SOLAR THERMAL PROCUREMENT

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Summary

The method of *co-operative or technology procurement* is a powerful demand-side tool to inspire innovation. With this method, major, future-oriented buyers articulatate their needs in challenging performance requirements and indicate a coming market, which stimulates manufactureres into quickly, but reliably developing new and much more efficient innovative solutions. In some energy and refurbishing projects, important results achieved are: reduction of energy or cost by half, and substantial speed-up of innovation as well as realisation. The objective of using this method in the IEA Solar Heating & Cooling Programme is to enlarge the market for active solar systems through major cost and price reductions and performance improvements. The expected results of this joint effort include installation of at least 10,000 systems, creation of a larger market, approx. 50% cost reductions, and contribution to an enlargement of the production of energy from sustainable sources.

1. INTRODUCTION

1.1 General possibilities

Reduction of energy use by half, reduction of total costs almost by half, and/or speeding-up both the development process and the realisation of individual projects are results achieved by using *co-operative or technology procurement*. With this market-demand process major buyers and users articulate their needs in functional terms, aggregate their purchasing power, and accelerate the innovation and diffusion process. Through parallel work and early involvement of leading buyers and users, the risks are reduced for manufacturers (Westling, 1991 and 1996). Table 1 is an overview of the results achieved in some technology procurement projects.

Project Area	**Result**
Lifts for existing buildings	Cost reduction by 48%
Refurbishment of bathrooms	Reducing total time from weeks to 2 days
Energy-efficient products/systems	Energy reduction 30-50%

Table 1. Overview of results, Technology Procurement

1.2 Solar background

The IEA Solar Heating & Cooling Programme has been active with R&D co-operation since 1977 and approx. 90 projects have been undertaken. Today, 20 member countries participate in the

programme. Recently a major IEA project ended - Task 14 "Advanced Active Solar Systems". The final report summarises the research work within this area and points out achieved results with about 15% cost reductions. Different countries also present their future "dream" systems. Substantial possible cost/energy improvements are foreseen due to system and product development. Further, other studies have indicated that the cost of solar thermal systems can be lowered by 50% with increased production and more efficient retailing.

2. THEORIES AND DEFINITIONS

2.1 Innovation instruments

Over the years, researchers have consistently debated which *instruments* are most effective in producing *innovations*. (In this context, it is important to note the difference between *inventions* and *innovations*, meaning new products, systems and processes which have left the laboratory and been introduced onto the market). Some researchers have emphasised the supply side (technology push), others the demand side (market pull). The conclusion drawn in recent times is that initiatives are important on *both* sides, but that most innovations - some researchers say 75% or more - have probably materialised as the result of steps taken on the demand side. Several researchers are agreed that apart from demand-side initiatives, efficient organisation and communication are also important (Mowery and Rosenberg, 1978; Lundvall, 1988). A comprehensive OECD report found that future-oriented purchasing, like technology procurement (see definitions below), is the only sure way of speeding up innovation (OECD, 1978). Technology procurement is a method of working on the demand side (see Edquist, 1990, Memorandum on Technology Policy).

The importance for innovation of building up *networks* of long-term relationships (interactions) between buyers or consumers and manufacturers or suppliers, is emphasised for example by Håkansson (1987). The importance of simplified communications has been shown in a large number of investigations, e.g by Allen (1977). The importance of involving the *customers or users* at an early stage, had previously emerged in studies from SAPPHO (Rothwell et al., 1974) and Rothwell (1977), as well as by von Hippel at MIT (1978). In later studies, von Hippel emphasised the importance of lead users (1986).

In many areas, the market is out of balance. There are many buyers, but they are not united. They may have valuable ideas but have difficulties imagining new products. Sellers and manufacturers are not well-informed about what their customers really want.

Interaction between users and producers and the organisation of the market have been stressed by Lundvall (1988 and 1991) and the importance of a "central co-ordinating agency" by Teubal (1991).

2.2 Definitions

Technology procurement may be characterised as an entire acquisition process aimed at directly stimulating innovation. It is not exclusively associated with any particular form of contract, though it is closest to design/build contracting with functional requirements and functional procurement.

Technology procurement has been defined in a memorandum from the Swedish Ministry of Industry as

> "a process, through which a commodity, service or system is procured, and for which development of new technical solutions is essential in order to meet the requirements of the buyer. The technical development work, being part of the process, may concern application of advanced technology, but also minor stages of development as well as product modifications. The development work may concern the product, the system or the production process, for which it is developed." (Industridepartementet Ds I 1982:4).

