



Technology procurement

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Contents

Preface.....	7
Executive Summary.....	9
1. Introduction.....	11
1.1 What is technology procurement.....	11
1.2 Bridging supply and demand.....	12
1.3 The steps of technology procurement.....	13
2. Recommendations.....	19
2.1 Anchoring of technology procurement.....	19
2.2 Recommendations for Nordic efforts.....	23
2.3 Recommendations for national efforts.....	24
3. Swedish experience.....	29
3.1 Examples of technology procurement.....	30
3.2 Stakeholders involved in technology procurement.....	31
3.3 Findings, Sweden.....	34
4. Norwegian experience.....	35
4.1 Specific experience with technology procurement.....	35
4.2 Stakeholders involved in technology procurement.....	38
4.3 Findings, Norway.....	40
5. Danish experience.....	41
5.1 Danish experience with technology procurement.....	41
5.2 Stakeholders involved in technology procurement.....	43
5.3 Findings, Denmark.....	45
6. Finnish experience.....	47
6.1 Specific experience with technology procurement.....	47
6.2 Stakeholders involved in technology procurement.....	48
6.3 Findings, Finland.....	49
7. Icelandic experience.....	51
7.1 Specific experience with technology procurement.....	51
7.2 Stakeholders involved in technology procurement.....	52
7.3 Findings, Iceland.....	53
8. International experience.....	55
8.1 Energy+.....	55
8.2 Energy+ pumps.....	56
8.3 Public Procurement for R & I.....	57
8.4 Co-operative procurement.....	58
8.5 U.S. – Emerging Technology Program.....	59
Annex 1: List of references.....	63
Annex 2: Practical Lessons Learned.....	67
Annex 3: Swedish Energy Agency technology procurement initiatives.....	71
Annex 4: Sammenfatning.....	73
Annex 5: Workshop noter.....	75
Annex 6: Spørgeguide.....	77

Preface

The Nordic Environmental Action Plan 2005 – 2008 points at the necessity of developing and using innovative environmental technologies that can disconnect environmental impact from economic growth. With the present project, the Integrated Product Policy Group of the Nordic Council of Ministers (NMRIPP) aims at supporting green innovation through public and private procurement in line with the Nordic Environmental Action Plan.

The Nordic Innovation Policy Cooperation Programme (Det Nordiska Innovationspolitiska Samarbetsprogrammet) 2005–2010 has the long term objective to develop *new sustainable products through future synergies between research in environmental technologies, innovation, strong competition skills and the use of cross-border public procurement*. Through its ability to support environmentally sound innovation and improve the environmental performance of public procurement, technology procurement is a promising tool for achieving this long term Nordic objective.

The goal of the project is that the technology procurement approach is commonly used in the Nordic countries to promote eco-innovation through public procurement.

The project has had two specific objectives:

- to provide a clear and well structured review of Nordic and international experience within technology procurement, and
- to provide recommendations for development and increased use of technology procurement.

The project has been accomplished by PlanMiljø Denmark (project lead), Jegrelius Sweden and GRIP Norway. The team has consisted of:

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Executive Summary

“Technology procurement” is a method of merging public procurement with innovation in order to achieve specific (and in this case environmental) benefits. Technology procurement is a bidding process that stimulates and enhances the development and market introduction of an article or a service non-existent on the market, requiring development to fulfil the purchaser’s objectives and demands. In other words, technology procurement is a market-transformation tool stimulating the development and commercialisation of new products that meet specific functional requirements (e.g. energy efficiency) that are not fulfilled by existing products on the market.

With technology procurement, information about the existence of a specific needs and demands from potential purchasers is conveyed in an organised way to the potential developers considering the entire supply chain. An effective technology procurement process requires that the demanded volume is large enough to stimulate the supplier given the current state of technology, i.e. the bigger the step to be taken, the greater the volume required.

Technology procurement exists in many varieties with some general steps of the process:

- Selection of target areas
- Pre-study or feasibility study
- Creation of a buyer group
- Formulation of specifications
- Tendering process
- Evaluation of tenders
- Spreading of information
- Further development.

Successful examples of technology procurement can be identified in individual countries and in international cooperation, embracing a variety of technologies and products such as household and commercial appliances, lighting systems, building components, and office and industrial equipment.

Since 1990, technology procurement has been used in especially Sweden to speed up the market introduction of energy-efficient products. Evident environmental and economic benefits have been achieved and innovation supported.

A vast number of technology procurement initiatives have been carried out in Sweden, and Sweden stands out from the other Nordic coun-

tries by having (had) both institutions and regulation with specific focus on technology procurement. It is estimated that more than 100 technology procurement projects and processes have taken place in Sweden.

The experience from the other Nordic countries is sparse, ranging from around eight projects in Finland to very few in Norway and Denmark – and none in Iceland.

Recommendations

- A central institution should undertake the role as *national leader* for technology procurement. Leadership means pointing out the direction, expressing visions and goals – and accepting the risk associated with departing the beaten track.
- An explicit national *vision* expressing themes such as sustainability and greening of the public sector should draw the attention of institutions and individuals in the direction of innovative procurement.
- A strategy for the inclusion of innovative environmental considerations in public procurement is necessary to most effectively pursue the vision and overall goals.
- A clear *structure* should provide a framework for public buyers enabling them to be innovative in the purchasing process. The technology procurement examples demonstrate a number of positions that should be filled.
- One of the most important factors for successful innovative procurement strategies is *a motivated and competent staff*. A participatory approach when conducting technology procurement projects and training programme for public purchasers and other relevant personnel are prerequisites for expanding the use of technology procurement in the Nordic countries.
- Implementation of expedient *systems* will ease the process of innovative procurement and ensure a certain harmonisation of the national or even supra-national approach. Relevant systems include guidelines, case stories, good practises and tools.
- Creation of a *culture* promoting innovative green procurement requires a long lasting effort during which leadership and communication are of vital importance.

