International Programme Experience in Providing Energy Efficiency Services Comparing Cost Effectiveness

February 1998
INDEEPAN.1998.1

This report was produced at DEFU by

Leslie Hebb	DEFU, Denmark
Casper Kofod	DEFU, Denmark

The report was produced in co-operation with the experts participating in Annex 1 of the IEA-DSM Agreement

Flavio Conti	European Commission - DG Joint Research Centre Institute for Advanced Materials/EST Unit
Anders Lewald	NUTEK, Sweden
Felix Martinez	Red Electrica de Espana, Spain
Lena Neij	Lund University, Sweden
Edward Vine	Lawrence Berkeley National Laboratory, USA
Harry Vreuls	Novem, The Netherlands Operating Agent for Task 1 IEA DSM Agreement

Table of Contents

Summary and Conclusions 4
1. Introduction 5
2. Participating Countries and Data Quality Control 6
   2.1. Data from 13 Countries 6
   2.2. Data Quality Control 7
3. DSM Activities and Energy Efficiency Technologies 9
   3.1. Different Types of DSM Activities 9
   3.2. Reason for Selecting DSM Activity 9
   3.3. Programme Status 10
   3.4. Energy Source 12
   3.5. Mixing of Incentives, Marketing and Technologies in the Programmes 12
   3.6. Technology 12
4. Targeting, Marketing and Participation 15
   4.1. Customer Targeting 15
   4.2. Marketing Techniques 15
   4.3. Participation 17
5. Evaluation, Savings, Costs and Effectiveness 20
   5.1. Evaluation Method 20
   5.2. Energy Savings 21
   5.3. Programme Costs 24
   5.4. Cost Effectiveness 24
6. High-Efficiency Lighting Systems 27
   6.1. Countries, Evaluation and Lighting Technologies 27
   6.2. Customers Targeted 29
   6.3. Marketing Techniques 29
   6.4. Evaluation Method 31
   6.5. Comparing Cost Effectiveness of Individual Programmes 32
7. Successful Programmes 35
   7.1. Goals versus Results 35
   7.2. Ten Most Cost Effective Programmes 36
      7.2.1. Number 1: Go Easy Campaign, Metercard (NL-4) 37
      7.2.2. Number 2: Low-Flow Showerheads 1 (NL-20) 37
      7.2.3. Number 3: Campaigns for Energy Saving Lamps (DK-3) 38
      7.2.4. Number 4: Occupancy Sensors in Schools (DK-6) 39
      7.2.5. Number 5: LCP Soest for Heating and Ovens (DE-7) 40
      7.2.6. Number 6: Saving on Electric Water Heating and Water (DK-11) 40
      7.2.7. Number 7: Energy Management Hardware Rebate Programme (USA-26) 41
      7.2.8. Number 8: Low-Flow Showerhead (NL-1) 42
      7.2.9. Number 9: Commercial Lighting Retrofit Rebate (USA-14) 42
      7.2.10 Number 10: Commercial and Industrial Lighting Rebate Programme (USA-23) 43
Appendix A 44

Summary and Conclusions

The INDEEP database is an international tool for designing, planning, evaluating, and comparing DSM (Demand-Side Management) and energy efficiency activities. By June 1997 the database contained 162 quality-controlled programmes from 13 countries. Evaluations have been completed for 61% of the programmes, therefore, not all data is available for all programmes.

The primary objective for nearly all programmes (96%) is energy efficiency. The programmes target only 46%, 12% and 11% of the residential, commercial and industrial customers respectively. The remaining 31% target primary non-residential customers.
Electricity consumption is affected by 90% of the programmes. Utility companies implemented around 80% of the programmes.

Seven out of ten programmes use only one marketing incentive, which in most cases is rebates cash awards. Two or more methods are typically used for marketing. Many programmes state that aggressive and broad marketing is necessary in order to obtain a high participation rate. It is difficult to determine which strategy gives the highest participation rate because different programmes and programme types are successful with different combinations of marketing methods and incentives. This topic will be studied in detail in the next analysis report, as well as the relation to the programme costs.

Fifty four percent of the programmes with evaluation method information use more than one method to calculate the energy savings, which indicates good quality. A comparison of the cost effectiveness shows that most cases are at a good level with a distinctive break to a group at a poor level. The next report will include the cost effectiveness for different types of programmes (campaigns, audits, control, education, standards, market transformation etc.).

A listing of the top 10 most cost-effective programmes shows that all except one are based on measured data and many on several types of data, which indicate evaluation of high quality. This list gives individual descriptions of the programmes and reasons for their success including very different programmes on low-flow showerheads, energy-saving lamps, commercial lighting retrofit, different types of energy management, occupancy sensors in schools, and gas for more efficient heating and ovens. Nine of the ten programmes come from Denmark, the Netherlands and USA. This may be due to the fact that these countries have implemented a large number of programmes and/or have experience from previous programmes. It indicates that less experienced countries could use INDEEP. In the near future additional data from a wider range of countries should be included in the database.

1. Introduction

INDEEP is a database which has been developed as a Task under the IEA DSM Agreement.

The INDEEP database is 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.

This analysis report is the first in a series that will be published by the IEA INDEEP expert group containing information about their work. The following analysis is based on the INDEEP data which was available in June 1997.

Chapter 2 shows that data are included from 13 countries, and that only data which has passed a quality control, has been included.

In chapter 3 the programmes are categorised with reasons for selecting them. The status of the programmes and evaluation are then described, followed by the technologies and techniques used.

The marketing techniques and participation are presented in chapter 4.

Chapter 5 describes how the programmes have been evaluated and their results, in the form of energy savings, programme costs, and cost effectiveness.

A more in-depth analysis is conducted on the most common technology "High-efficiency Lighting Systems" in chapter 6. The analysis compares marketing techniques, evaluation methods and, at an individual level, the participation, participation rates, electricity savings, programme costs, and cost-effectiveness of the programmes.

Finally in chapter 7, the top 10 programmes in the INDEEP database with the lowest Total Resource Cost are summarised and commented on to show the characteristics of successful DSM programmes.

2. Participating Countries and Data Quality Control

2.1. Data from 13 Countries

The INDEEP Database currently (June 1997) consists of 162 DSM programmes implemented in 13 countries and using a broad range of energy-saving technologies. The number and percentage of programmes from each country are shown in figure 1. The largest number of programmes, 24%, comes from the United States, followed by the Netherlands submitting (17%), Denmark (15%), Spain (14%), and Sweden (11%).

More than 162 programmes have been collected, but they are not included in the analysis due to the lack of essential data. This is explained further in section 2.1 on Quality Control.

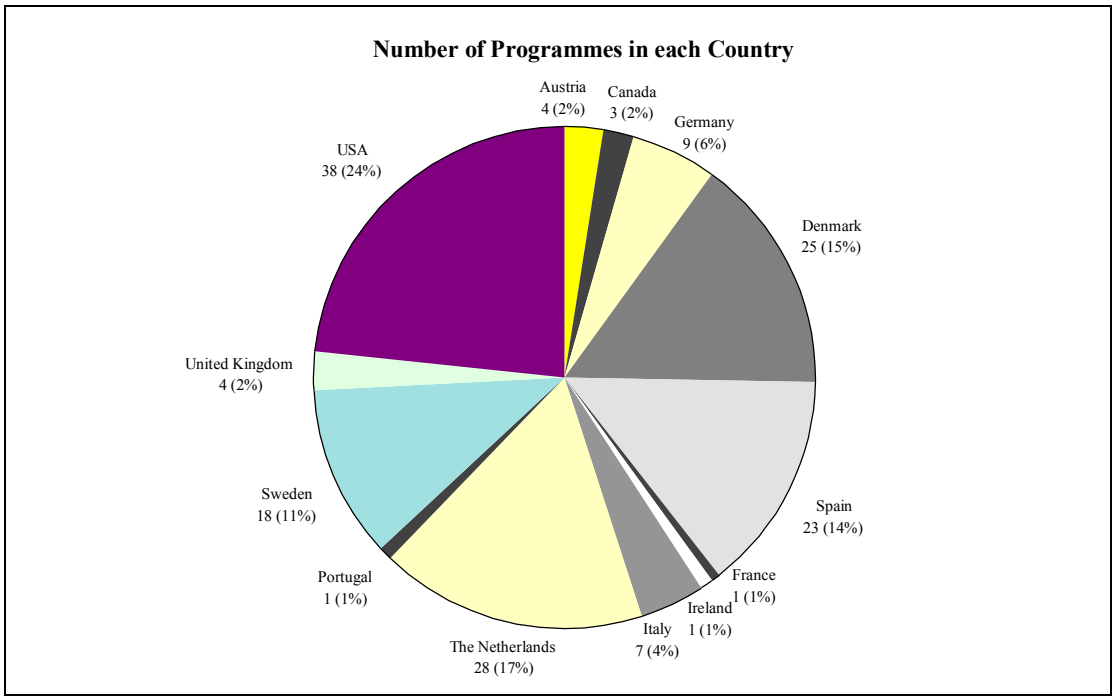

Figure 1. Number of Programmes divided by Country

The majority of programmes in the database are implemented by utility companies (80%); followed by central governments (14%); regional governments and energy service companies (2%), and non-profit organisations (2%). The primary objective in nearly all programmes is energy efficiency.

2.2. Data Quality Control

The quality of the programme data in INDEEP is directly related to the value of the database as a design or evaluation tool for current and future DSM programmes. In the spring of 1997, the INDEEP experts attempted to ensure the quality of the available information by forming a quality control group.

The quality control group consists of INDEEP data which must be completed for all of the programmes in the database:

- the summary
- the programme status
- the implementing agent
- the energy sources affected
- technologies
- evaluation status
- the reasons for selecting the DSM activity

As shown in figure 2, five of these fields currently have 100% availability, while the summary is missing for a few programmes (they are included because summaries will be completed soon) and technologies are available for 97% of the programmes.

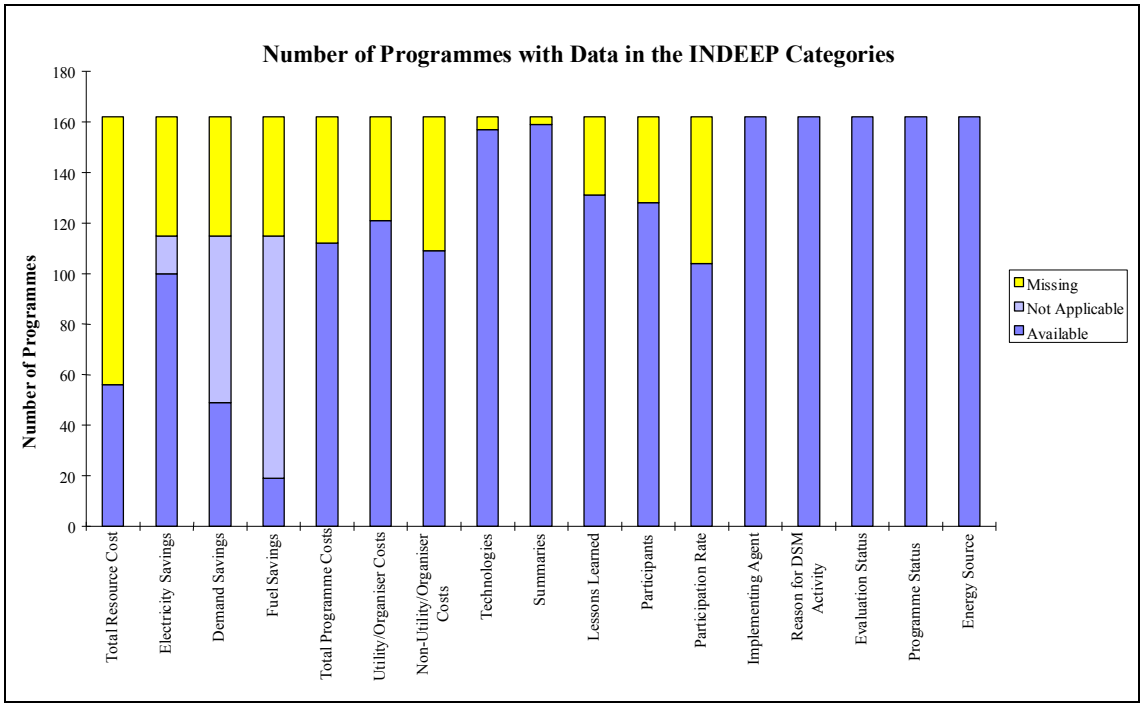

Figure 2. Number of Programmes with Available Data

All the criteria for basic information except the summary and technologies are thus being met for the quality control group, but 19 programmes which were submitted to the INDEEP

experts were not included in the database due to the lack of available information about the programmes. In 1997 the database, as a whole, has thus in 1997 reached a high level of quality due to the content and availability of the information on the programmes in the database.

Figure 2 shows the available data for the most important types of information which, besides the basic information also includes information about savings, costs, participation, energy efficiency measurement and lessons learned. Unfortunately, not all of this data is available for every programme. The missing data often makes it difficult to analyse and compare all the programmes or aspects of the database. According to the evaluation status, only 99 (61%) of the 162 programmes have completed their evaluations. Therefore, not all data are available for the remaining programmes. In future, the data will be improved and updated by the work of the INDEEP expert group.

As shown, 56 (35%) of the programmes have enough data to calculate the Total Resource Cost, which is a measure of the cost-effectiveness of the programmes and the easiest way to compare them; 100 (62%) programmes have electricity savings data; 112 (69%) programmes have total programme cost data; 157 (97%) programmes have at least one associated energy-efficiency technology; 159 (98%) programmes have a programme summary; and 128 (79%) programmes have participation data.

3. DSM Activities and Energy Efficiency Technologies

3.1. Different Types of DSM Activities

INDEEP programmes are categorised into different types of DSM activities. A single programme may be placed in as many programme categories as are applicable. Figure 3 shows how INDEEP programmes fall into programme type categories.

The majorities of programmes are general information programmes (88 programmes) and installation of conservation measure programmes (72 programmes). Fifty four of the programmes in the database are site-specific information programmes, and 37 are market transformation programmes.

