

# **Improve the cost effectiveness of Demand Side Management programmes: The INDEEP Database (Results of the IEA DSM Annex 1)**

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## **Synopsis**

An international database on energy efficiency programmes (INDEEP) has been developed. Data from almost 240 programmes and 15 countries are included in this database, that is (restricted) available on the Internet. At the moment these programmes are analysed and the software finalised. Results from the interim analysis are presented, including the ten best programmes related to cost (all less than 0.02 Euro a saved kWh). A final report on this Task for the IEA DSM Agreement will be available by the end of the year 2000.

## **1. Introduction**

The International Database on Energy Efficiency Programmes (INDEEP) is one of the Tasks in the IEA Demand-Side Management (DSM) Agreement. This Agreement was signed in December 1993 and Task 1 started in May 1994. INDEEP has been designed to make information available on electric and gas utility demand-side management or energy efficiency services programmes. It also contains information from programmes carried out by governmental agencies, energy service companies, and others. It focuses on programme descriptions and key summary data on programme costs, participation rates, energy and demand savings, market delivery designs, and evaluation methodologies.

The development of an international database as well as the data collection and its analysis is a time-consuming activity. In section two, we present important phases in this process. Also the content of the database at the moment is presented. Section three highlights the main elements in the Data Collection Instrument, and makes clear what kind of information is collected. The results from the interim analysis (situation end 1997) are included in section four. Section five gives an overview on the INDEEP Internet software. In the last section an option for a new Task with emphasis on evaluation is summarised.

## **2. Development of the INDEEP database**

The work started in 1994 with an expert group from the USA, Korea, Austria, Denmark, Sweden, Spain, the Netherlands and a delegate from the European Commission. The work plan holds seven subtasks, as presented in table 1.

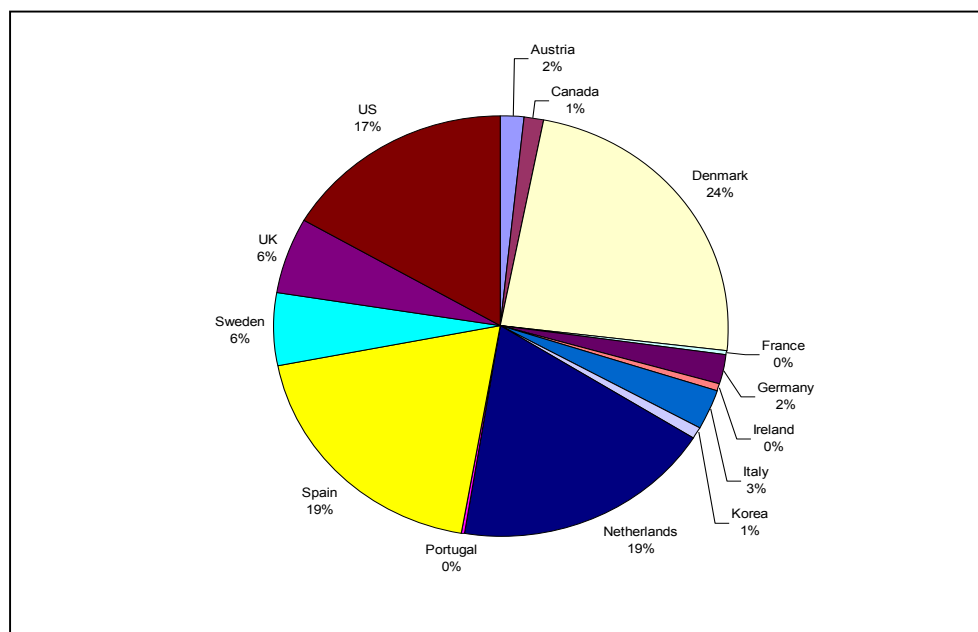
During the first two years the expert group developed and tested the Data Collection Instrument (DCI) that is described in the next section. They also collected data on programmes to test and improve this instrument. After three years the analysis on the data started. The outcome of this is available in the report "International Programme Experience in Providing Energy Efficiency Services Comparing Cost Effectiveness" (Novem, February 1998). As the number of programmes increased, the need to develop a database special for this project was proven. In 1998 a first prototype was ready and a year later the testing of the software started. This software is available in several languages, additional to the main, English one.