Specific recommendations are included for the Nordic Council of Ministers and for four Nordic countries.

1. Introduction

For quite some years greening of public and private procurement has been used as a way of reducing the environmental burden and supporting green products commercialisation. And for many years – and with rising strength – the notion of innovation has been a buzzword in the industrialised world as a means to cope with increased competition and globalisation. “Technology procurement” is a method of merging these two concepts into one.

In a Nordic context technology procurement has been used primarily in Sweden. Before 1990 the typical user of technology procurement was a single buyer issuing complex functional specifications for a system to be developed. During the last sixteen years, technology procurement has been used in Sweden and other countries as a methodology to speed up the market introduction of energy-efficient products.

Historically, technology procurement dates back at least 250 years. In 1713, the English “Longitude Act” offered a prize of 20,000 pounds for a method to determine longitude, and in 1773 John Harrison was awarded the prize for his portable chronometer.

Successful examples of technology procurement can be identified in individual countries and in international cooperation, embracing a variety of technologies and products such as household and commercial appliances, lighting systems, building components, and office and industrial equipment. Evident environmental and economic benefits have been achieved and innovation supported.

1.1 What is technology procurement

Technology procurement is a bidding process that stimulates and enhances the development and market introduction of an article or a service non-existent on the market, requiring development to fulfil the purchaser’s objectives and demands. In other words, technology procurement is a market-transformation tool used to stimulate the development and commercialisation of new products that meet specific functional requirements (e.g. energy efficiency) not fulfilled by existing products on the market. In some cases technology procurement may include procurement that stimulates the market development of existing products that have very low/non-existent market penetration. This is often termed aggregated or cooperative procurement.

In this report, technology procurement is defined as an innovative process, and the definition does not include the very similar process of procurement aggregated or cooperative procurement.

Technology procurement is one of the potential underlying strategies for procurement-driven innovation. Innovative procurement has three major mutually independent focus areas: Supplier development (e.g. products, distribution and support); buyer development (e.g. new ways of using the products, new budget rules for allowing innovative procurement decisions, new administrative rules for motivating effective use of products); and regulatory development (i.e. changing the regulatory structure to allow new products, usages, etc). Technology procurement emphasises the first of these focus areas, but, as some of the following examples demonstrate, cannot ignore the other two.

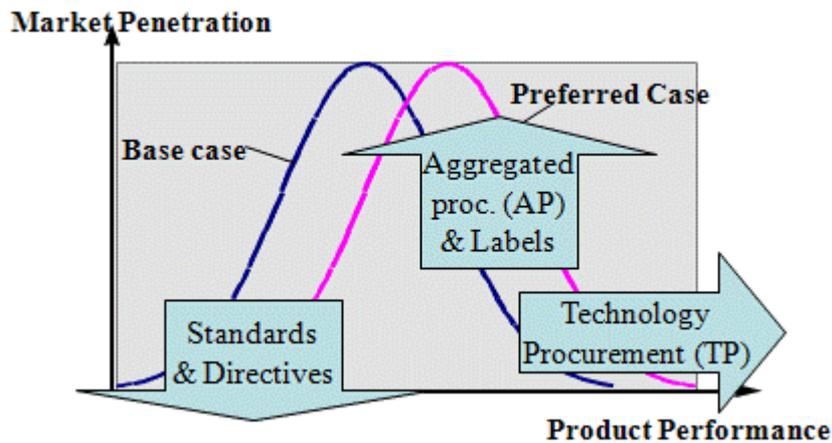


Figure 1: Technology procurement is one of many different instruments to stimulate a desired market transformation (Hans Nillson, 2007-interview).

Technology procurement should be seen in relation to other market transforming tools, e.g. labelling and information campaigns. As illustrated in figure 1, technology procurement is not supposed to raise sales volumes of existing products but rather to drag the whole market in a desired direction by introducing new technology. Some might argue that the technology would have been introduced later on anyway. This may in some cases be true; however, by leapfrogging ahead and introducing the technology at an earlier stage benefits are gained sooner.

1.2 Bridging supply and demand

With technology procurement, information about the existence of a specific need and demand from potential purchasers is conveyed in an organised way to the potential developers considering the entire supply chain.

How the methodology is used in practice depends on the product and the objective of the technology procurement. If, for example, public purchasers conduct a procurement process regarding energy-efficient products (e.g. a household appliance), a fast introduction of the product to the public market will be of utmost importance. And if the defence sector through technology procurement promotes innovation of a weapon system, the objective will probably be specific to the situation (and not fast introduction to the market).