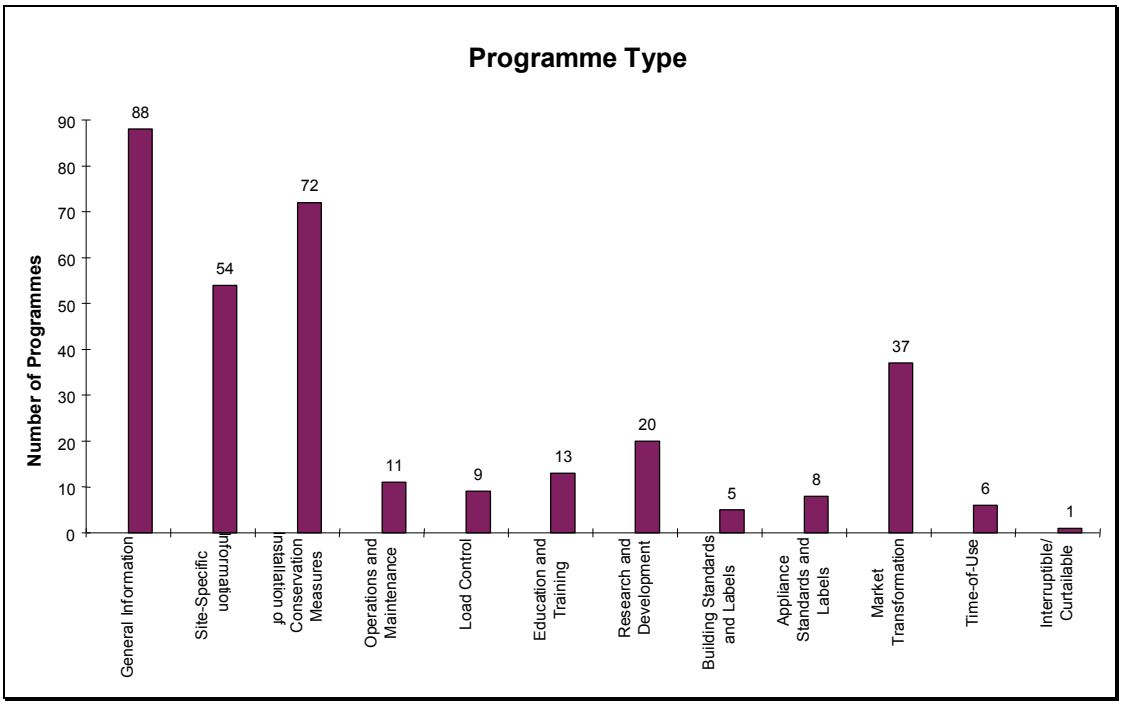

Figure 3. Number of Programmes of Each Programme Type

3.2. Reason for Selecting DSM Activity

Each programme in the INDEEP database can have up to five reasons (out of 17 reasons) why its implementing agents chose to enact that particular DSM programme. The reasons are split into four separate categories: regulatory, economic, environmental, and marketing of the implementing organisation. Figure 4 shows how many programmes cited each category.

A frequent reason (52 programmes) for implementing the DSM programmes is regulatory incentives. Selecting the particular DSM activity for economic reasons (i.e. economic development, cost of service) was the least likely. Environmental reasons were the most frequent, with 62 programmes implementing the DSM programme as a long- term resource option and 47 in order to aid the reduction of global warming. Marketing reasons were also very frequent. One third of the programmes in the database (51) were implemented as energy-saving programmes in order to augment public image.

In general, image and environmental concerns are the main reasons that agents such as governments and utilities implement DSM programmes.

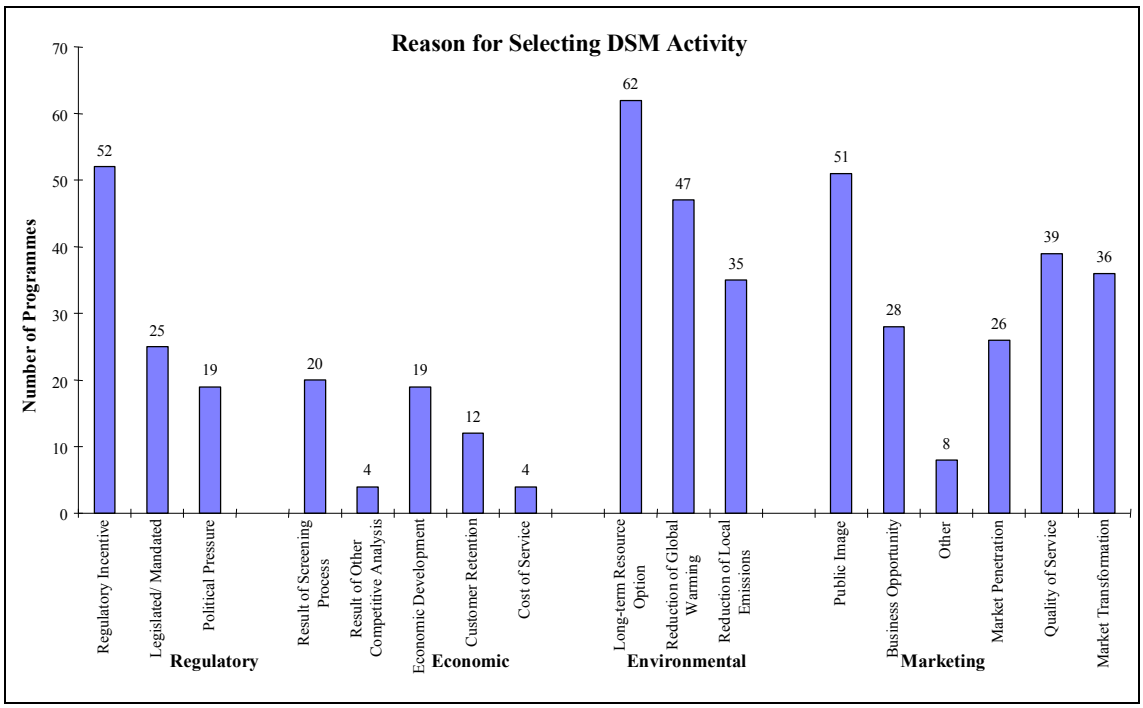

Figure 4. Reason for Selecting DSM Activity

3.3. Programme Status

The continuation status is available for all 162 programmes. Figure 5 shows that 57% (93) of the programmes in the database are currently still being implemented while 43% (69) have been terminated.

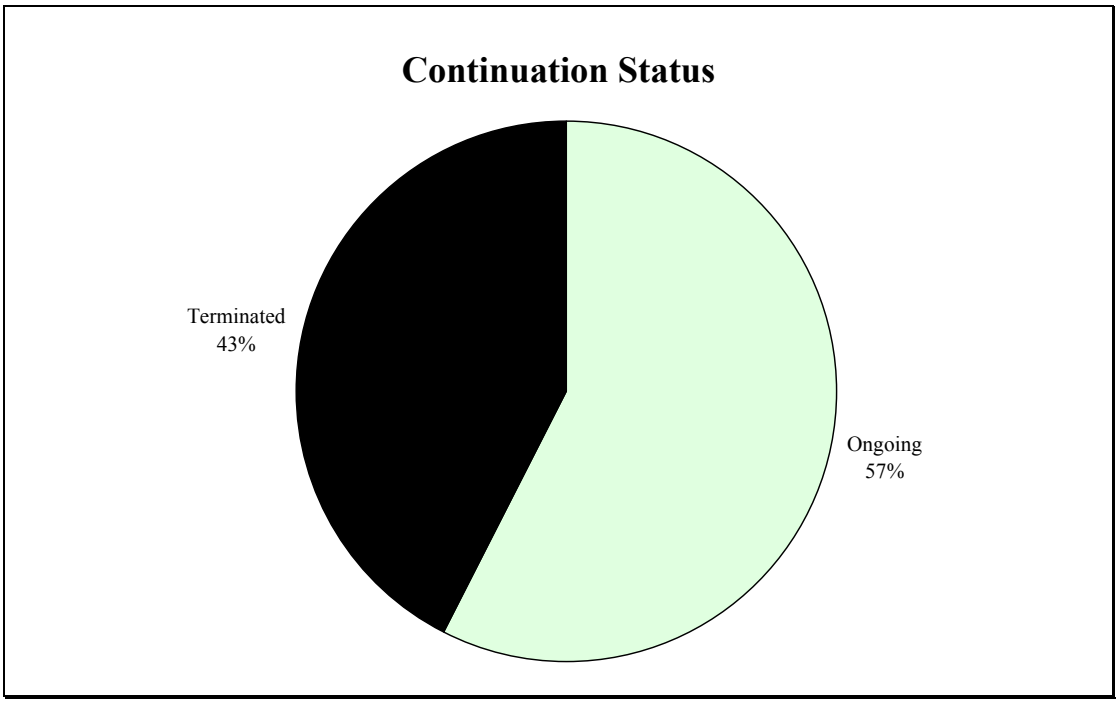

Figure 5. Continuation Status

Figure 6 shows that 61% (99 programmes) have completed evaluation of the programme, while 34% (50 programmes) still have ongoing or planned evaluations, and 5% (8 programmes) are not planning to perform an evaluation. For programmes, which are ongoing, new evaluation information is expected to be included in the future updating of INDEEP.

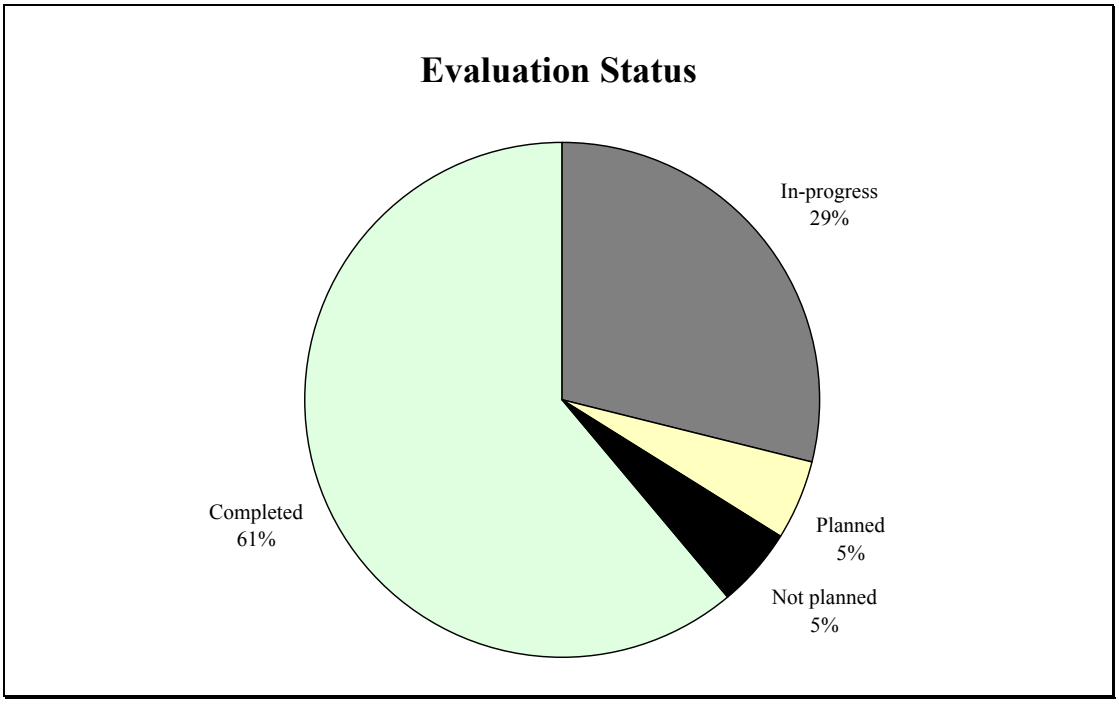

Figure 6. Evaluation Status

3.4. Energy Source

The INDEEP programmes may affect four different types of energy sources: electricity, gas, fuel oil, or district heating. Table 1 shows the number of programmes that apply to one or more energy source: 83% (134 programmes) of the programmes in the database affect only one energy source.

Number of Energy Sources	Number of Programmes
1	134
2	14
3	3
4	11

Table 1. Number of Energy Sources Used

Table 2 shows the number of programmes that affect each type of energy source. The main energy source within the database is electricity which is affected by 90% (146) of the programmes, 23% (37) of the programmes affect gas, 10% (16) affect fuel oil, and 10% (16) have district heating as an energy source.

Types of Energy Sources	Number of Programmes
Electricity	146
Gas	37
Fuel Oil	16
District Heat	16

Table 2. Types of Energy Sources

3.5. Mixing of Incentives, Marketing and Technologies in the Programmes

Many of the programmes used more than one marketing method, marketing incentive, and technology. These variables identify the programme and directly affect programme results such as customer participation, energy savings, and cost. Consequently, the mixing of variables makes it very difficult to attribute programme success or failure to one single factor.

3.6. Technology

The programmes in INDEEP are characterised by energy-efficiency technology codes including real technologies, energy conversion systems, apparatus, as well as immaterial techniques (see a list in appendix A). A single programme can be characterised by up to seven different types of energy technologies. More than 80 different energy-saving technologies are represented in the database.

Almost 100% (157 of 162 programmes) of the programmes in the database include technology data. Table 3 shows the number of programmes using one or more energy-saving technologies: 57% (92) of the INDEEP programmes with available information use a single energy-saving technology while 40% (65) use a mixture of technologies.

Number of Technologies Used	Number of Programmes
0	5
1	92
2	21
3	9
4	10
5	9
6	7
7	9

Table 3. Number of Programmes Using Numbers of Technologies

Figure 7 shows the most common technologies being promoted.