Table 1: Subtasks for the INDEEP project

Subtask	Main activity	Main period
1. Programme identification	<ul style="list-style-type: none"> <li>develop a survey questionnaire</li> <li>implement the questionnaire</li> <li>identify programmes</li> </ul>	1994-1995
2. Design planning	<ul style="list-style-type: none"> <li>determine the data collection</li> <li>develop, test, and evaluate the DCI</li> </ul>	1994-1997
3. Design the database	<ul style="list-style-type: none"> <li>select software package</li> <li>start software development</li> <li>improve software to internet</li> </ul>	1997-1998
4. Data collection and entry	<ul style="list-style-type: none"> <li>data collection, using the multi-languages DCI</li> <li>quality control on data</li> <li>data entry</li> </ul>	1995-1998
5. Data analysis and report preparation	<ul style="list-style-type: none"> <li>analyse the first 100 programmes</li> <li>prepare an interim report</li> <li>conduct a final analysis and report</li> </ul>	1997 1999-2000
6. Updates to the database	<ul style="list-style-type: none"> <li>update existing data</li> <li>add new data</li> <li>improve software</li> </ul>	1998-2000
7. Promoting and marketing	<ul style="list-style-type: none"> <li>prepare information material</li> <li>present INDEEP results</li> </ul>	continues

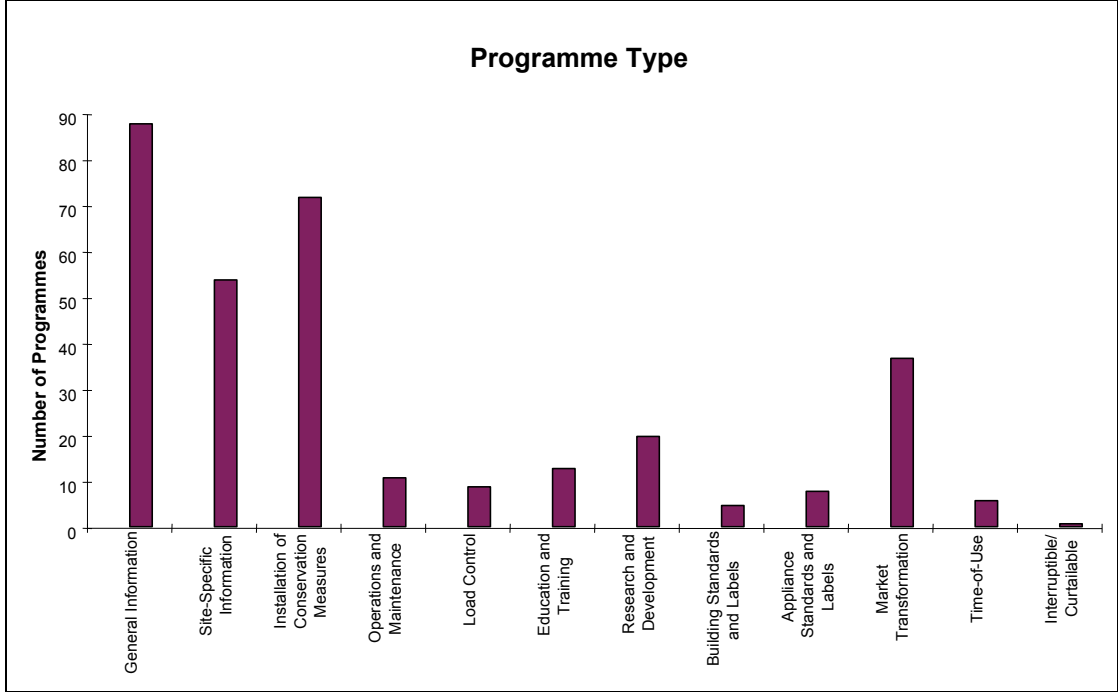
At the end of 1999 information on 227 programmes was stored in the database. At the moment some 10 additional programmes are available in the INDEEP database. Most of these programmes were implemented in countries within the European Union: 54 in Denmark, 43 in Spain and 42 in the Netherlands. Programmes from the United States, Canada and Korea are also included. Figure 1 shows the distribution of the programmes (end 1999) over the various countries.

Figure 1: Programmes in the INDEEP database by country



The majorities of programmes are general information programmes, and installation of conservation measure. Also programmes with site specific information and market transformation are major types of programme. It should be kept in mind that a programme could be characterised up to five types. In figure 2 the main types are presented.