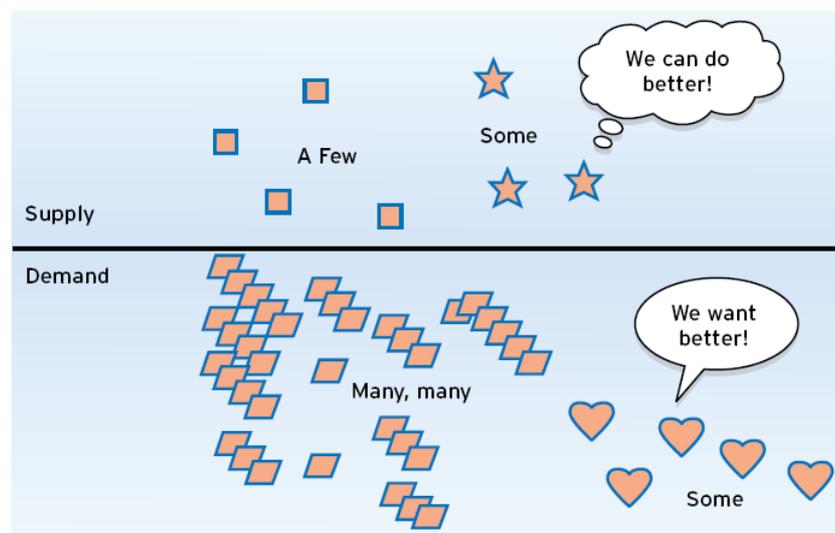


Figure 2 Technology procurement helps bring out the potential for better products on fragmented markets. (Illustration idea: Hans Nilsson)

In general, technology procurement processes have aimed at changing fragmented markets with many buyers and also many (potential) suppliers.

1.3 The steps of technology procurement

Although technology procurement exists in many varieties some general steps of the process can be identified. The model used with success by the Swedish Energy Agency includes the following steps:

- Selection of target areas
- Pre-study or feasibility study
- Creation of a buyer group
- Formulation of specifications
- Tendering process
- Evaluation of tenders
- Spreading of information
- Further development

1.3.1 Selection of target areas

Selecting the right target areas or product groups for technology procurement is crucial to harvest the best possible innovative and environmental benefits of the resources. The selection process should not focus too narrowly on just developing new technology but include new products, new services, products adapted to new markets, increased product availability and development of new distribution systems.

As a general rule, technology procurement requires that the demanded volume is large enough to stimulate the supplier given the current state of technology, i.e. the bigger the step to be taken, the greater the volume required¹. This usually implies that a central decision-making authority is in place and motivated. Procurers of public services are particularly interesting candidates.

1.3.2 Pre-study or feasibility study

The initial phase is of critical importance for the overall process. This phase consists of a feasibility study that examines the technology and market prospects for the specific functional needs. The selected functional need in combination with the available technology must provide the necessary potential for improvements of the new product in energy efficiency or other functional features. Moreover, there must be significant signs of a future market demand for these new or improved products. While the demand may not exist at the time of the feasibility study, those who initiate the process should have a clear plan of how demand can be stimulated (e.g. through marketing campaigns) to an extent capable of attracting manufacturers' interest. If these two conditions are valid, then the process can continue to the next stage.

The supply chain (from the purchasing phase through production to the developing phase) must be examined and the crucial decision makers and market actors identified. The dissemination of information to the market for the specific demand, mixed with the right incentives, initiates and accelerates market acceptance of the new product.

1.3.3 Creation of a buyer group

A group of well-informed and influential purchasers, defined as a "buyer group", must establish an aggregated demand for the new product. The main issues of this phase are the identification of motivated buyers, the capability of them to act as a group and the influence they represent in the market.

The larger and more influential the buyer group, the more incentives they create for manufacturers to participate. It should be noted, however,

¹ With the right incentives for the manufacturers, a technology procurement process may also be launched for a smaller volume of products aiming at a catalytic effect

that a large buyer group is not necessarily a crucial factor. If the buyer group consists of buyers that are generally regarded as market leaders, this can compensate for a relatively small group. For suppliers, one of the most important aspects is the prestige and the market recognition attained from winning a procurement competition based on the specifications of those leading buyers.

The procurers must be willing to face the specific challenges connected with the technology procurement process. These may be:

- Economic
 - Price uncertainty
 - Unclear cost of the procurement process itself
 - Uncertain operational costs
- Timely delivery/quality
 - Risk of not getting many (or even any) qualified offers
 - Manufacturers not being able to satisfy the demand in time
- Administrative
 - Internal and external rules/regulations may need to be adapted
 - Increased risk of reactions from non-selected suppliers
 - Need for organisational development incl. training
- Competences
 - Increased requirements to procurers' technical knowledge
 - Complex procurement process

Few procurement officers will be willing to take these risks without being guided by strong political leadership and high-level willingness to accept the specific challenges mentioned above.

1.3.4 Formulation of specification

The buyer group formulates product specifications with the help of technical experts. It should be emphasised that the specifications are not “rocket science”. On the contrary, they tend to build on sound technical knowledge of what is technically feasible without large investments in research and development slowing the pace. The difficult task appears to be reaching consensus on the precise expectations of the buyers of the new product. These must be translated into rigid functional specifications (mandatory or desired) without specifying the use of a particular technology.

Moreover, even if the aim is to have more efficient products entering the marketplace, all other product features are equally important to make the product acceptable – and desirable – for the end user. Examples of such features are noise level, aesthetic design, user friendliness and, of course, low life-cycle costs.

Another important issue that must be dealt with at this stage is the identification of evaluation and testing procedures for the evaluation of manufacturers' bids.