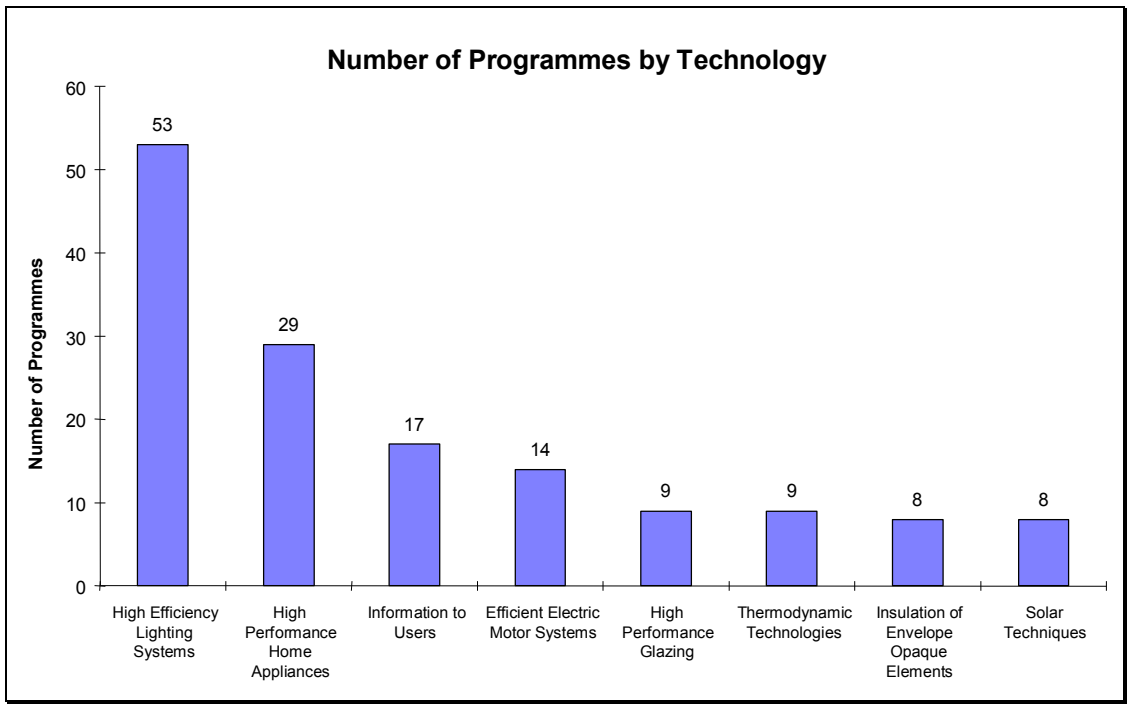

Figure 7. Number of Programmes by Most Common Technology Categories

Table 4 shows a count of the total number of programmes for the major subcategories in each main technology category.

Name of Technology	Number of Programmes	Programmes in the main category

Building Envelope	4	
Insulation of Envelope Opaque Elements	8	
High Performance Glazing	9	
Energy Gathering Components	1	
Reduction of air infiltration and exfiltration flows	6	
External Building Shadings	1	
Thermodynamic Technologies	3	
Heat Pumps	9	
Chillers	1	
CHP Technologies	2	
Heat Recovery Systems	2	2
Thermal Generators and Distribution Systems	2	
Furnaces	2	
Boilers	4	
Pipe and Duct Systems	4	
Storage Techniques	6	6
Solar Techniques	8	8
HVAC Control and Regulation	3	
Component Control Devices	5	
Building Energy Management Systems	4	
End Use Technologies	7	
High Efficiency Lighting Systems	53	
High Performance Home Appliances	29	
Advanced Office Appliances	2	
New Electrical Load Equipment	3	
Advanced Electric Systems	3	
Efficient Electric Motor Systems	14	
Other Technologies	13	13
Immaterial Techniques		
Information to Users	17	
Tariff/Rates	3	
Certification and Labelling	3	
Managerial Measures	3	

Table 4. Sum of programmes with use of different technologies

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.

4. Targeting, Marketing and Participation

4.1. Customer Targeting

Figure 8 shows the types of customers targeted by the programmes in the database. A single programme may target more than one type of customer. According to the "Total" series in figure 8, 57% of the programmes are targeted at residential customers, 41% at commercial customers, 32% at industrial customers, and 8% at agricultural customers.

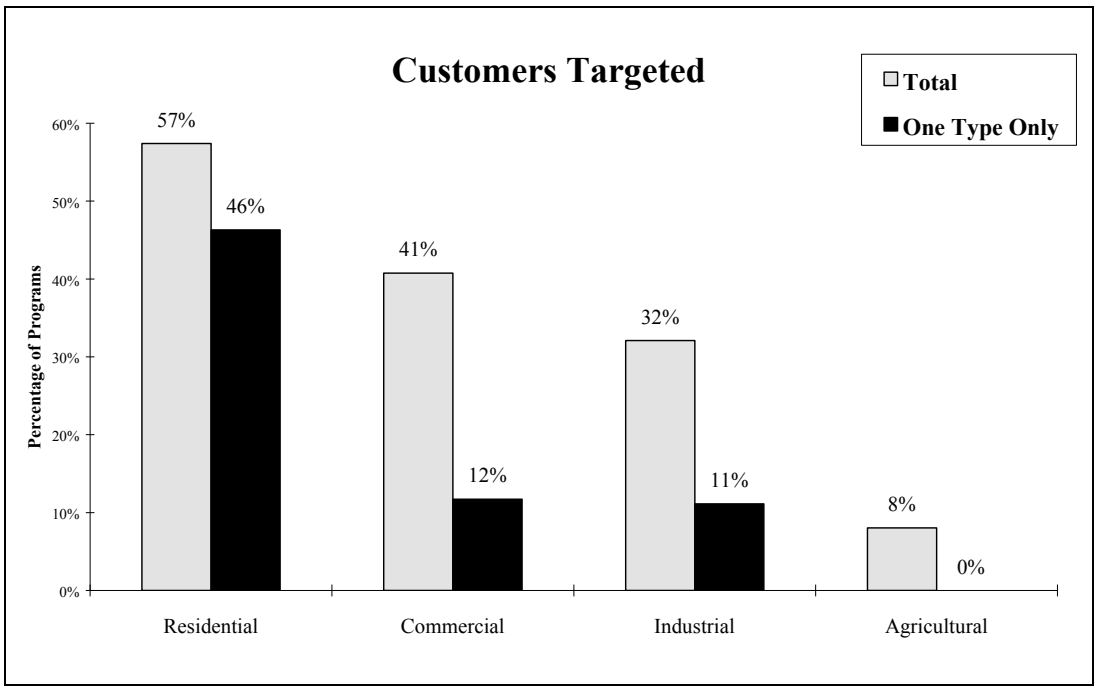

Figure 8. Customers Targeted

The "One Type Only" series in figure 8 refers to programmes that target a single type of customer: 46% of the INDEEP programmes target only residential customers, while 12% target only commercial, 11% target only industrial customers, and none of the programmes target just agricultural customers. From the differences in the two graphs, it is clear that many of the programmes that apply to residential customers do not target other customer groups, while commercial and industrial customer programmes apply to more than one customer group.

4.2. Marketing Techniques

Table 5 shows the amount of mixing involved in the marketing incentives. Marketing incentives (i.e. rebates, financing, etc.) are used in 82% (133) of the INDEEP programmes, and in 69% (92) of those programmes, only one incentive is used to promote the programme. Only a few programmes mix the different types of incentives.

Number of Marketing Incentives Used	Number of Programmes
0	29
1	92
2	35
3	6

Table 5. Marketing Incentive Mixing

Figure 9 shows the most widely used marketing incentive to be Rebates and Cash Rewards.

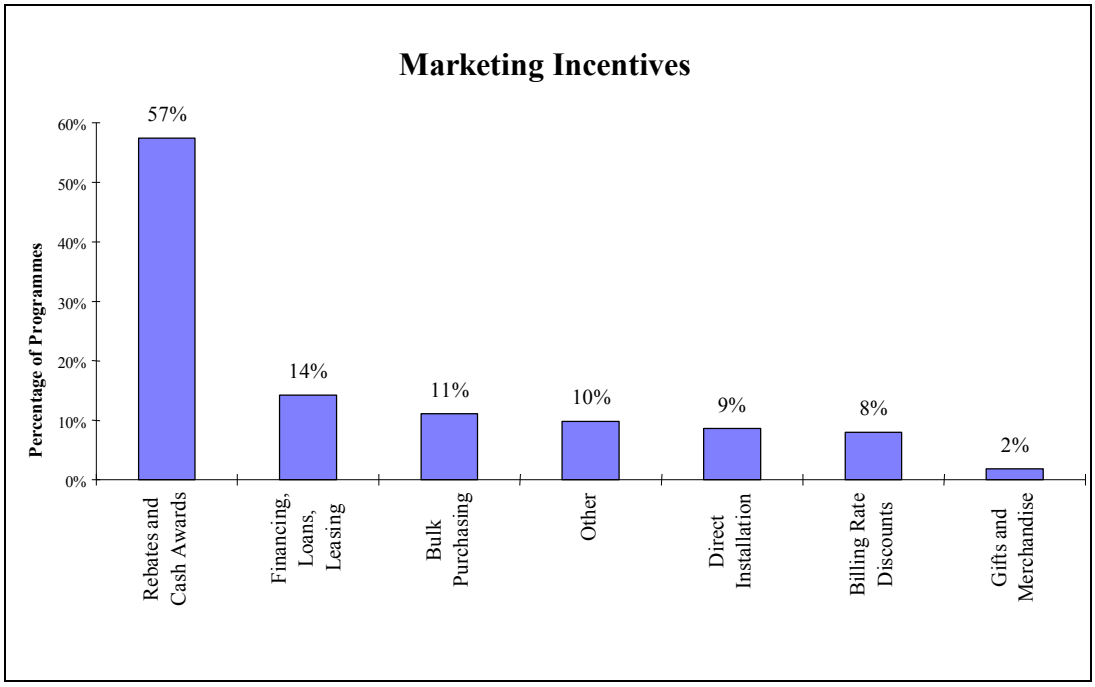

Figure 9. Percentage of Programmes vs. Marketing Incentives

As shown in table 6, marketing methods (i.e. direct mail, advertising, etc.) are used in almost all (94%, 153) of the INDEEP programmes, and the degree to which they are used is greater than that of the marketing incentives. Programmes are very likely (73%, 111) to use two or more methods for marketing. In the lessons learned and summary in the database, many stated that aggressive and broad marketing campaigns using different methods are necessary in order to obtain a high participation rate.

Number of Marketing Methods Used	Number of Pro-grammes
0	9
1	42
2	55
3	33
4	18
5	5

Table 6. Marketing Method Mixing

Figure 10 shows the overall percentage of programmes using the different marketing methods. Marketing methods are often used together, so increased participation can not always be attributed to a single method. No single marketing method stands out above the rest.

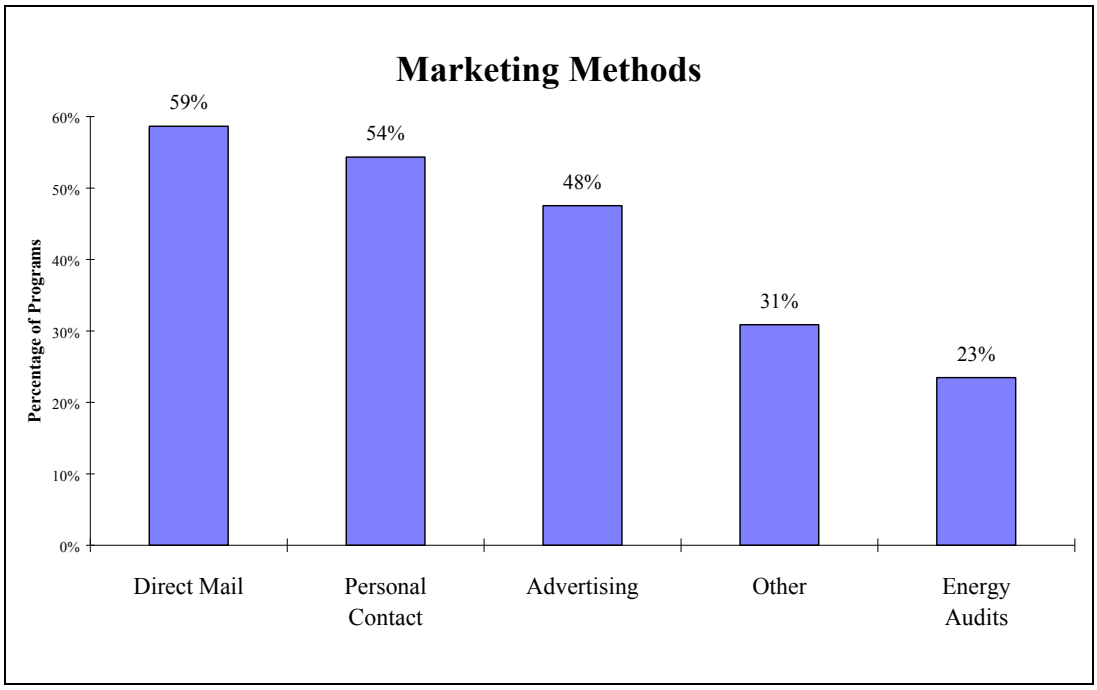

Figure 10. Percentage of Programmes vs. Marketing Methods

4.3. Participation

Participation information varies widely throughout the database and depends on the number of eligible customers. It is difficult to determine what strategy attracts most participants because different programmes and programme types are successful with different marketing methods and incentives, but several techniques are mentioned more than once throughout the database as instrumental in achieving a high degree of customer participation.

Several programmes in the database find that involving the customers as designers and implementers in the programme, as well as participants, give good participation results.

The US programme "Energy $avings Plan" allows vendors, contractors, utility customers, and industrial customers to help plan, design, and participate in the ongoing evaluation of the programme and annual modifications. The programme was able to achieve a participation rate of 50%.

A utility in the Netherlands implemented a programme to try to influence energy behaviour with the assistance of neighbourhood organisations. The customers in the neighbourhood were directly involved with the utility in group meetings to discuss to the energy situation in the area. This programme "Neighbourhood Energy Approach" was able to obtain a participation rate of 50%. Involving customers in the design and implementation of the programmes is effective, but it is usually only feasible for programmes with a small group of eligible customers.

Other INDEEP programmes believed very aggressive marketing to be the key to greater participation. The Netherlands programme "Go Easy Campaign, Metercard" achieved a participation rate of 50% for this programme, that promotes self-metering by customers, by organising a mass media campaign during the first week of the programme. The campaign increased knowledge of and participation in the programme.

The Italian programme "LAMPADINA BLU" which attracted 50,000 participants in a CFL (Compact Fluorescent Lamps) dissemination programme, found that if the programme involves appliances, a broad advertising campaign involving vendors was the key to success. No rebates were given in this programme.