**Figure 2: Programmes by programme type**



### 3. The Data Collection Instrument

The experts from the countries participating in the INDEEP task developed a data collection instrument (DCI) that was tested in a pilot and discussed with potential users in several national and two international workshops (Vienna and Madrid). The initial DCI was 20 pages long and requested very detailed information. After discussions, the information was restricted to a four pages form that includes:

- A: Programme information (name, organisation, contact information etc.)
- B: Programme type, status and scale (including reasons for selecting and evaluation status)
- C: Objectives and targets
- D: Technologies and immaterial techniques
- E: (Consumer) markets and marketing methods
- F: Costs
- G: Savings
- H: Lessons learned (qualitative information by the programme management)

An example of the DCI, including the definitions is presented in the “Progress Report INDEEP 1996-1997” (Novem, 1998). This report is also available at the IEA DSM Website [dsm.iea.org](http://dsm.iea.org).

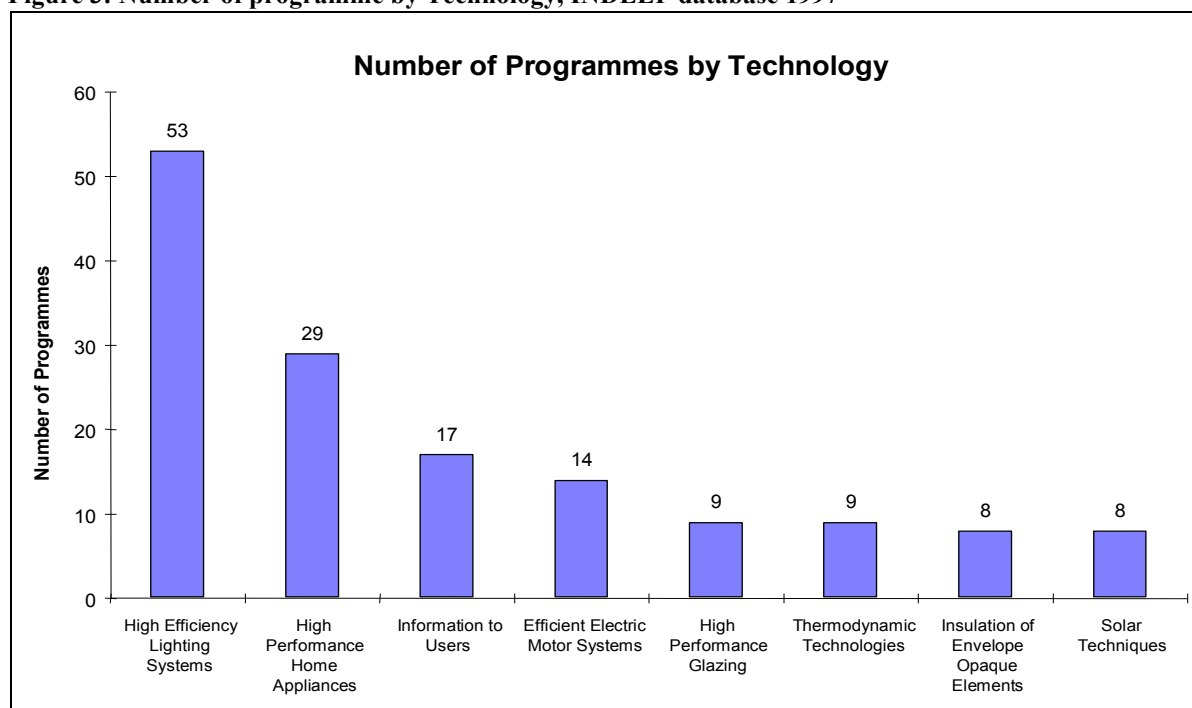
## 4. Interim analysis

In 1997 the data in the INDEEP database had been analysed. At the moment the second and final analyse is ongoing. It is not possible to present preliminary results at the moment, so the information is referring to the situation mid 1997; at that moment the database contained 162 quality-controlled programmes for 13 countries. Evaluation have been completed for 61% of the programmes, therefor, not all data is available for all programmes.