1.3.5 Tendering process

After formulation of the specifications, a tendering process should be launched. Communication with manufacturers must comply with all legal requirements, but the process should also allow as many participants as possible to ensure maximum quality of the tenders.

One of the most powerful incentives for manufacturer participation is to have the buyer group commit to a certain sized order of the new product. It is important to note that the buyer group in most cases has not made any legally binding commitments to buy a specific number of products. Rather it is the credibility of the buyer group and the suppliers' confidence in the commitment of the buyers that have motivated the suppliers to bid.

Further, the invitation to tender must be clear and precise and include all necessary information regarding specifications, prices, awards, evaluation criteria and rules, along with marketing conditions for the winner(s). The tendering period must be long enough in the light of product complexity for the manufacturers to develop prototypes and submit their bids.

1.3.6 Evaluation of tenders

After submission of bids, the evaluation process begins. The evaluation may include prototype testing and measurements. It is of great importance that the evaluation be performed by an independent jury or similar group and that this is specified in the invitation to tender. The winner(s) will be selected according to the evaluation criteria already specified in the invitation to tender, and contracts should be made with the winning manufacturer(s).

Awards can take many shapes. In some instances, it is sufficient for the suppliers to win the opportunity to have their newly developed products tested and used by competent buyers, who can give feedback. In other cases, the volume of units delivered helps reduce risk for a manufacturer when starting serial production. Formal awards of excellence, as well as press releases, demonstration projects and marketing campaigns are other important tools.

One way of risk-minimisation is to use award criteria ("should") rather than technical specifications ("must"). Evaluation and weighting of such criteria is complex, therefore capacity building of procurement officers is necessary.

1.3.7 Spreading of information and further development

The value of the process is not primarily related to the success of the specific product developed, but rather to total market transformation. Publicity, along with follow-up activities, is necessary to multiply the success and maximise the impact of the process in the market. The winner's achievements must be spread to the market, and the new technical solution developed and benefits from its application must be widely known.

2. Recommendations

The tool of “technology procurement” entails interesting perspectives for combining the large expenditure on public procurement in the Nordic countries with the need for environmental improvements, constant innovation and development of the Nordic business sector.

The many examples from regional, national and supra-national contexts described in this report elucidate the considerable benefits that can be achieved through technology procurement. At the same time, the examples and the national reviews provide input to a set of recommendations aiming at increased and effective use of technology procurement as a means of supporting environment-friendly and energy-saving technologies in the Nordic countries.

2.1 Anchoring of technology procurement

Not surprisingly, the benefits of technology procurement cannot be harvested without allocation of resources to initiate, facilitate, nurture, feed and evaluate the procurement processes. The examples demonstrate, however, that considerable socio-economic and environmental benefits can be achieved if such resources are made available for key institutions.

Having said that, the review of technology procurement experience points at a series of organisational elements crucial for an effective and future-oriented utilisation of this auspicious tool.

2.1.1 Leadership

By undertaking the role as national focal institution for innovative green procurement, a dedicated institution – be it a national procurement organisation, a state department or another national or sub-national entity – can ensure the necessary focus on the long-term goals and support proper organisation of each technology procurement process. The focal institution should function as an operative agent with resources in the form of time, money and competent staff.

The most visible technology procurement institution in the Nordic countries has been NUTEK in Sweden, but also Motiva in Finland has played an important role in the national context. In Norway, Innovation Norway has had the responsibility for the Public R&D programmes that have many similarities to technology procurement.

Leadership means pointing out the direction, expressing visions and goals – and accepting the risk associated with departing the beaten track.

Procurement officers will not engage themselves in technology procurement without clear messages and support being expressed from a superior authority.

Among the tasks of the focal institution are:

- Formulate, disseminate and promote the vision.
- Induce dialogue between institutions and stakeholders on how to target the vision.
- Promote establishment of user and purchaser groups enabling technology procurement, i.e. setting up buyer groups.
- Launch technology procurement projects and stimulate and support technology procurement processes in other institutions.
- Ensure compilation and dissemination of good practice, including networking events.
- Address legal issues and develop guidelines or handbooks for procurement officers on how to minimise legal risks.
- Participate in international networks to ensure compilation and dissemination of good practice at international level, e.g. the International Energy Agency's working groups.
- Participate and support other institutions' participation in international technology procurement projects – e.g. the Energy+ projects.

2.1.2 Vision – political signals

An explicit national vision expressing themes such as sustainability and greening of the public sector should draw the attention of institutions and individuals in the direction of innovative procurement. Technology procurement fits perfectly into a national development context aiming at innovation of environmentally sound technologies and a general greening of the society through implementation of such technologies. Such strategies and plans exist in most countries, an example is the 2007 Danish National Action Plan for Environmental Technologies (which for the moment does not deal with technology procurement). As recommended by NUTEK², it is important to see technology procurement as part of an overall policy for public procurement and innovation.

By streamlining innovation and environment in public procurement, procurement staff (normally focused on reducing the cost of procurement) may more proactively utilise the opportunities for playing a more dynamic role in society. The present efforts of the Finnish working group on technology procurement may lead in this direction.

Technology procurement is mentioned in several Swedish acts as a means to achieve environmental improvements. As in Sweden the vision

² Reference: Offentlig upphandling som drivkraft för innovation och förnyelse, Redovisning av regeringsuppdrag, R2006:21, NUTEK

could be institutionalised through inclusion in the legislative framework in the other Nordic countries.