Rebates and cash rewards seem to be a good way to induce participation, but it is not a guarantee. About 60 programmes in the database use rebates or cash rewards as their only marketing incentive. These programmes have participation rates ranging from less than 1% to 100% of all eligible customers. The programmes with the highest participation rates found that a combination of a rebate and a good marketing campaign was best at attracting customers. One German programme achieved one of the highest participation rates of all German CFL programmes by offering direct installation of a CFL, or one free coupon for a CFL, for each household and supporting it by a convincing marketing campaign.

In the UK, with funds raised from a levy on gas consumers, a GBP 200 cash rebate was offered to owner-occupied households for the purchase of a gas-condensing boiler. The programme attracted twice as many applicants as expected due to the large rebate and the advertising campaign.

Overall, there is no single strategy that attracts the most participants. Each programme is unique and has a different technique for marketing, but combinations of marketing methods and incentives seem to work well.

5. Evaluation, Savings, Costs and Effectiveness

5.1. Evaluation Method

An important aspect of the INDEEP database is the reliability of the energy savings data. This can partially be determined by the data used to calculate the savings. Table 7 shows the mixing involved with different types of evaluation methods used to calculate the energy savings: 46% (54) of the programmes with evaluation method information use only one method to determine the savings, while the remaining programmes use two or more methods to calculate savings produced by the DSM programme.

Number of Evaluation Methods	Number of Programmes
0	44
1	54
2	27
3	19
4	8
5	5
6	4
7	1

Table 7. Number of Evaluation Methods Used

27% (44) of the programmes have no evaluation method specified presumably because the evaluation is in-progress (25%), planned (5%) or not planned (5%) as shown in figure 6.

Figure 11 shows how many programmes used each type of evaluation method. The most common way to calculate the savings (50%, 81 programmes) is to use engineering data. This is usually the easiest way to obtain energy saving data, but may also be the least reliable since the saving is projected from calculations and not from measurement of the results.

Only 30 of the programmes use engineering data as their only method for determining energy savings; the other 51 programmes use engineering data as a secondary check with another evaluation method (measured data).

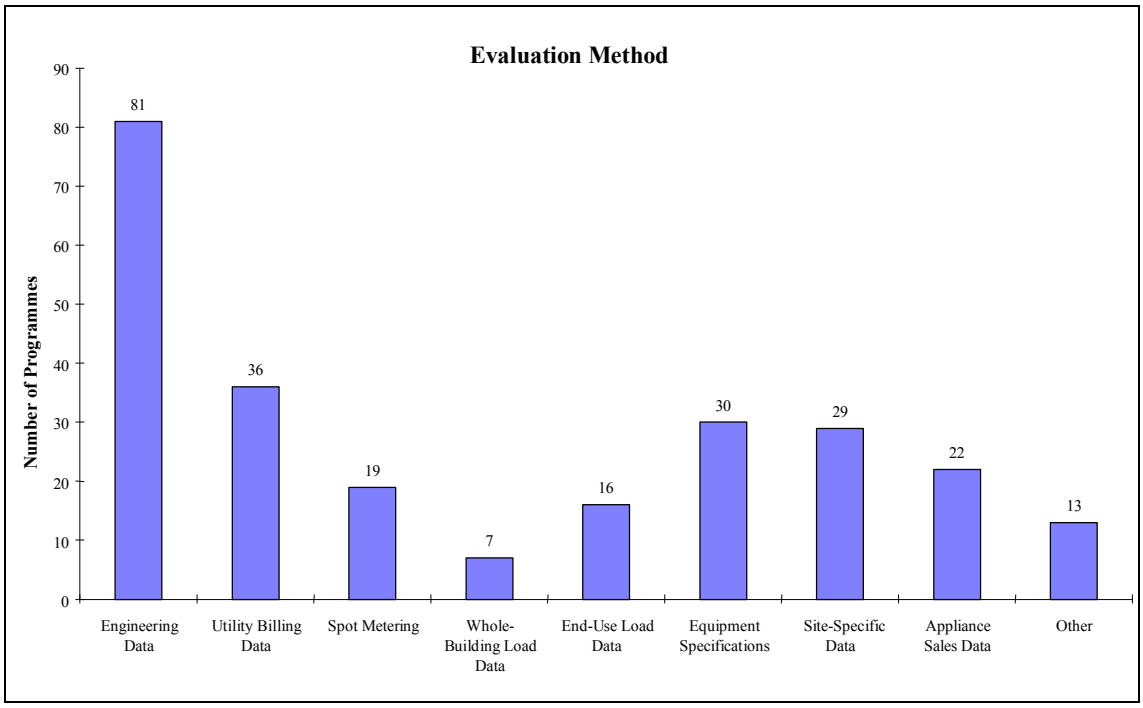

Figure 11. Evaluation Method

The programme evaluations often use several other sources of measured data such as spot metering (12%, 19 programmes), site-specific data (18%, 29 programmes), equipment specifications (19%, 30 programmes), and utility billing data (22%, 36 programmes) in their calculations.

5.2. Energy Savings

Three different types of energy savings created by the INDEEP programmes may be entered into the database: electricity, power demand, and fuel savings. A programme can have one or more types of savings.

As mentioned in section 3.4, the main energy source affected in INDEEP is electricity, with 90% (146 programmes) affected:.

Sixty two percent (100) of the programmes in the database brought electricity savings. Seventy two programmes have annual electricity savings data, and 40 have cumulative savings. The programme savings range from 5 MWh to 3,535,000 MWh. Figure 12 shows the number of programmes that fall in each savings range for the annual and cumulative data. The amount of electricity savings achieved depends largely on the characteristics and size of the particular DSM programme.

For figures 12 and 13 the number of programmes with cumulative saving data in two categories, are higher than programmes with annual data, which may be explained by the fact that evaluation is not done annually in some programmes.

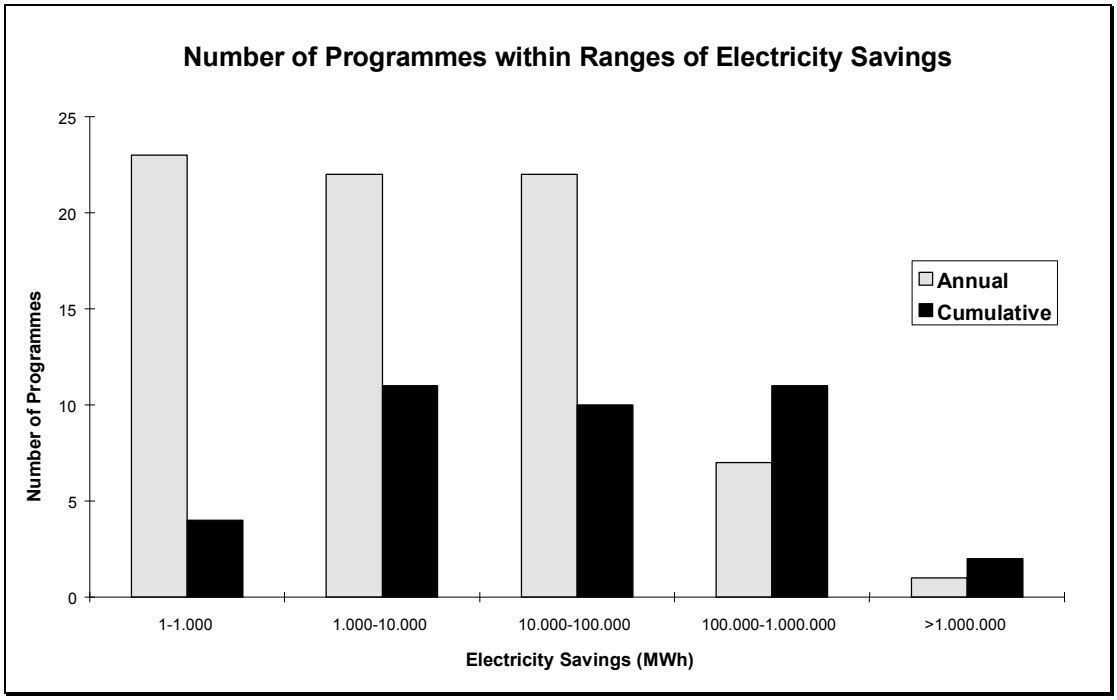

Figure 12. Number of Programmes vs. Annual and Cumulative Electricity Savings

As with the electricity savings, the demand savings fall into a wide range and the degree of savings is particular to the programme and its characteristics.

Annual demand savings are reported in 30% (49) of the INDEEP programmes, and for 19 programmes cumulative demand savings are reported. Figure 13 shows the number of programmes in the database with demand savings in six different ranges.

Around 24% of the programmes with annual data calculated demand savings between 0.1 MW and 1.0 MW, but one programme recorded annual savings of over 100 MW.

Most of the cumulative demand savings recorded are greater than 1.0 MW over several years, and two programmes "LCP Pilot Study" from Portugal and the "Condensing Boiler Programme" from the UK, recorded demand savings in excess of 1,000 MW over several years.

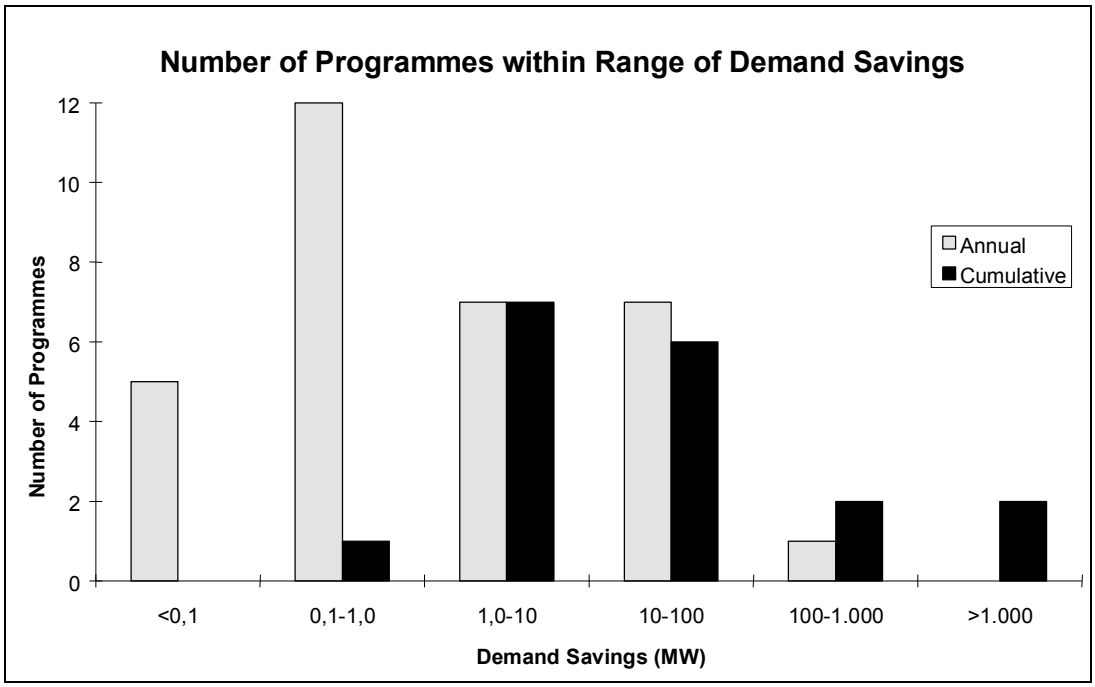

Figure 13. Number of Programmes vs. Annual and Cumulative Demand Savings

Only 19 (12%) of the programmes in the database have fuel savings data. Again, there is a wide range of recorded savings, which shows that fuel savings depend largely on the specific goals, characteristics, and implementers of the programmes. Fifteen programmes have annual fuel savings data and eight programmes have cumulative data as shown in figure 14. Naturally, the cumulative programmes have a higher percentage of programmes with larger savings.

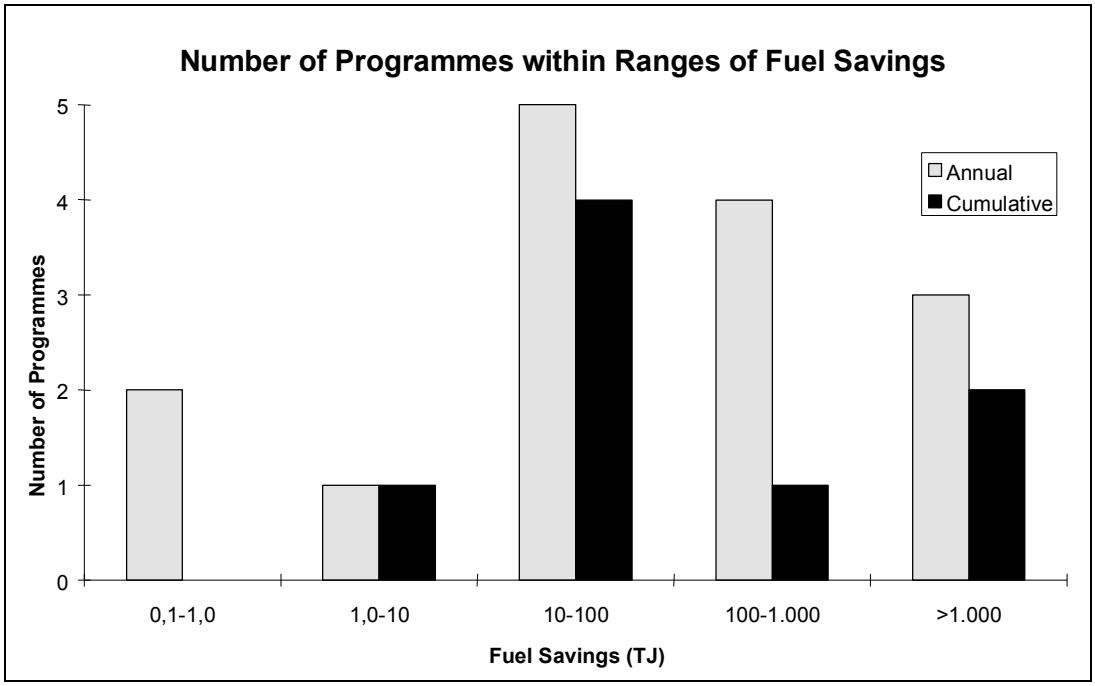

Figure 14. Number of Programmes vs. Annual and Cumulative Fuel Savings

5.3. Programme Costs

The possible range for any type of energy savings is clearly very extensive due to a large variety among the INDEEP programmes. The same trends can be found in the total programme costs.