### 4.1. Programmes by technology

The majority of programmes (95) produce electricity savings by using better "End Use Technologies". Within that, 53 deal with high efficiency lighting systems and 29 deal with high performance appliances. Although there is this main technology category on different kinds of electricity savings, other technology categories may also generate electricity savings; e.g. different kinds of insulation technologies in the building envelope group will save electricity if electricity is used for heating.

Figure 3: Number of programme by Technology, INDEEP database 1997



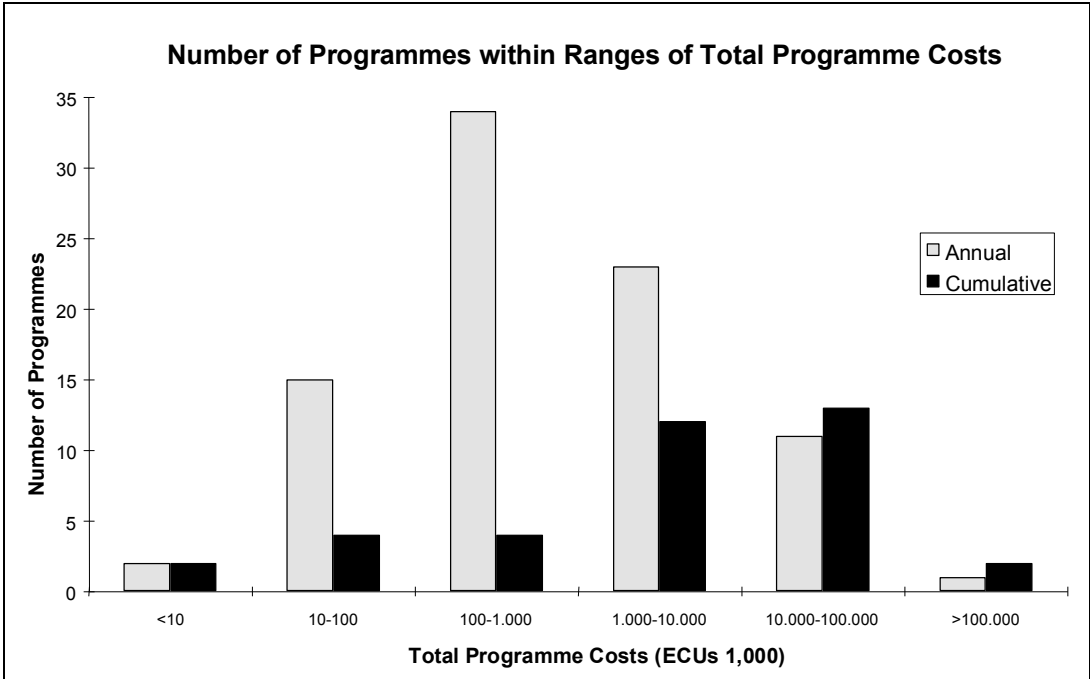
### 4.2. A broad range of total programme cost

The total programme costs in INDEEP are made up of Utility/Organiser Costs and Non-Utility Organiser Costs. The database can also show the percentage of incentive versus non-incentive costs needed to implement the DSM programmes.

Figure 4 shows a broad range of total programme costs required to implement the INDEEP programmes: 112 of the programmes in the database have cost data available, 86 have annual cost data, and 45 have cumulative cost data. As shown below, the greatest number of programmes (34) cost between ECU 100,000 and 1,000,000 to run for a single year, but they

can cost as little as ECU 10,000 or as much as ECU 100,000,000 depending on the size and characteristics of the programme.