The Norwegian Action Plan for Environmentally and Socially Responsible Procurement specifies that further measures for stimulation of technology procurement should be considered, and the Norwegian Panel for Green Public Procurement has established a working group on the theme of Public Procurement and Innovation.

2.1.3 Strategy

A road map for the inclusion of innovative environmental considerations in public procurement is necessary to most effectively pursue the vision and overall goals. With specific objectives and associated actions, the strategy elucidates the amount of resources allocated to this work field, motivates stakeholders and enables meaningful evaluation of the efforts.

The strategy may deal with, among others, the following areas of action:

- Prioritisation of target areas and sectors
- Investigation of purchaser needs
- Investigation of effects on the procurement process
- Training needs
- Pilot projects
- Risk mitigation

2.1.4 Structure

The structure should provide a framework for public buyers enabling them to be innovative in the purchasing process. The technology procurement examples demonstrate that the following positions should be filled:

- An active and competent purchaser group
- Facilitator and project manager - technology procurement projects are long lasting (2–4 years) and involve many partners, why skilled project management and facilitation is needed.
- Experts responsible for feasibility studies and other background investigations
- Purchaser group members
- Contact person to suppliers

2.1.5 Personnel

One of the most important factors for successful innovative procurement strategies is a motivated and competent staff. Motivation among procu-

urement officers can be achieved by applying a participatory approach when conducting technology procurement projects. A clear and communicated vision for the use of technology procurement is also an important motivation factor.

With the exception of Sweden it seems that public purchasers and personnel in relevant Nordic organisations have little or no knowledge about technology procurement. A training programme for public purchasers and other relevant personnel is a prerequisite for expanding the use of technology procurement in the Nordic countries.

One of the tasks of the focal institution is risk handling. Addressing legal and economic risks is crucial in order to motivate the procurement officers to use technology procurement. The risk of using an unknown or unfamiliar methodology is a barrier that must be overcome through strong leadership and support, but also through training and pilot projects.

Thus, relevant themes for capacity building include each of the steps of technology procurement as described above, but also risk handling and economic and legal issues associated with the methodology.

2.1.6 Systems

Implementation of the expedient systems will ease the process of innovative procurement and ensure a certain harmonisation of the national or even supra-national approach. The technology procurement methodology itself constitutes the overall system; specific development of each element of the procurement process will increase effectiveness of technology procurement and reduce the risks and uncertainties connected with the process. Relevant systems include guidelines, case stories, good practises and tools.

2.1.7 Culture

Creation of a culture promoting innovative green procurement requires a long lasting effort during which leadership and communication are of vital importance. One sign of such a culture is when communication of specific needs and demands from buyers to potential developers and producers has become institutionalised and normal practice. In Iceland the tradition of close cooperation has been formalised and developed into the concept of technology forums. In Denmark the tradition of cooperation is weaker, even though experiences exist with in the Electricity Savings Trust. The lack of tradition - or reluctance towards public-private cooperation – is an obstacle for increased use of technology procurement that must be actively dealt with.

Another cultural issue is the question of procurement officers' loyalty to processes and framework agreements in decentralised cultures as in the Nordic countries. Genuine implementation of the technology procure-

ment strategy requires continuous focus on the organisations' and the individuals' ability and will to act as desired.

2.2 Recommendations for Nordic efforts

Promotion of technology procurement at the Nordic level could be anchored in a firm collaboration, exploiting the opportunity for integrated and joint procurement across the Nordic countries by defining common requirements. One way of sharing responsibility would be to allocate specific products groups to specific countries (as is done for the Swan labelling), based on experience with common formats.

From a supplier point of view it would be attractive not only to be invited to submit bids for joint Nordic procurements but also to be made aware of technology procurement projects in the individual Nordic countries.

This common Nordic task could be handled by the Nordic Council by arranging conference(s) on technology procurement, with parallel sessions for different product groups, methodology sessions, risk handling sessions etc. The conference(s) should target procurement officers, manufacturers and public decision makers responsible for presenting visions and policies.

A second role of the conferences could be to communicate procurement budgets and future needs, so that the market can prepare itself for upcoming needs and tenders. This concept is used with success by the Icelandic authorities and trade organisations.

Experiences from the International Energy Agency during the 1990s show a potential for setting up multi-national joint buyer groups and networks for compilation of experiences and dissemination of these between the participating countries. This is an obvious way to address the knowledge barrier that exists in most of the Nordic countries due to lack of experiences.

The Nordic experience with technology procurement could potentially strengthen the efforts of the nine points of the EU Environmental Technology Action Plan, ETAP. Very obvious connections exist between the methodology and the action plan element for Improving Market Conditions, not least when it comes to action 4 *Performance Targets*, action 7 *Green Public Procurement* and action 8 *Awareness Raising and Training*. Less strong, but still interesting, links exist to action 1 *Increase and Focus Research, Demonstration* and action 3 *Environmental Technology Verification*. By informing the national focal points for the respective elements of the technology procurement perspectives the NMRIPP might fertilize the ground for more firm implementation of technology procurement also at the European level.

2.3 Recommendations for national efforts

Recommendations for national efforts in Denmark and Norway are categorised according to the seven organisational elements (described in section 4.1.1 – 4.1.7) pointing at specific sub-elements that need strengthening.