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 15 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.

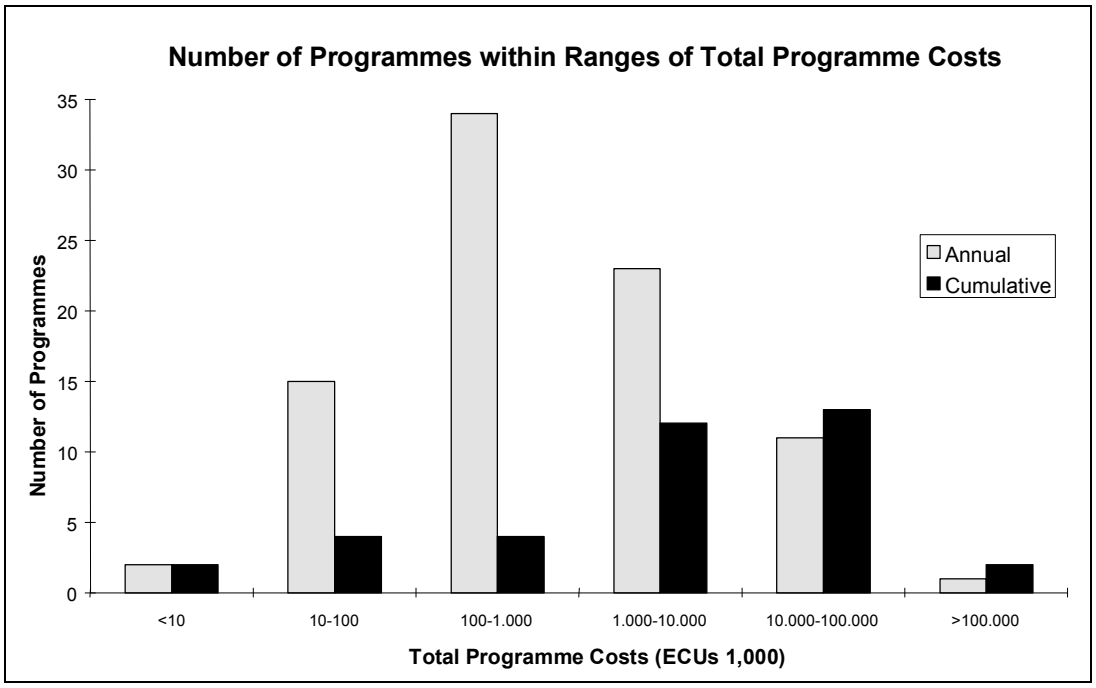

Figure 15. Number of Programmes vs. Total Programme Costs

5.4. Cost Effectiveness

The cost effectiveness of the INDEEP programmes is calculated in two separate ways within the database. The first is the Total Resource Cost. Currently, 56 of the 162 programmes in the database can be compared using the Total Resource Cost (TRC) calculation. This calculation is measured in ECU/kWh and compares the cost of the DSM programme to the energy savings which it produces. The smaller the TRC, the more cost effective the programme. It is calculated using the PMT function in Excel. This function takes the total programme cost and spreads it out equally over the lifetime of the energy savings using a 5% annual interest rate.

It then divides this calculated annual payment by the annual energy savings in kWh. The TRC for the INDEEP programmes ranges from 0 to ECU 0.54 kWh.

Figure 16 shows the programmes that fall within the specified resource cost ranges. The majority of programmes including TRC (12) have TRCs under ECU 0.01 kWh. These programmes have excellent cost effectiveness. Many other programmes also do quite well. A total of 37 programmes have a TRC less than ECU 0.05 kWh. Figure 16 shows a distinctive break between programmes with fairly low TRCs and higher TRCs. Thirteen INDEEP-programmes have TRCs greater than 0.1, which indicate a very poor cost effectiveness.

Many programmes in INDEEP produce a wealth of energy savings with very little money and the reverse is also true. Much of this depends on the type of programme that is being implemented and how the marketing is carried out.

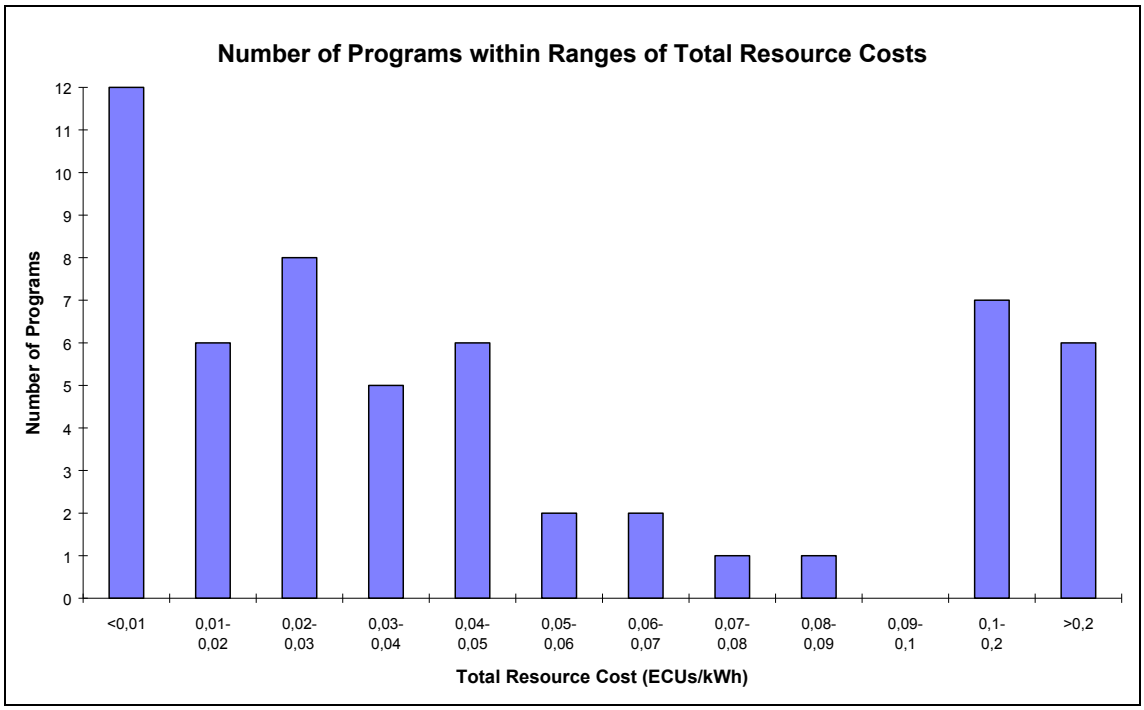

Figure 16. Number of Programmes vs. Total Resource Costs

The other measure of cost effectiveness that is included in INDEEP 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 17. The same trends persist in this type of comparison as in the TRC. 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.

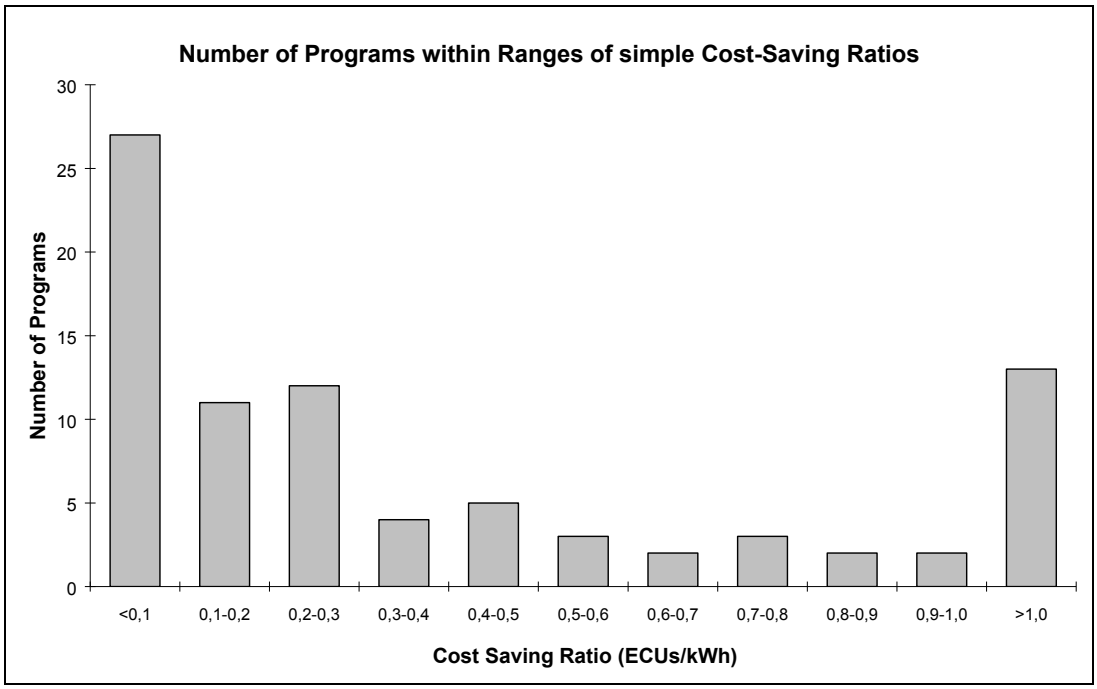

Figure 17. Number of Programmes vs. Simple Cost-Saving Ratio

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.

6. High-Efficiency Lighting Systems

6.1. Countries, Evaluation and Lighting Technologies

Many types of analysis could be achieved based on the INDEEP data. Some are exemplified by a more in-depth analysis of the high-efficiency lighting system programmes.

High-efficiency lighting systems are at the moment the most common technology in the INDEEP database. One third (53 programmes) of all programmes in INDEEP use high-efficiency lighting systems to generate energy savings. More than half of the programmes are from the United States, followed by Spain (12%) as shown in figure 18.

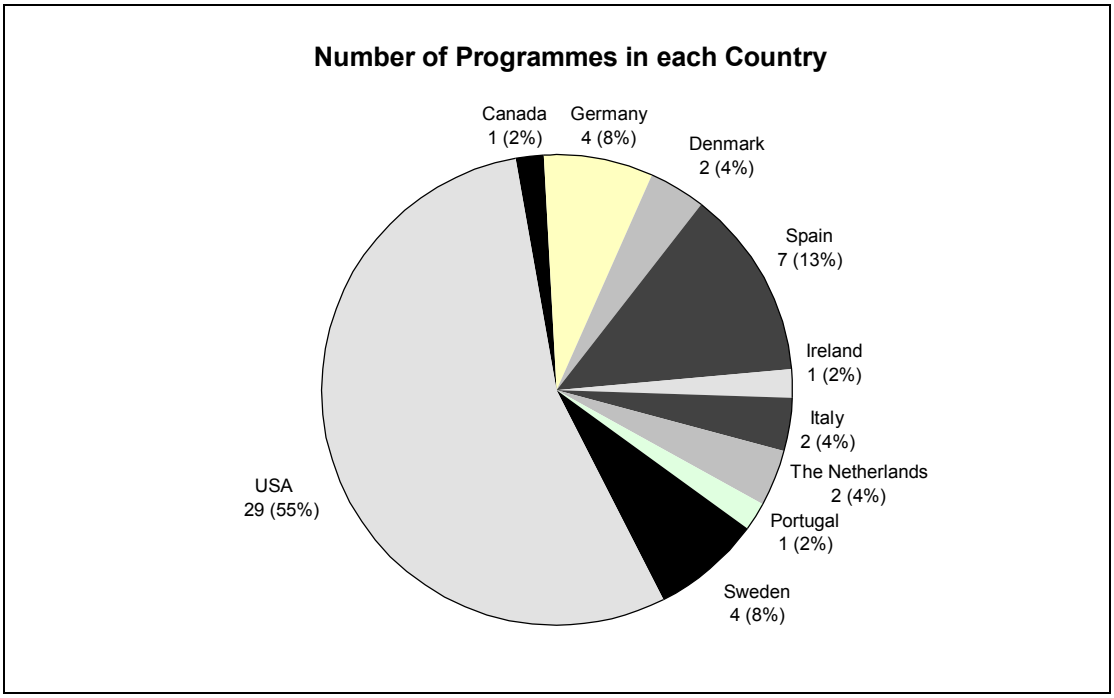

Figure 18. Countries with INDEEP programmes in High Efficiency Lighting Systems

Figure 19 shows the evaluation status of these programmes. Seventy seven percent of the programmes in this technology have completed their evaluations.

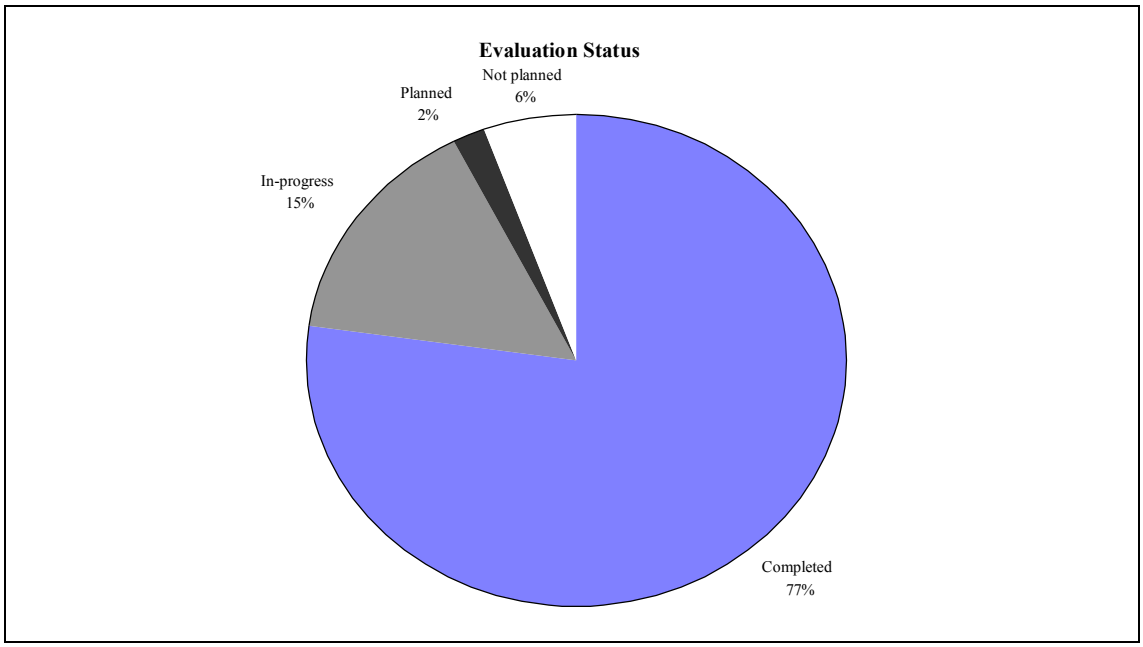

Figure 19. Evaluation Status of Programmes using High Efficiency Lighting Systems

Figure 20 shows that many of the lighting programmes use a mixture of different types of technologies.