**Figure 4. Number of Programmes vs. Total Programme Costs, INDEEP database 1997**

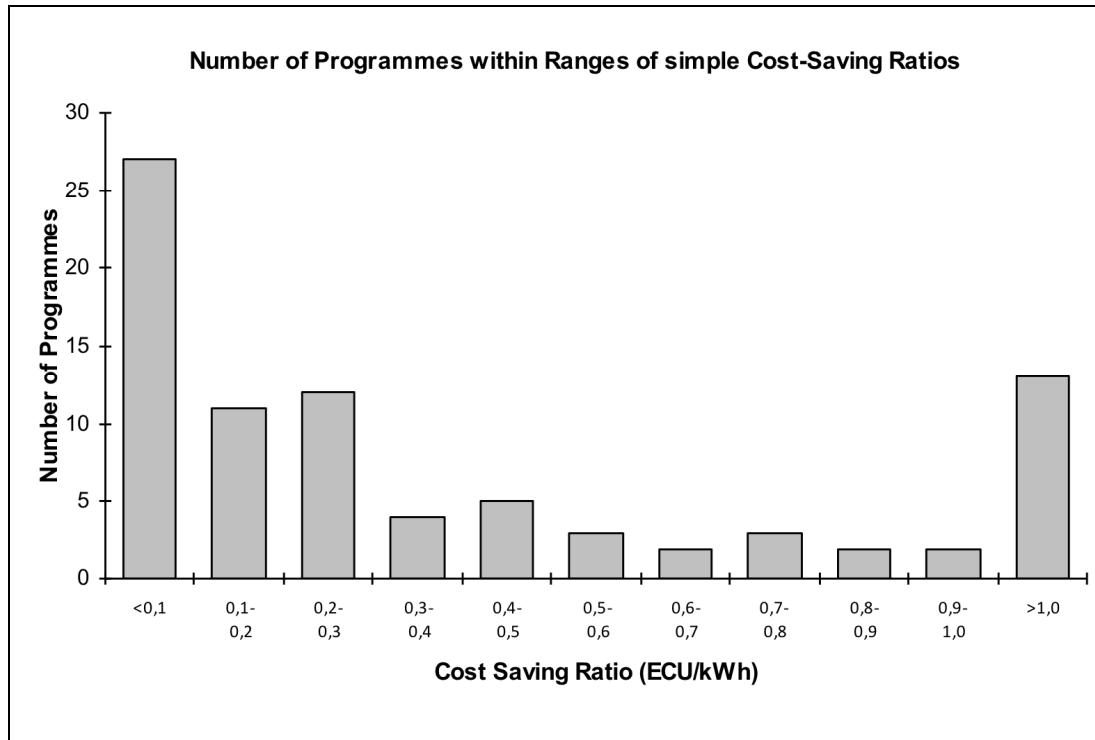


**4.3. Cost-saving ration**

The cost effectiveness of the INDEEP programmes is calculated in two separate ways within the database. The first is the Total Resource Cost; the other is a simple cost-saving ratio. This calculation is first carried out on cumulative data, and if this is not available, annual data is used. The simple cost-saving ratio is measured in ECU/kWh and simply divides the total programme cost by the energy savings. The lower the ratio, the more cost-effective the programme. This calculation is used to compare more of the programmes in the database because only 35% of the programmes have data to calculate the TRC. Fifty two percent (84) of the INDEEP programmes are included in this comparison in figure 5. The same trends persist in this type of comparison as in the TRC that is not presented her. Many of the programmes (50), have cost-saving ratios of less than ECU 0.3 kWh, but there are also several (13) with ratios greater than 1.0. There are relatively few programmes in between.

Total Resource Cost and Simple Cost-Saving Ratios are useful in gauging the degree of cost-effectiveness of a programme, but one should be aware that many DSM programmes are very individual and unique, and these calculations are not always capable of capturing all facts. Also, the energy price is not the same for each programme, which has an influence on the value of the savings.

Figure 5. Number of Programmes vs. Simple Cost-Saving Ratio, INDEEP database 1997