2.3.1 Denmark

The following findings form the point of departure for the recommendations for increased use of technology procurement in Denmark:

- Technology procurement has only been used in a few pilot projects in Denmark.
- The Panel for Environmentally Friendly Procurement has been in operation since 2004 and will prepare its new strategy during autumn 2008.
- The Danish EPA in close collaboration with (among others) Local Government Denmark has initiated many projects within green procurement, including preparation of a wide-ranging set of criteria for green procurement.
- Innovation is seen as a very important tool for development and ongoing competitiveness for Danish industry. The Government has a quite intensive focus on user-driven innovation, and considerable support funds are available for projects.
- Danish industry comprises a broad range of manufacturers within many different product groups.

The following recommendations emanate from the model for anchoring of technology procurement (4.1.1–4.1.7):

- The results of the NMRIPP Technology Procurement Project should be presented to the Danish Procurement Panel, the Board for Industry and Building (“Erhvervs- og Byggestyrelsen”), the Ministry of Science and other relevant ministries and administrative units (dealing with environmental or innovative issues), and a dialogue with key stakeholders should be established.
- A juridical review should ensure that technology procurement as a tool complies with existing regulation – or propose legislative modifications to open up for technology procurement.
- Relevant product areas for technology procurement should be identified and pilot projects carried out to demonstrate the benefits and challenges of technology procurement to authorities and procurement officers.

- A ministry or an underlying administrative unit should assume leadership for implementation of technology procurement.
- A vision and a strategy should be prepared, the latter identifying the most promising fields of involvement.
- An effective overall structural setup should be determined, in the light of which each technology procurement process should divide mandates and tasks according to its own specific structure.
- To improve efficiency of the technology procurement processes, systems for the most difficult process elements should be elaborated.
- Training of procurement officers should be initiated in order to establish the necessary competences for technology procurement.

2.3.2 Norway

The following findings form the point of departure for the recommendations for increased use of technology procurement in Norway:

- There is very limited experience in Norway with technology procurement.
- The Panel for Environmentally Conscious Public Procurement, established in 2005, is expected to recommend standards for product specific criteria in January 2008. Innovation is a very likely focus.
- Three ministries have published an Action Plan for Environmental and Social Responsibility in Public Procurement in June 2007. A directorate will be established January 2008 that will include coordination of public procurement in its mandate and probably have the responsibility for following up on the plan.
- A White Paper on Innovation is presently being prepared and the Panel has been invited to come with input.
- A large part of Norwegian industry is concentrated within the primary sectors (energy, metals and foodstuffs), and there is relatively limited production of manufactured goods.

The following recommendations emanate from the model for anchoring of technology procurement:

- The results of the NMRIPP Technology Procurement Project should be presented to the Norwegian Procurement Panel as background information to their work on Innovation and Procurement.
- Technology procurement should be introduced to the Procurement Board and the new directorate.
- A dialogue should be established with Innovation Norway and the IFU/OFU mechanisms so as to see how one can find options for use of technology procurement.

- A juridical review should ensure that technology procurement as a tool complies with existing regulation – or propose legislative modifications to open up for technology procurement.
- An identification of product areas should be carried out, focusing on overlaps between the public and private markets (e.g. building equipment, energy systems, communications solutions, etc).
- Pilot projects should be carried out to demonstrate the benefits and challenges of technology procurement to authorities and procurement officers.
- A ministry or an underlying administrative unit should assume leadership for implementation of technology procurement.
- A vision and a strategy should be prepared, the latter identifying the most promising fields of involvement.
- An effective overall structural setup should be determined, in the light of which each technology procurement process should divide mandates and tasks according to its own specific structure.
- To improve efficiency of the technology procurement processes, systems for the most difficult process elements should be elaborated.
- Training of procurement officers should be initiated in order to establish the necessary competences for technology procurement.

2.3.3 Finland

The following findings form the point of departure for the recommendations for increased use of technology procurement in Finland:

- Eight technology procurement projects have been carried out. Half of the projects were in a national context and the others in international cooperation; two of them IEA (International Energy Agency) projects, the others EU-projects.
- Motiva's practical knowledge and experience create a good starting platform for new technology procurement projects.
- The potential of technology procurement is presently being discussed by a working group for a national Green Public Procurement Plan under the Ministry of Environment.
- There is a lack of knowledge on the methodology among important institutions.
- Funding exists for classic technology development but is difficult to identify for technology procurement.

The following recommendations emanate from the model for anchoring of technology procurement:

- A ministry or an underlying administrative unit – for example Motiva – should assume leadership for implementation of technology procurement.
- A vision and a strategy for use of technology procurement as a method should be prepared, the latter identifying the most promising fields of involvement. The new Green Public Procurement Plan could include identification and accomplishment of new technology procurement projects to create an experience platform for the relevant institutions.
- The knowledge of the existing and previous technology procurement efforts should be communicated to the relevant organisations and institutions, highlighting the potential benefits of the methodology.
- Training of procurement officers should be initiated in order to establish the necessary competences for technology procurement.
- To enable development of new technology procurement projects it is essential that a funding structure is constructed to support this kind of initiatives.