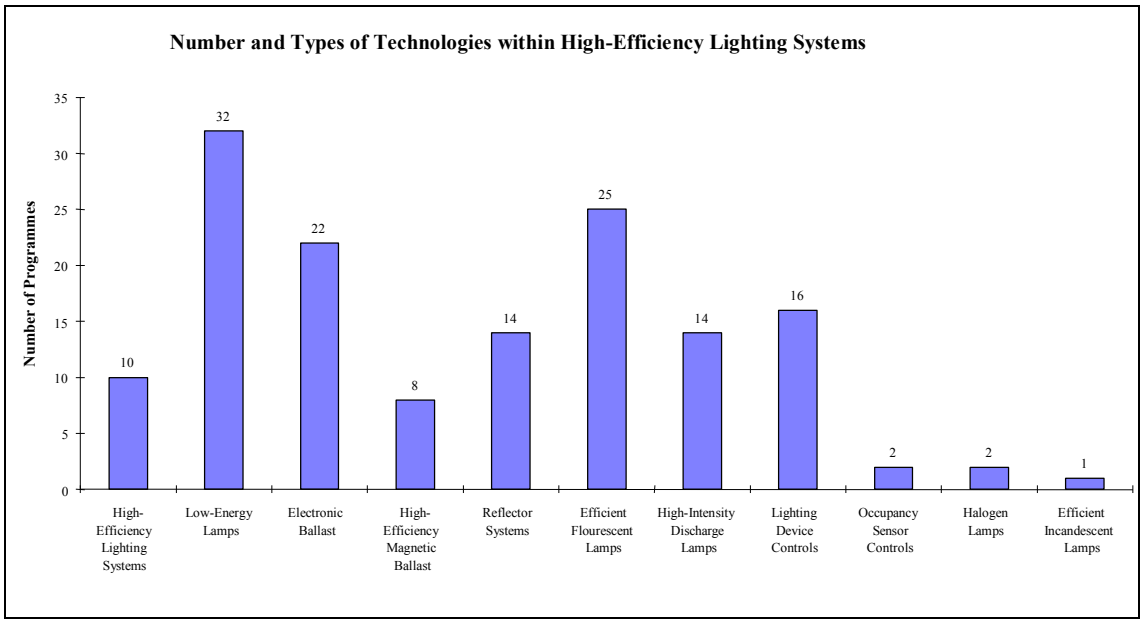

Figure 20. Specific Types of High Efficiency Lighting Technologies

6.2. Customers Targeted

According to figure 21, the majority of high-efficiency lighting programmes target commercial customers (62%), followed by industrial customers (51%), residential customers (40%), and agricultural customers (11%).

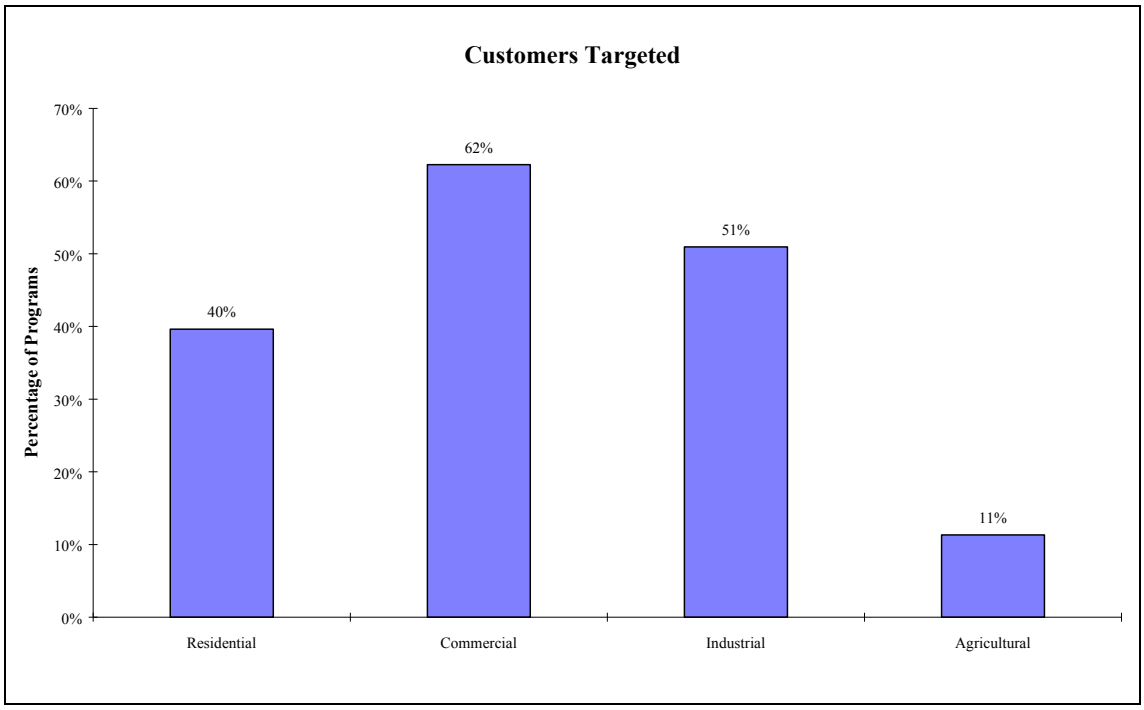

Figure 21. Customer Type in High-Efficiency Lighting Programmes

6.3. Marketing Techniques

The amount of mixing involved in the marketing techniques for high-efficiency lighting systems is shown below. Marketing incentives, table 8, are used in 96% (51) of the programmes. In 69% (35) of those, only one incentive is used to promote the programme.

Number of Marketing Incentives Used	Number of Programmes
0	2
1	35
2	13
3	3

Table 8. Marketing Incentive Mixing for High-Efficiency Lighting Systems

Figure 22 shows the percentage of high-efficiency lighting programmes using different types of marketing incentives. Clearly, most programmes (79%) use rebates and cash rewards to stimulate participation in their programmes. This is an effective, but costly method.

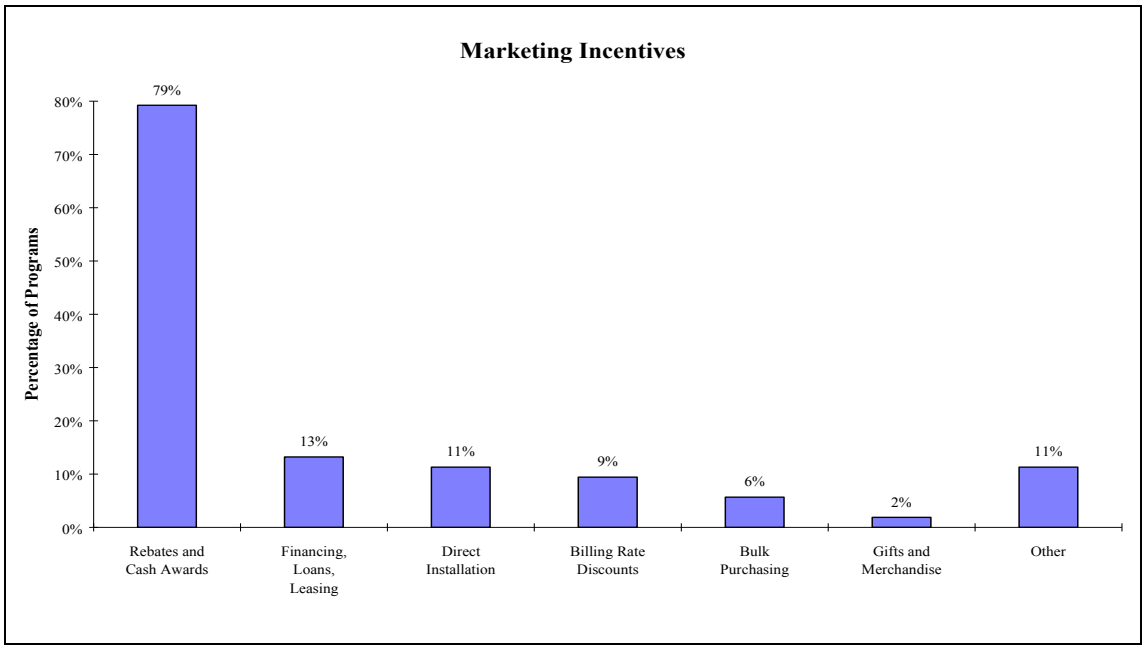

Figure 22. Percentage of High-Efficiency Lighting Systems by Marketing Incentives

Marketing methods are used in 94% (50) of the high-efficiency lighting system programmes, and 78% (39) of those use two or more methods to induce participation as shown in table 9.

Number of Marketing Methods Used	Number of Pro-grammes
0	3
1	11
2	14
3	11
4	10
5	4

Table 9. Marketing Method Mixing for High-Efficiency Lighting Systems

Figure 23 shows that 60% (32) of the programmes using marketing methods use direct mail, 55% (29) use advertising, and 64% (34) use personal contact.

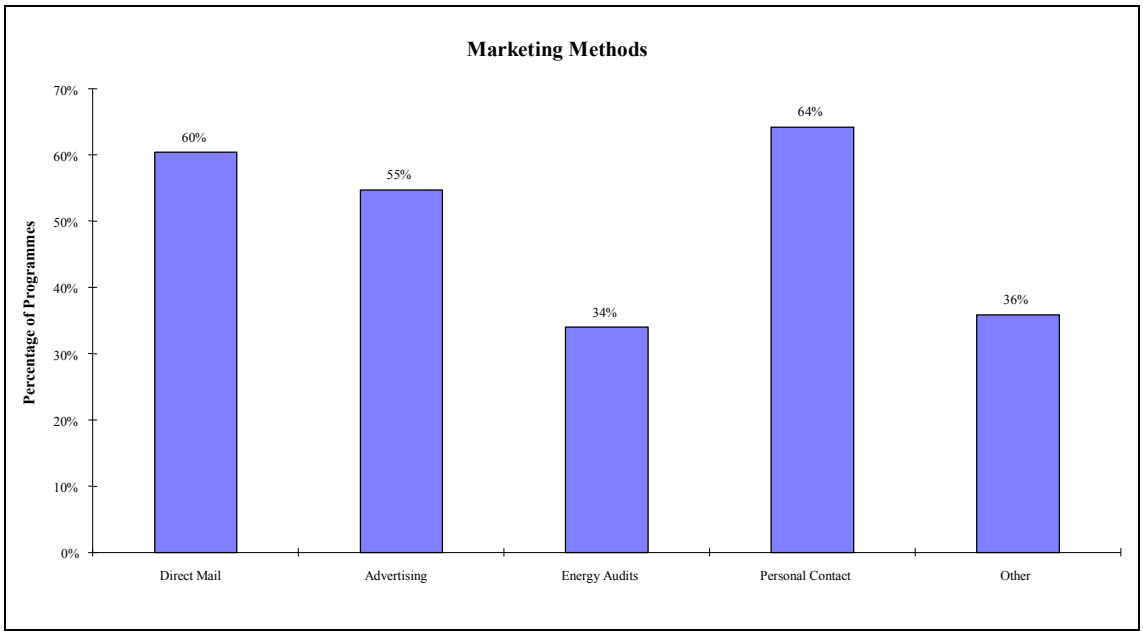

Figure 23. Percentage of High-Efficiency Lighting System Programmes by Marketing Methods

6.4. Evaluation Method

The evaluation methods used by the high-efficiency lighting system programmes are shown below. Table 10 shows that 49% of these programmes use more than one evaluation method to calculate the savings. The more evaluation methods used, the more reliable the savings data.

Number of Evaluation Methods	Number of Programmes
0	7
1	20
2	11
3	6
4	4
5	3
6	2

Table 10. Number of Evaluation Methods Used, High Efficiency Lighting Systems

As with the complete database, in high-efficiency lighting system programmes, the most prevalent way to calculate savings is using engineering data (33 programmes). Figure 24 shows the number of high-efficiency lighting programmes using the different evaluation methods to calculate savings for the 53 programmes. Twenty six programmes use more than one evaluation method.