Co-operative procurement includes both
- technology procurement (of something not yet existing on the market), and
- acquisition of existing products/systems in some organised ways (for instance among the 25 per cent "best", - most energy-efficient, or best in some other aspects)

where, in both cases in this paper, the most influential buyer or a number of *buyers combine* their efforts and, to a varying extent, work jointly with the formulation of requirements, invitation for tenders, evaluation and actual buying, and influence the market transformation by the use of support activities (rebates, information, labelling, awards, etc.).

We know that innovation and product development today is carried out in circular or spiral loops and with parallel work, instead of in a process with different stages following one after the other in a linear way.

3. EARLIER EXAMPLES

3.1 Many areas

Articulating the needs and communicating the purchasing power have been successful innovation methods used in a number of areas. Development of railway locomotives, electricity and telecommunication innovations and more efficient use of energy are examples of areas where the demand-side activities have resulted in better solutions.

3.2 Energy projects

A number of energy end-use projects have been fulfilled recently, using the technology procurement method. In Sweden, large energy reductions of 30-50 per cent have been achieved as a result of these projects. Table 2 illustrates the results from some technology procurement projects.

As far as ventilation for example is concerned, it was possible to achieve a reduction of the energy use by half. A project in Western Sweden concerned the replacement of 59 fans in a residential area owned by the co-operative organisation HSB. One of the competitors, Fläkt AB in the ABB Group of companies, succeeded beyond all expectation. The electricity requirement for ventilation was halved from 750 kWh to 380 kWh per apartment and year. It is estimated that there are about 50,000 similar units in the country, resulting in potential savings of over SEK 100 million for the country's entire stock of apartment buildings. The next step is now being taken. 2,000 fans are now going to be renovated.

Project area	Result	Energy reduction
Refrigerator/Freezer	From 1.2 kWh/litre comparable volume per year to 0.8	by 33%
Clothes washers & dryers for laundry rooms	From 2.6 kWh/kg of laundry to 1.2	by 50%
Ventilation. Replacement of fans in residential area	From 750 kWh/apartment and year to 380	by 50%
Heat pumps	Two different suppliers have been chosen for further development and deliveries	by 30 %

Table 2. Results obtained from some technology procurement projects in the energy field in Sweden. (Source: NUTEK, 1993)

Similar methods have been used internationally, e.g. by the French organisation HLM, the Association of Municipal Housing Companies, in developing control systems for apartment houses, "Domotique", a form of intelligent buildings (HLM et al., 1990).

In a project in Germany for ventilation and cooling equipment (RWTUV, 1991) it has been possible to reduce energy consumption by more than half, down to 40 per cent of the earlier consumption. An important factor in this project was that there was one, strong customer, Deutsche Telekom, the German Telecommunications Administration, pointing at a large market of several thousand units.

The US Energy Policy Act (1992) and Climate Change Action Plan (Clinton and Gore, 1993) contain a number of initiatives, which have been followed by concrete actions in a number of different areas with Federal and State Agencies as important buyers. In the United States, a "Golden Carrot" programme was first used for energy efficient refrigerators with 30-35 per cent energy reduction, and it is now being followed by the Consortium for Energy Efficiency, CEE, in a number of fields, such as ventilating and cooling systems. One additional example is a project for a 30 per cent more efficient incandescent HIR lamp initiated by the Department of Defense, DOD, the Department of Energy, DOE, and the Environmental Protection Agency, EPA. This initiative has now been supported by collaborative International Energy Agency efforts in April 1997 from European countries, both in the lighting and drier fields. These procurement and promotion activities are organised within the International Energy Agency (IEA) DSM Implementing Agreement and its Annex III "Co-operative Procurement - Market Acceptance for Innovative Energy-Efficient Technologies".

4. OBJECTIVES AND OPPORTUNITIES FOR SOLAR PROCUREMENT

4.1 Objective

The objective of this proposed project is to achieve major cost reductions and a widened market for active solar systems. This can be reached by information exchange and collaborative buying,

resulting in further technological development and scale effects of larger series.

4.2 Opportunities through collaboration

By showing sufficient joint efforts through collaborative mass buying of at least 10,000 systems, different manufacturers of components and systems can be inspired to invest more in adapting their solutions and in production facilities resulting in scale effects and reduced costs and prices - a performance and cost breakthrough for active solar systems and a widened market.

5. SCOPE AND STRUCTURE OF PROPOSED TASK

5.1 Scope

The Task is planned to deal with small and medium sized active solar systems, but primarily with small systems (SDHW), see Table 3.

	New buildings	**Existing buildings**
Small systems (SDHW)	main goal	main goal
Medium size	included	included
Very large	not included	not included

Table 3. Size of systems to be included

5.2 Structure of proposed Task

For pedagogical reasons, the Task work is illustrated by a number of steps, see Appendix 1. It should however be emphasised that work in innovation projects proceeds in reality rather by many parallel activities in a circular and spiral development than stepwise by steps following one after another.