2.3.4 Sweden

A vast number of technology procurement initiatives have been carried out in Sweden and the Swedish experience by far exceeds the aggregated experience of the rest of the Nordic countries. The following findings form the point of departure for the recommendations for increased use of technology procurement in Sweden:

- Over the years many efforts have been made to increase the use of technology procurement in order to promote a competitive Swedish Industry, to lower the costs of public procurement, to reduce energy consumption, and lately to support environmental innovations.
- Institutions dedicated to technology procurement have provided the necessary knowledge to conduct the procurement processes.
- As technology procurement is mentioned in several Swedish acts as a means to achieve environmental improvements, the legislative basis for technology procurement is in place.
- The Public Procurement Act (LOU) came into force in 1994. There are several examples from the Energy Agency and the LIP-office demonstrating that technology procurement may be conducted under the LOU.

The following recommendations emanate from the model for anchoring of technology procurement:

- To improve conditions for technology procurement, leadership should be assumed by a central stakeholder with competence to support innovative procurement processes.

- The challenges concerning the financial and administrative situation for technology procurement projects should be dealt with.
- An information campaign is necessary to increase the knowledge of technology procurement.
- A few pilot procurement projects in selected target areas would be useful for compilation of experience, preparation of tools, development of competences and uncovering of new challenges and potentials. For example new methods may be developed regarding evaluation of the toxic content and environmental properties of specific products.

3. Swedish experience

A vast number of technology procurement initiatives have been carried out in Sweden, and Sweden stands out from the other Nordic countries by having (had) both institutions and regulation with specific focus on technology procurement. It is estimated that more than 100 technology procurement projects and processes have taken place in Sweden.

The use of technology procurement in Sweden took place in the energy sector in Sweden after 1990. The Department of Energy at the Swedish National Energy Administration, which later became NUTEK, developed and used technology procurement to create a large market for the new products. At its peak, around 35 people were working with technology procurement. The Swedish Energy Agency has carried out more than 55 technology procurement projects between 1990 and 2005 of which around 40 have led to innovative actions (refer to annex xx).

The office for the Local Investment Programme, LIP, has been another driver behind the use of technology procurement. LIP has embraced more than 20 projects with technology procurement procedures. Also the County Councils' Fund to Technology Procurement and Product Development, LFTP, the Swedish Delegation for Sustainable Technology and several other institutions have played an important role for placing technology procurement as an important tool in the Swedish striving towards more environmentally sound and – especially – energy-saving commodities.

The below table summarises some of the results and outcomes from the Swedish projects.

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 0.8	By 70 %
Ventilation. Replacement of fans in residential area	From 750 kWh/apartment and year to 380	By 50 %
High-frequency ballasts for lighting	Price reduction by half Accelerating market	By 20 %
Windows	From 5,900 MWh/year to 3,300 MWh in one project in Västerås	By 44 %
Heat pumps	Two different suppliers were chosen for further development and deliveries	By 30 %

As illustrated technology procurement is a well established tool for green innovation in Sweden. In a memorandum from 2004³, The Swedish Environmental Advisory Council proposed that the Government should adopt a strategy for Energy-Efficient Buildings including use of technology procurement as a tool for stimulating the forefront. In a very recent study of public procurement as a driver of innovation, NUTEK recommends a national policy for public procurement, further development in five areas to certify that the policy guidelines are not in conflict with national regulations or other policy ambitions, and strengthening of the national support structure for public procurement.

3.1 Examples of technology procurement

Two of the many Swedish examples of technology procurement are described below.

3.1.1 Super isolated windows

A large part of building heat is lost through the windows. In 1991–1992 the Department of Energy Efficiency at NUTEK carried through a technology procurement to get energy-efficient windows on the market. The purchaser group consisted of property owners, property administrators and specialists. The Specification of Requirements contained demands on thermal transmittance, performance, durability and optical characteristics.

The development process started in May 1991 where 16 selected window manufacturers received an invitation with the specifications from the purchaser group. Also other window manufacturers had the possibility to take part, and of the 16 tenders received eight were from the selected manufacturers. Nine windows were selected for further testing, after which two winners were appointed and received price money and grants for further development to be documented by researchers.

The windows reduce the cold draught of air providing greater flexibility during construction as radiators are no longer needed. Disadvantages of the windows were the windows' weight, the price and the slightly lower light permeability.

A framework agreement was signed committing property owners to work actively towards energy efficiency, hereby engaging a conservative line of business to contribute to development of a super isolated window. The procurement was less successful due to misjudgement of the market and unexpected changing external conditions.

³ A Strategy for Energy-Efficient Buildings, Swedish Environmental Advisory Council, Memorandum 2004:2

3.1.2 Heat pumps

The first Swedish technology procurement process targeting small houses focused at heat pumps. A pre-study concluded that technology development in the heat pump business was weak and that there was a need to replace oil and direct acting electricity heating with heat pumps. The purchaser group consisted of property owners, energy suppliers, energy service companies, Norwegian Water Resource and Energy administration (NVE), NUTEK and the Swedish Testing and Research Institute. The national Swedish Board and Motiva in Finland were passive members.

An international tender resulted in 23 offers of which ten were granted 50,000 SEK and further evaluated by Vattenfall and Swedish Testing and Research Institute. The two winners, each receiving 300,000 SEK, met the targets of 30% less energy consumption, 30% cheaper and no halogens in the cooling media. The first hundred buyers received a discount of 3,000 SEK. Two dedicated NUTEK technicians promoted the new product through an information campaign, seminars, a brochure, articles and energy/house exhibitions, causing a huge increase in heating pump sales figures.