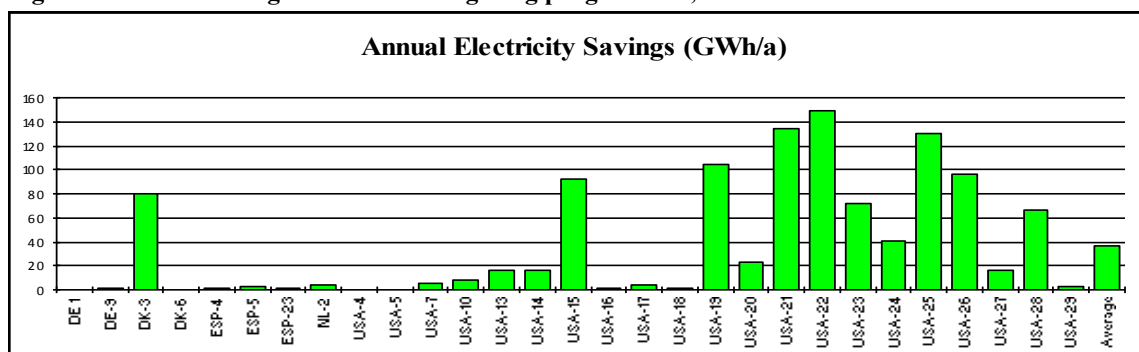


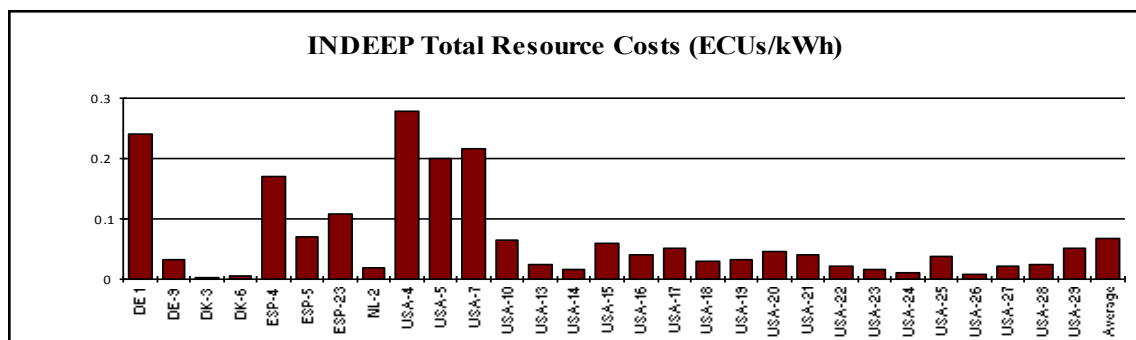
#### 4.4. Cost Effectiveness of Lighting Programmes

Figure 6 shows individual key figures for 29 of the 53 lighting programmes in the INDEEP database with enough information to calculate the total resource cost. The last column gives the average for these 29 programmes.

Annual participation data in figure 6 gives the volume of customers involved in the DSM programme for the most recent year. The Danish programme "Campaigns for Energy Saving Lamps" (DK-3) has the most participants by far of any other programme in this group, 520,000 customers. "Licht Light" (DE-9) is second with 42,000 participants. The total resource cost takes energy savings, programme costs, and average measure lifetime to calculate the cost effectiveness of the programme. This figure shows that the Danish programme, DK-3, is also the most cost effective with total resource costs as low as ECU 0.0017 kWh. The average total resource cost for CFL campaigns is ECU 0.066 kWh.

Figure 6. Annual savings and TRC for lighting programmes, INDEEP database 1997





#### 4.5. Ten Most Cost Effective Programmes

The Total Resource Cost is calculated in the database and is used to rank the 10 most cost-effective programmes in the database. It has to be remembered that only 35% of the programmes have data to calculate the TRC, e.g. most of the 23 Spanish programmes started in 1995 and only four have data to calculate the TRC.

According to the Total Resource Cost, the best 10 programmes in the INDEEP Database are listed in table 2. Global depth descriptions of these programmes are given below.

**Table 2. Ten most cost effective Programmes, INDEEP database 1997**

Rank	Programme Name	Country	TRC (ECU/kWh)	Evaluation data *)
1	Go Easy Campaign, Metercard	Netherlands	0.001	En, (Bi)
2	Low-flow showerheads 1	Netherlands	0.001	Bi, Sa, Ot
3	Campaigns for energy-saving lamps	Denmark	0.002	Eq, Sa
4	Occupancy sensors in schools	Denmark	0.004	Si
5	LCP Soest for heating and ovens	Germany	0.006	En, Eq
6	Saving on electric water heating and water	Denmark	0.007	Si, Sa
7	Energy Management Hardware Rebate Programme	USA	0.008	En, Si
8	Low-flow Showerhead	Netherlands	0.009	En, Sa
9	Commercial lighting Retrofit Rebate	USA	0.016	En, Sp, Eq, Si
10	Commercial and Industrial lighting Rebate	USA	0.016	En, Bi, Si, Ot

\*) En = Engineering      Sp = Spot metering      Si = Site-specific      Ot = Other  
 Bi = Billing      Eq = Equipment specified      Sa = Appliance sales

1. Go Easy Campaign, Metercard; from the Netherlands is a programme designed to promote self-metering by the residential customers that were targeted. The programme began in October 1993 at full-scale on a regional level, and after the evaluation was completed, the programme has continued.
2. Low-Flow Showerheads (1) was a pilot programme implemented by an utility in the Netherlands. The programme ran for three years from September 1991 to November 1994. Customers renting an electric boiler from the utility have the opportunity to have a low-flow showerhead installed at reduced prices, including the opportunity to finance it.