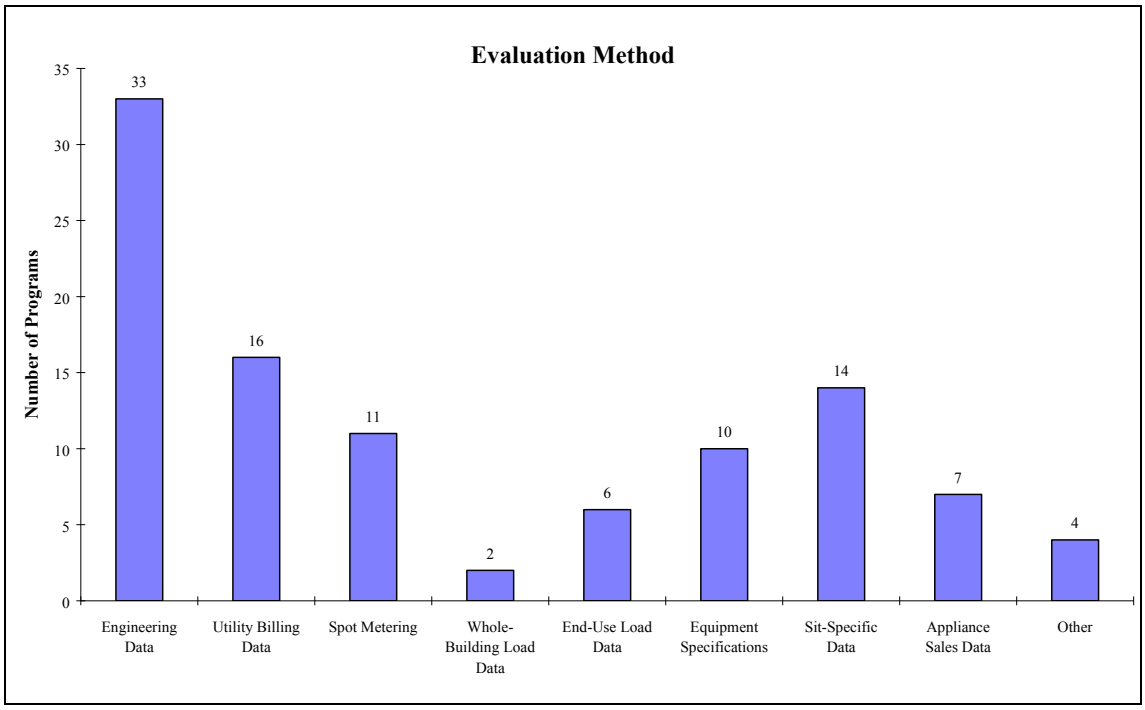

Figure 24. Number of Programmes vs. Evaluation Method

Overall, from the information given in the lessons learned category of the INDEEP database, giving monetary incentives, free installation of equipment or materials, or rebates together with aggressive marketing techniques seems to increase the participation and participation rate, and from that, increase the energy savings in high-efficiency lighting system DSM programmes. This is very expensive, so programmes geared towards cost effectiveness concentrate on educating targeted customers and non-customers on energy-efficiency techniques and limiting their monetary incentives.

6.5. Comparing Cost Effectiveness of Individual Programmes

Figure 25 shows individual key figures for 29 of the 53 programmes with enough information to calculate the total resource cost. The last column gives the average for the 29 programmes.

Annual participation data in figure 25 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 annual participation rate chart gives an indication of the success of the marketing techniques used to promote the programme. The Spanish programme, DOSALUZ (ESP-

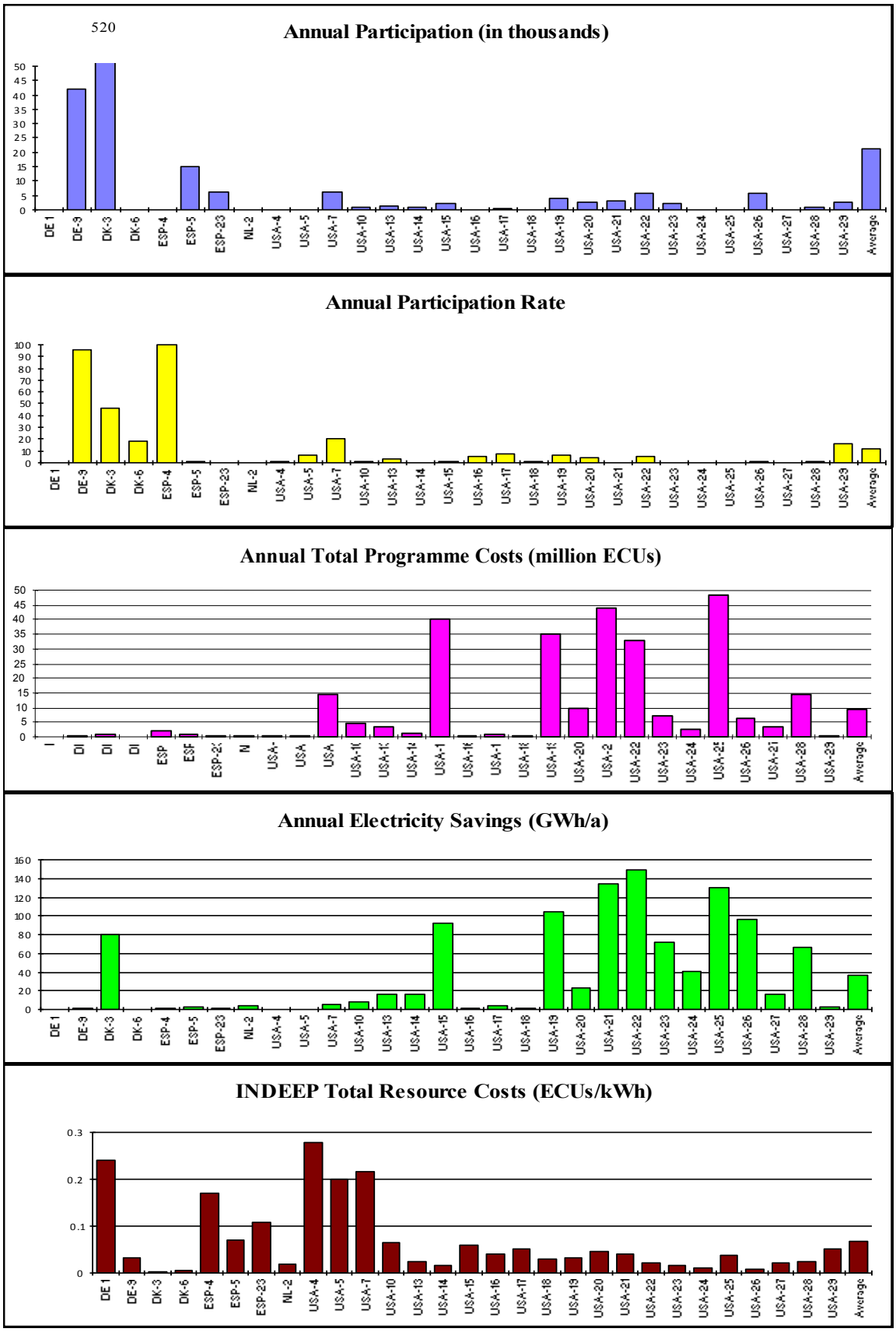

Figure 25. Comparison of Individual Programmes on High-Efficiency Lighting Systems

4) has the highest participation rate with 100% and the German CFL programme "Licht Light" installed one 15 W CFL in nearly every household in Jena, giving a 95% participation rate. Forty six percent of the households in the Danish programme mentioned above contain CFLs.

The annual total programme costs in ECU and the annual electricity savings in MWh/year are also shown in figure 25. The average programme cost is in excess of ECU 10 million and the average electricity savings are around 160,000 MWh/year.

The total resource cost takes energy savings, programme costs, and average measure lifetime to calculate the cost effectiveness of the programme. Figure 25 shows that the Danish programme, DK-3, is 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.

7. Successful Programmes

The characteristics of individual programmes within the database may be examined as well as the trends of entire technology groups or the entire database. When looking to improve, evaluate, or create DSM programmes, it is important to look at other existing programmes that are successful. The success of a programme can be measured in many different ways such as cost effectiveness, total energy savings, or achievement of the original goals. The following two sections deal with the goals versus the results and a top 10 list of the most cost-effective programmes in the database (mid 1997).

7.1. Goals versus Results

The INDEEP survey asks for five types of goals that the implementing agent wishes to achieve through the DSM programme. The participation goals are the most numerous. Forty two programmes in the database have both participation goals and results that can be compared. An X-Y plotting of this on a logarithmic scale is shown in figure 26.

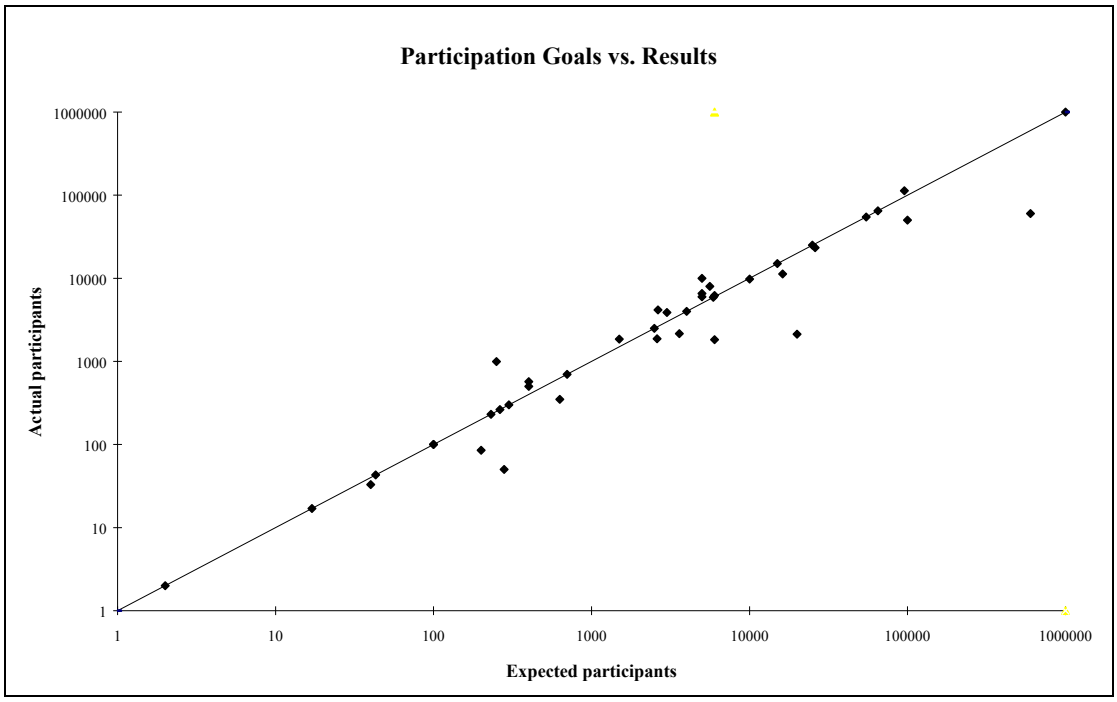

Figure 26. Participant Goals versus Results

This figure has to be used carefully because many of the responses on goals were given after the programme had been implemented and/or evaluated. In other words the goals stated could be influenced by the results for a number of programmes.

The number of programmes that achieved or exceeded their goals is over twice the number that failed to meet them. Several programmes that did not meet their goals did very poorly. Some problems included the need for better marketing and dissemination of information about the programme and the need for improved cooperation between participating parties.

7.2. Ten Most Cost Effective Programmes

The Total Resource Cost is calculated in the database (see section 5.4) and can be 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 11. In-depth descriptions of these programmes are given below.

It should be stressed that, as indicated in table 11, all the programmes except one have been evaluated based on measured data and not just engineering (estimated) data. Most of the programmes have been evaluated based on two or more types of data, which indicate good quality!

Rank	Programme Name	DCI #	Country	TRC (ECU/kWh)	Evaluation data *)
1	Go Easy Campaign, Metercard	NL-4	Netherlands	0.001	En, (Bi)
2	Low-flow showerheads 1	NL-20	Netherlands	0.001	Bi, Sa, Ot
3	Campaigns for energy-saving lamps	DK-3	Denmark	0.002	Eq, Sa
4	Occupancy sensors in schools	DK-6	Denmark	0.004	Si
5	LCP Sorest for heating and ovens	DE-7	Germany	0.006	En, Eq
6	Saving on electric water heating and water	DK-11	Denmark	0.007	Si, Sa
7	Energy Management Hardware Rebate Programme	USA-26	USA	0.008	En, Si
8	Low-flow Showerhead	NL-1	Netherlands	0.009	En, Sa
9	Commercial lighting Retrofit Rebate	USA-14	USA	0.016	En, Sp, Eq, Si
10	Commercial and Industrial lighting Rebate	USA-23	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

Table 11. Top 10 INDEEP Programmes by Total Resource Cost

7.2.1. Number 1: Go Easy Campaign, Metercard (NL-4)

NL-4, Go Easy Campaign, Metercard, from the Netherlands is a programme designed to promote self-metering by the residential customers that were targeted.

During the first week of the programme, the utility organised a mass media campaign consisting of direct mailings and advertisements to inform potential participants of the programme. Customers who returned the answer card sent out by the utility to introduce the programme were then continuously sent meter cards to be completed giving the customer's energy consumption.

Monitoring and targeting can reduce overall energy consumption by influencing customers behaviour. Therefore, the utility published the degree-days in the newspapers every week, so customers could calculate their target energy use and then monitor the actual use.

The programme began in October 1993 at full-scale on a regional level, and after the evaluation was completed, the programme has continued.

The utility used no marketing incentives to maintain participation, but it found that introducing a "game element" into the campaign helped to retain customer interest.

The programme is reported to have used only engineering data in the evaluation, but the INDEEP experts suppose/hope some billing data was also have used. In 1994, 170,000 households, 50% of all eligible customers, participated in the programme. The large number of participants produced electricity savings of 270,000 MWh and fuel savings of 823 TJ for the total programme cost of only ECU 180,000 to the utility. With large savings and low cost, this programme has a very low TRC of ECU 0.0007 kWh.

7.2.2. Number 2: Low-Flow Showerheads 1 (NL-20)

This was a pilot programme implemented by the ENECO-RED 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. The showerheads achieve electricity savings by reducing the amount of warm water used in the shower; thereby reducing the amount of electricity required to heat the water. The goal was to install 5,000 low-flow showerheads, thereby saving 2.5 million kWh of electricity. The utility doubled its participation goal and nearly doubled its energy saving goal.

The most recent year of evaluation data was 1991. In 1991, the programme supplied 10,000 of its 30,000 boiler-renting customers with new showerheads, giving the programme a 33% participation rate. The utility company supported all of the programme costs amounting to

ECU 50,000, only 10% of which were incentive costs. A total of 4,500 MWh of electricity was saved in 1991, giving a total resource cost of 0.0011 assuming a 15-year lifetime of the savings produced by the new showerhead.

The programme was implemented by the utility company to improve the quality of service to their customers, reduce global warming, and penetrate the showerhead market. The utility uses direct mail to market its programme to all types of residential customers, while direct installation and bulk purchasing are used as incentives to induce residents to join the programme and buy a low-flow showerhead once they have heard about it.

Appliance sales data, utility billing data and other not-specified data were used to complete the evaluation of the programme, and the estimated payback period of the programme costs is three years.

The utility believes the programme to be successful, partly due to the fact that customer's trust the utility companies and believe the information they are given. Therefore, residents are very willing to participate in programmes implemented and marketed by their utility company. Financing also seemed to be a key point in inducing customers to join the programme.