Step 1 is the work during the *Project Definition Phase*, where a definite Task Text and Work Plan for the whole project will be worked out, including time schedule and required resources. Background material will be summarised in a number of short fact reports. Some of the participating countries have taken on the responsibility for different topics. The purpose of this work has been to create a knowledge base for further activities and, not least, to be able to provide potential members of "buyer groups" with convincing facts about "Solar Procurement". Examples of topics are included in the detailed work plan for the Project Definition Phase (PDP).

Different alternatives for the Task Work Plan are illustrated in Text and Time Schedules (Appendix 1). Before starting the steps after the PDP, decision should be made concerning which alternative to choose.

Step 2 includes: *Preparations* for joint buying and procurement (acquisition and buying), including final identification of possible buyers and more definite formulation of goals. This is also where the Task, after a decision, formally starts. The formulation of preliminary goals by performance criteria will be worked on at the beginning, but the final formulation of goals and objectives should be greatly influenced by the needs expressed by engaged buyers.

The requirements may be divided into two levels - "mandatory" and "desired" requirements - for energy as well as for other important non-energy areas. Furthermore, market contacts will be developed, existing manufacturers of different components and systems will be identified, and concrete buyer groups - which have been initiated earlier - will get their final formation. The groups should consist of leading and interested buyers from utilities and housing companies. It is very important that coordinators in the participating countries - "national project managers" - are nominated and work actively on the formation of these buyer groups.

Step 3 is the actual *Procureme*nt, or aquisition, consisting of invitation, tender preparation and evaluation of tenders, ending up with one or more contracts or contractual arrangements. The procurement should aim at being a true international activity where also service and maintenance are considered. Very preliminary analyses at an initial workshop in September 1996 - also with manufacturers present - show that total *orders in the magnitude of 10,000 units* would give important signals to manufacturers of components that a future market will be opened. The 10,000 units should be divided among the participating countries according to earlier solar activities as well as to the pronounced ambition in the individual country. The manufacturers may, as a result, consider investing in further refinement and adaption of technical solutions and in more efficient production facilities. The distribution chain, including also the management of installations, will also be influenced by the activities. Attention will be paid to a more efficient organisation of after-sales support, service and maintenance.

Step 4 is the *Development*, including preparation for and the organisation of production and deliveries, and it will mainly take place with the organisation of suppliers of components and systems. The work will be carried out in collaboration with the interested, future-oriented buyers. If needed, this phase includes also prototype evaluation of one or several prototypes, comprehensive single components or whole systems and pilot installations for single or small-scale deliveries. It is anticipated that already existing testing methods and testing facilities could be utilised.

The last step, *step 5*, is the *Diffusion* phase, comprising the start of a series delivery, and evaluation.

It will be further analysed whether the work should initially be fulfilled through smaller, limited buying efforts in the different countries - all of them observing the same principles with the same, or very similar, requirements, followed later by larger coordinated buying - or if the large-scale buying should start very early.

In any case, previous and ongoing active solar projects, which include large-volume buying such as the EU Solar Project and large national projects in Germany, The Netherlands and Denmark, will be systematically analysed in order to find similarities and a common base for collaborative efforts.

The three different alternatives of variable length will be further analysed by the working group.

6. EXPECTED RESULTS

The experiences from this work will be an important contribution to the development of general collaborative activities using the demand side.

Results expected from the Task will include:

- Installation of at least 10,000 SDHW-systems or equivalent in larger systems
- Making the market more international
- Leading to a steady growth of the market.

By aggregated mass purchasing *a larger market* will be created for more cost-efficient products. Both the preparations and the work within the new Task can be seen as a valuable *learning process*.

A model for international collaborative work for facilitation of innovation and diffusion of more efficient solutions in the active solar field will be developed.

The Task will contribute to an enlargement of the production of energy from sustainable sources. The non-energy benefits include environmental improvements by avoiding substantial air pollution.

The project will show the way for using bulk-buying activities for innovation in the energy supply side as well as for end-use systems.

At least 50% cost reductions are expected to be achieved through joint efforts. Well worked-out performance specifications and valuable information material will be other results created within the proposed Task. Purchasing by thousands and ten thousands will be more frequent, which will further contribute to cost reductions.

7. COLLABORATION AMONG BUYERS

Take the opportunity to join and articulate your needs together with other future-oriented buyers and aggregate the purchasing power in a co-operative technology procurement initiative. This will also help reduce the risks involved to manufacturers in their development efforts to find more efficient and reliable components and systems and will give purchasers a good opportunity of working together in future-oriented groups of buyers. By this breakthrough endeavour, the important scale effects will be achieved, which will help reduce the risks, inspire series production and consequently, reduce the costs of the system components.

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