3. The programme Campaigns for Energy Saving Lamps, was one of 17 campaigns operated in Denmark between 1988 and 1994 which were designed to promote and increase the use of compact fluorescent lamps (CFLs). Sixty utilities in western Denmark spent a total of ECU 4,140,000 by 1997 on advertising and promoting CFLs in a programme. The programme uses various methods of advertising.
4. Occupancy Sensors in Schools is a programme that deals with installing occupancy sensors in school buildings, so lighting electricity is not wasted when rooms are not occupied. The programme was initially tested as a pilot programme in three schools, and is now running full-scale at the regional level. The full-scale programme began in January 1995.
5. LCP Soest for Heating and Ovens is a German incentive programme aimed at replacing electric ovens with gas ovens and electric heaters and old gas boilers with gas-condensing boilers. The programme spent a total of 31,750 Euro on advertising the campaign and issuing cash awards for participation.
6. The goal of the Saving on Electric Water Heating and Water programme was to avoid digging a new well by reducing the water consumption of the constituents in the region. In this connection a more specific goal was set to persuade 1500 families to participate, each saving 1500 kWh in electricity consumption.
7. Energy Management Hardware Rebate Programme. This USA programme affects a wide range of customers and electricity-saving technologies. All types of commercial, industrial, and agricultural customers are targeted and building owners, managers, and administrators, as well as energy service companies and appliance manufacturers are targeted as non-customers.
8. The Dutch Low-Flow Showerhead (2) was at full-scale regional level and implemented in the winter 1993/94. The goal was to install 20,000 low-flow showerheads which were reached very successfully, within sales of 40,000 (20% of the eligible customers). A result of this success and similar actions by other utilities was that the prices for the showerheads decreased.
9. Commercial Lighting Retrofit Rebate programmes was implemented in the USA during the years 1985-92. It was at full-scale programme at regional level and involved 5,381 commercial customers. The programme offered rebates based on the reduction in summer and/or winter peak demand anticipated as a result of lighting retrofit equipment installations. Energy service companies (ESCOs) were used to promote the programme.
10. The USA Commercial and Industrial Lighting Rebate Programme was also at a full-scale regional level in 1991. The utility offered fixed rebates to customers who installed energy-efficient lighting measures. Incentives were also provided to trade allies. The average rebate covered approximately 73% of the installed cost of efficiency measures.