7.2.3. Number 3: Campaigns for Energy Saving Lamps (DK-3)

The programme described in the INDEEP Database 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 such as radio, television, and bus advertisements along with posters, brochures, and leaflets directed at the public to inform them of the benefits of using CFLs instead of conventional light bulbs. By 1994, 520,000 households had installed CFLs, a 46% participation rate.

The campaign is a general information programme directed towards transforming the entire residential market into a market that uses CFLs. It was implemented for many reasons including the need to reduce global warming and harmful local emissions, to improve the public image and quality of service offered by the utility companies, and as a response to political pressure.

The evaluation is still in progress, but appliance sales data and equipment specifications were used to gather cost and savings data for 1993. Several market surveys have also been carried out. In 1993, ECU 830,000 was spent by the utilities in marketing the CFLs, and 80,000 MWh in electricity was saved through the use of these more efficient lamps throughout the region.

Aside from the advertising, a key factor in the success of this programme was convincing manufacturers and retailers to reduce the price of CFLs in return for massive marketing and a huge sales volume.

7.2.4. Number 4: Occupancy Sensors in Schools (DK-6)

This DSM programme 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. The evaluation is still ongoing based on site-specific data, but in 1996, 50 out a possible 280 schools participated in the project, and a total of 150 MWh was saved in electricity. The total programme cost of DKR 40,000 (ECU 5200) in 1996 was supplied by the regional Danish utility company, NESA.

The programme uses direct mailings and personal contact to inform the schools of the project, and financing and bulk purchasing as incentives to get them involved. These techniques produced an 18% participation rate.

The programme is targeted at manufacturers of the occupancy sensors and at Danish schools. This particular programme was selected partly as a business opportunity for the sensor manufacturers, partly as a market transformation technique, and also as a programme mandated by the legislature.

7.2.5. Number 5: LCP Soest for Heating and Ovens (DE-7)

This is an 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 DM 63,547 on advertising the campaign and issuing cash awards for participation. Programme goals included converting 15 old gas boilers and 15 electric heaters to gas-condensing boilers and 100 electric ovens to gas ovens. The programme was prepared to offer monetary incentives of DM 600 for participants who converted old gas boilers to gas condensing boilers, DM 2000 to convert electric heaters to gas condensing boilers, and DM 200 to convert electric ovens to gas ovens.

The programme ran for one year between 1994 and 1995 full-scale at a regional level. It has since been terminated and the evaluation completed. Through engineering data and equipment specifications, the programme was shown to save 614 MWh in electricity in a single year. Twenty nine rebates were issued to participating customers. The programme was very cost effective, but the participation was low in comparison to the goals. The implementing agent believed that better marketing methods should have been used along with higher incentives in order to increase participation.

The programme used two very diverse technologies to produce energy savings: electric ovens and cookers (code 82,6) and gas-condensing boilers (42,2). This programme was a general information programme targeting 1-2 family homes with electric space heating and multi-family homes with individual electric and non-electric space heating as customers, and building owners and retailers as non-customers.

The programme was seen as a worthwhile business opportunity that would reduce global warming and improve the public image of the utility while complying with the political pressure of the governing bodies.

7.2.6. Number 6: Saving on Electric Water Heating and Water (DK-11)

The goal of this 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.

The programme targeted 1-2 family houses with electric space heating using personal contact to inform them of the campaign and rebates and cash rewards to enlist their participation. The programme achieved a participation rate of 74% with 1,850 out of 2,500 eligible customers participating in the programme.

In 1992, ECU 106,000 was spent and 2800 MWh was saved in electricity by the utility company EFFO, with the use of low-flow showerheads, percolators on tap water, and low

water consumption toilets. Ninety six percent of the costs were incentive costs, and site-specific and appliance sales data was used to collect the electricity savings information.

This programme was specifically selected as a long-term resource option programme, and the lifetime of the savings is estimated at six years.

Ultimately, the goal was reached.

7.2.7. Number 7: Energy Management Hardware Rebate Programme (USA-26)

This 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.

The programme is still ongoing. The most recent year of energy saving and programme cost data was collected using engineering calculations and site-specific data in 1992.

In 1992, 1% (5,603) of eligible customers participated in the programme, and 96,572 MWh in electricity savings was recorded for the entire year.

ECU 6.5 million was spent on the programme in the same year. Seventy seven percent of the total programme costs were spent on monetary incentives such as rebates and cash rewards, while 23% of the programme costs were used on various other non-incentive expenses including marketing the programme using direct mailings, advertising, energy audits, and personal contact.

The programme generates its energy savings through the use of low-energy lamps, electronic ballast, efficient fluorescent lamps, high-intensity discharge lamps, and lighting device controls.

Key aspects to the success of the programme include marketing techniques emphasising personal contact and on-site validation of any installed equipment.

7.2.8. Number 8: Low-Flow Showerhead (NL-1)

NL-1 from the Netherlands is another programme rather similar to NL-20 (number 2) implemented by the RED utility in the winter 1993/94.

The programme was at full-scale regional level. 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. The programme produced electricity savings of 900,000 kWh and 27 TJ gas, besides reducing the amount of water.

Engineering data as well as appliance sales data were used in the evaluation of the programme. The utility explained that the success was due to the sales techniques used which stressed the short payback period, required very little effort from the customer and gave free use for 14 days.

7.2.9. Number 9: Commercial Lighting Retrofit Rebate (USA-14)

USA-14 was implemented by the Central Maine Power Company during the years 1985-92.

The programme was at full-scale 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.

The programme was well evaluated based on engineering data, spot metering data, equipment data, and site-specific data. The programme produced 3 MW peak demand savings and 15,731 MWh electricity savings (on average 0.6 kW and 3 MWh per customer).

The utility stressed that a well-defined description of the commercial and industrial lighting market would be helpful for assessing past performance as well as designing future programmes and establishing future programme goals.

7.2.10. Number 10: Commercial and Industrial Lighting Rebate Programme (USA-23)

USA-23 was implemented by New York State Electric and Gas at 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.

The programme was evaluated carefully by engineering, bill, site-specific and other non specified data. The programme produced 71,470 MWh and 17 MW from 2,404 participants (on average 3 MWh and 7 kW per customer, which give demand savings more than 10 times higher than in USA-14 (number 9) although the energy savings are the same).

Lessons learned are that trade allies say that the utility needs to further educate architects and engineers about lighting efficiency and new lighting technologies. It is also said that the utility should investigate how to update lighting manuals used by these groups.

APPENDIX A

Code	Number		TECHNOLOGIES
10			**Building Envelope**
	11		Insulation of Envelope Opaque elements
		11,1	Insulation of External Walls (Exterior)
		11,2	Insulation of External Walls (Interior)
		11,3	Insulation of External Walls (Cavity)
		11,4	Roof /Attic Insulation
		11,5	Basement Insulation
	12		Dynamic Insulation
		12,1	Ventilated Curtain wall
		12,2	Ventilated Chamber built-in PV blinds
	13		Transparent Insulation
	14		High performance glazing
		14,1	Double Glazing U>=2.7 Wm2K
		14,2	Double Glazing 2.7>U>=1.8 Wm2K
		14,3	Glazing U<1.8 Wm2K
		14,4	Electrochromic Glazing
	15		Low emissivity finishes for internal surfaces
	16		Energy-gathering components
	17		Reduction of air in- & exfiltration flows
		17,1	Fenestration weatherstripping
		17,2	Fast-acting, self-repairing doors
		17,3	Energy-efficient Factory doors
	18		External Building Shadings
		18,1	Fixed Solar Shadings
		18,2	Movable Solar Shadings (smart control)
		18,3	Movable Solar Shadings (manually)
		18,4	Vegetation & Trees for shading purposes
	19		Double skin cladding
20			**Thermodynamic Technologies**
	21		Heat Pumps
		21,1	Electrically driven
		21,2	Combustion eng.driven
		21,3	Chemical HP
		21,4	Absorption HP
	22		Chillers
		22,1	Absorption
		22,3	Thermal Compression
	23		CHP Technologies
		23,1	Small modular systems
		23,2	Diesel cycle Medium size
		23,3	Gas Turbine CHP
		23,4	Counterpressure plant
30			**Heat Recovery Systems**
	31		Dehumidifiers
	32		Heat Exchangers
	33		Heat Recovery from appliances
	34		Heat Recovery from industrial uses
40			**Thermal generators & distrib. systems**
	41		Furnaces
		41,1	Fluidised Bed
	42		Boilers
		42,1	High-Efficiency Boilers
		42,2	Gas-condensing Boilers
		42,3	Boiler Cascade
		42,4	Separate HW summer heater
		42,5	Heat Radiant Pipes
	43		Advanced Burners
		43,1	Emulsifiers
		43,2	Low-NOx burners
		43,3	New nozzle for derating the plant capacity
		43,4	Replacement of burner for different fuel used
	44		Adv. Heat Emission Devices
		44,1	Underfloor Low Temp. Heating
		44,2	Wall/Ceiling embedded heating
		44,3	High-Performance Radiators

Code	Number		TECHNOLOGIES
	45		Pipes and Ducts
		45,1	Insulation & sealing
		45,2	Flow Restrictors
		45,3	Reduction of Flow resistance
		45,4	Balancing
		45,5	Reduction of the ventilation rate
		45,6	Energy-Efficient Air filters
		45,7	Showerhead restrictors
	46		Efficient Air-Handling Units
50			**Storage techniques**
	51		Sensible Thermal Storage
		51,1	HW Tank-lagging jackets
	52		Latent Thermal Storage
	53		Ice Storage
	54		Aquifer Storage
60			**Solar Techniques**
	61		Passive Solar Heating
		61,1	Sunspaces
		61,2	Direct Gains
		61,3	Indirect gains
		61,4	Others
	62		Passive cooling
		62,1	Evaporative cooling
		62,2	Natural Ventilation conversion
		62,3	Window Smart Ventilation Control
		62,4	Night Cooling
	63		Active Solar Heating
		63,1	Flat collectors
		63,2	Vacuum tube collectors
		63,3	Concentrating collectors
		63,4	Air collectors
		63,5	Others
	64		Daylighting
		64,1	Light shelves
		64,2	Skylights
		64,3	Reflective louvers
		64,4	Prismatic /holographic films
		64,5	Light Pipes
	65		PV applications
		65,1	PV building integrated-grid connected syst.
		65,2	PV building integrated-stand-alone systems
		65,3	PV isolated grid connected system
		65,4	PV & Thermal Hybrid integrated panels
70			**HVAC Control & Regulation**
	71		Components control devices
		71,1	Thermostats on radiators
		71,2	Regulator valves for controlling temp & waterflows
		71,3	Switch from CAV to VAV
		71,4	PI/PID control instead of on/off or prop. control
		71,5	Different set values for Heating & Cooling
		71,6	Change to individual zone control
		71,7	Remote control of set values for thermostats
		71,8	Optimised Start & Stop of fans
		71,9	Optimum start/stop of night cooling
		71,10	Economiser control of air recirculation damper
		71,11	Automatic summer/winter compensation
		71,12	Revised schedule for operation of circulators
	72		Metering devices
		72,1	Individual Heat Metering
		72,2	Individual HW Metering

Code	Number		TECHNOLOGIES
	73		Building Energy Management Systems
		73,1	Timers and programmers on HVAC components
		73,2	Electr. Control of Electr. Heated house
80			**End Use Technologies**
	81		High-Efficiency Lighting Systems
		81,1	Low-Energy Lamps
		81,2	Electronic Ballast
		81,3	High-efficiency magnetic ballast
		81,4	Reflector Systems
		81,5	Efficient Fluorescent Lamps
		81,6	High-Intensity discharge lamps
		81,7	Lighting Device Controls
		81,8	Occupancy Sensor Control
		81,9	Halogen lamps
		81,10	Efficient Incandescent lamps
	82		High-Performance Home appiances.
		82,1	Fridge/Freezers
		82,2	Washing machines
		82,3	Dishwashing machines
		82,4	Clothes Dryers
		82,5	El. Water Heaters improv./switch to gas
		82,6	Electric Ovens & Cookers
		82,7	Colour TV
		82,8	Hi-Fi and Video recorders
		82,9	Kitchen Extraction Hood
	83		Adv. Office Appliances
		83,1	Photocopiers
		83,2	Printers
		83,3	Computers and Workstations
		83,4	Telefax machines
	84		New electrical load management
		84,1	Power Factor Compensation
		84,2	Power Quality Improvement
		84,3	Load Shift to low tariff
		84,4	Power Limiters
	85		Advanced Electric systems
		85,1	Power Factor Correction
	86		Efficient Electric Motor Systems
		86,1	Energy-Efficient Motors
		86,2	Permanent Magnet Motors
		86,3	Adjustable Speed Drives
		86,4	Cable Sizing
	87		New efficient mobility devices
		87,1	Advanced Internal mobility devices
		87,2	Advanced External mobility devices
90			**Other Technologies**
	91		Fuel Cells
	92		Wind generators
	93		Biomass energy
	94		Biogas energy
		94,1	Biogas exploiting landfills
			Biogas from digestors
	95		Small Hydro
	96		Integrated Renewable Energies
	97		Thermodynamic changes
	98		Industrial Applications
		98,1	Compressed Air
		98,2	Liquid Gas expansion
		98,3	Advanced Electrolysis
	99		Miscellanea
		99,1	Geothermal energy for thermal uses
100			**All technologies**

Code	No.	IMMATERIAL TECHNIQUES
101		**Information to users**
	101,1	Consumers general information by media (TV, newspap
	101,2	Teaching users about savings techniques
	101,3	Billing with informative graphics etc. on the bill
	101,4	Energy Manager formation and training
	101,5	Free Audit on site with ECO identification & suggestion
102		**Tariff Rates**
	102,1	Daily Time of Use Rates
	102,2	Seasonal Time of Use Rates
	102,3	Interruptible Rates
103		**Certification and Labelling**
	103,1	Energy Certification of building energy consumption
	103,2	Appliance Labelling
	103,3	Heating System Performance Labelling
	103,4	Cooling System Performance Labelling
104		**Managerial Measures**
	104,1	Implementation of En. Manager position in public admin
	104,2	Implementation of En. Manager position in ind. compani
	104,3	Ext. Planned Maintenance Service
	104,4	Switch to Heat Service supply company