficiency of the workshop.

The task group aimed at bridging this gap by its presentation to the minister. However, to date, the coordinator only prepared a very draft presentation which he sent out for comments. A significant delay in the initial plan is hence already manifest.

Thus, to finish, a mixed, careful and not only optimistic conclusion seems appropriate: Discussions during the SEPCo workshops and the task forces initiated have set things in motion towards sustainable energy supply. However, the ultimate success of the project cannot be anticipated yet. The South African project partners themselves characterised this process as “evolutionary”, and we feel that ongoing consulting and support would be helpful and necessary for the eventual realization of the SA EA. As the consulting process to implement energy agencies has just begun in South Africa, periodic external support from a trained specialist would be useful for the further planning and implementation process.

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