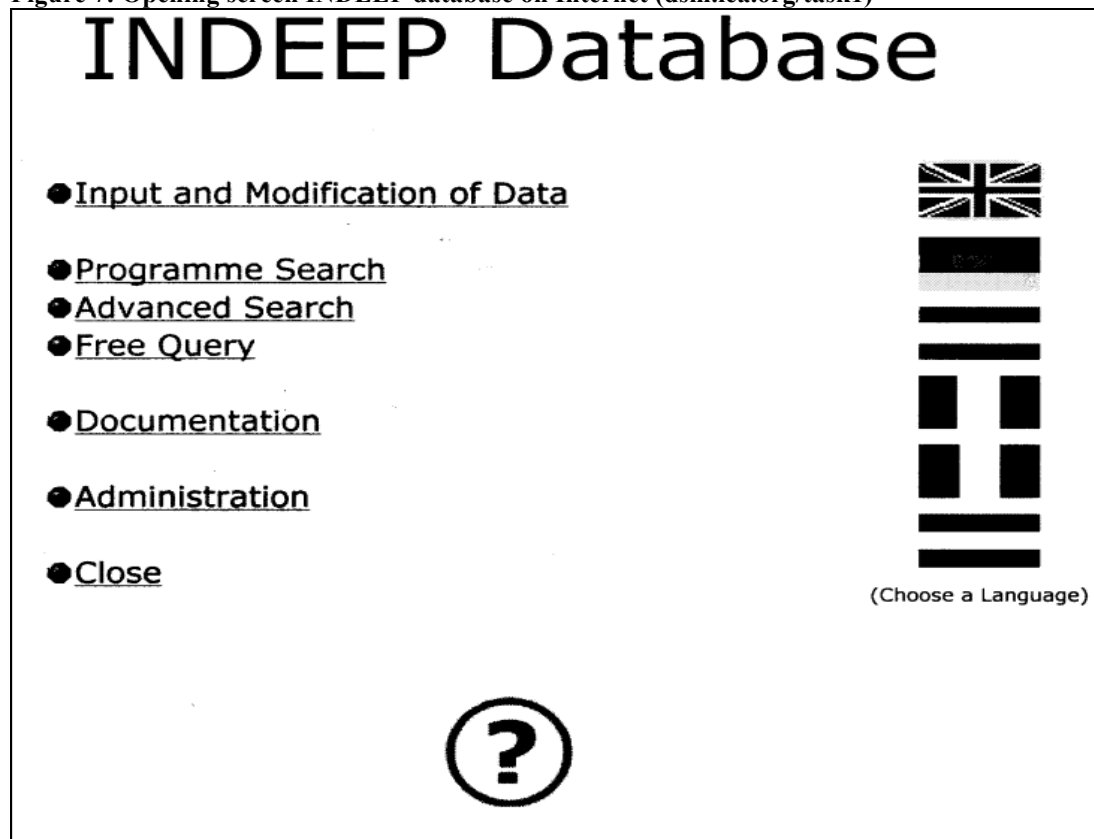
## 5. INDEEP Internet software

During the testing of the DCI in the first year, data was stored in spreadsheets. As the shortened DCI proved to be a useful instrument to collect data, the development of a database, using the database software ACCESS, was started by the end of the second year. A prototype was developed first and during the third year the software development focused on upgrading this prototype to a tailor-made database. However more and more discussion showed up on the real time database, available for use. In 1998 it was agreed that the software should be developed for the Internet and to stop (i.e. not upgrade) the programmes developed for the prototypes (using the ACCESS software). The Internet version will have an option to select languages other than English from the opening screen. There will be three search options:

1. Programme search: to find programmes for a country or a specific technology. It is also a useful tool if the user already has some information on a programme (e.g. from the one-page summary) and wants more information on that specific programme.
2. Advanced search: this uses the various fields in the database to find a group of programmes. The fields are organised into four groups: General, Energy related, Marketing related, and Others. Field values can be filled in within each group, but a combination of fields can also be used in the search.
3. Free query: to search information in the text fields 'lessons learned' and 'programme summary'.

The software is available for all participating countries. To get access, the national expert authorises a user. Every one will one of these day have also the possibility to see the section Documentation and input a programme (see figure for the opening screen)

Figure 7: Opening screen INDEEP database on Internet (dsm.iea.org/task1)



## 6. New common work dealing with evaluation

The INDEEP task is coming to an end during this year 2000. The INDEEP database might continue for a short period and be updated to keep the information available as a tool for:

- designing or planning new Demand-Side Management (DSM) programmes and increased energy-efficiency services and programmes;
- Evaluating existing programmes by drawing comparisons between similar programmes throughout the world that are included in the database.

The Executive Committee (EXCO) for the IEA DSM Agreement is at the moment discussing new common work tasks; one targeted to evaluation. In this new potential task elements from the INDEEP project will be reused, but the emphasis is on the evaluation on the (cost effective) impact of DSM programmes for Kyoto's CO<sub>2</sub> targets. One of the outcomes of the new, proposed task is to ensure that uniformed information on DSM and Energy Efficient programmes can be developed.

The main approach will be to use national and international expertise to collect and judge the information. In this national expertise should be included experiences programme evaluation, in the (inter) national standards for CO<sub>2</sub> emissions related to energy use, and in programme costs.

The Task will hold two subtasks:

1. to develop a common framework and draft an international evaluation guidebook, and
2. To test, improve and finalise the guidebook.

The planned period to do the work is about 1,5 year for each of the subtask. Apart from the knowledge each country experts will gain, the following reports are foreseen:

Subtask 1:

1. A general framework for programme evaluation.
2. A catalogue of available databases and models, costs and usefulness for evaluation.
3. A draft version of the evaluation guidebook.

Subtask 2:

4. A report on specific national elements within an international evaluation guideline.
5. A report on the use of the evaluation guidebook.
6. A modified, final version of the evaluation guidebook.