3.2 Stakeholders involved in technology procurement

Technology procurement in Sweden has involved several actors, including process initiators, purchasers and manufacturers of the new product.

3.2.1 Authorities at national level

- *The Swedish National Board for Technical Development, STU*, initiated, supported and promoted several technology procurement processes until it ended its work in 1991. The board also issued publications disseminating knowledge on technology procurement and facilitating use of the methodology.
- *The Swedish National Board for Technical and Industrial Development, NUTEK*. NUTEK's Department of Energy Efficiency was 1988–1998 assigned by the Swedish Parliament to lead a technology procurement programme on more effective energy usage. Ten employees and twenty-five consultants worked with technology procurement during the early nineties.
- *The County Councils' Fund to Technology Procurement and Product Development, LFTP*, was formed in 1982 by the County Council union and STU. LFTP supported development of ideas, technology procurement and product development aiming at the county councils until 1999 when the institution was closed.
- *The Swedish Energy Agency*, formed in 1998, took over the responsibility for technology procurement from NUTEK. The new

program has been less extensive in terms of both finances and personnel, and the results less impressive. Today three employees are working with technology procurements.

- *Swedish Council for Building Research, now FORMAS*. The Swedish Council for Building Research has published reports to promote technology procurements and has partly funded a technology procurement process solar heating.
- *The Swedish Delegation for Sustainable Technology* was appointed by the Government in 1996 to stimulate development and introduction of environmental adapted products, processes and technique. They have used requirement specification, list of criteria, demonstrations, competitions and technology procurements.
- *Vinnova, Swedish Governmental Agency for Innovation Systems* is a State authority that aims to promote growth and prosperity throughout Sweden. Their particular area of responsibility comprises innovations linked to research and development. Their tasks are to fund the demand driven research required by a competitive business and industrial sector and to strengthen the networks that are a necessary part of this work.
- *The National Board of Housing, Building and Planning, Boverket*, is the central government authority for planning, the management of land and water resources, urban development, building and housing under the Ministry of the Environment. Boverket monitors the function of the legislative system under the Planning and Building Act and related legislation and proposes regulatory changes if necessary. To ensure effective implementation Boverket also provides information to those engaged in planning, housing, construction and building inspection activities. The Energy Agency co-operated with Boverket to achieve synergy effects.
- *The Swedish Consumers Agency, Konsumentverket*, is a state agency with the task to help the general public in Sweden with consumer affairs. Konsumentverket has contributed with advice and experience with production of requirement specifications. They have been members, mainly supportive members in the purchasers group at the Energy Agency.
- *The National Board for Public Procurement (NOU)* was a public authority organised under the Ministry of Finance. They supervised compliance with the Public procurement Act (LOU) and supported the Government Offices. NOU closed in the fall of 2007.

3.2.2 Municipalities and counties

The municipalities have been involved in many technology procurement projects with the city of Stockholm as is one good example. Within the

Local Investment programmes, LIP, they performed approximate 20 technology procurements.

During the eighties several county councils conducted technology procurement processes. One co-ordination project was Prosam run by four county councils. Despite later collaboration activities, technology procurement has not been used.

3.2.3 Procurement organisations and others

- *The Swedish Association of Public Purchasers*, SOI, is a non-profit association of some 1000 public purchasers and public procurement officers. SOI is promoting the development of professional procurement in the public sector
- The unit for *Co-ordination of Government Procurement* was established in 1998 to increase efficiency in public spending and thus achieve more value for money by a central unit.
- OPIC provide services to suppliers, public procurers and private buyers. They conduct procurement monitoring and are market leaders in terms of public procurement training for the private sector.
- *The Swedish Administrative Development Agency*, Verva, is coordinating the development of central government in Sweden and is one of the Government's central advisory agencies. Verva promotes and supports the development of public administration, including procurement within the IT sector.
- *Kommentus* is owned by the municipalities and make procurements according to The Public Procurement act⁴ as consultants.
- *BASTA* ("Phasing out very dangerous substances from the construction industry") has been established by the four largest construction companies in Sweden, NCC, JM, Peab and Skanska, together with their trade organisation, the Swedish Construction Federation.
- *The Ecocycle Council* was formed in 1994 and is a network with representatives from construction and real estate sector. The council is divided into four groups; Builders and property owners, architect companies and technical consultants companies, construction industry and construction material industry. The purpose is to co-ordinate environmental interest and act as a contacting member to the Ministry of Environment, the National Board of Housing, Building and Planning, the Swedish Environmental Agency.

⁴ The Public Procurement Act, LOU, 1992:1528 came into force in 1994

3.3 Findings, Sweden

A vast number of technology procurement initiatives have been carried out in Sweden and the Swedish experience by far exceeds the aggregated experience of the rest of the Nordic countries.

- Over the years many efforts have been made to increase the use of technology procurement as method in order to promote a competitive Swedish Industry, to lower the costs of public procurement, to reduce energy consumption and lately to support environmental innovations.
- Institutions dedicated to technology procurement have provided the necessary knowledge to conduct the procurement processes.
- As technology procurement is mentioned in several Swedish acts as a means to achieve environmental improvements, the legislative basis for technology procurement is in place.
- The Public Procurement Act (LOU) came into force in 1994. There are several examples from the Energy Agency and the LIP-office demonstrating that technology procurement may be conducted under the LOU.

4. Norwegian experience

Only one relevant case of technology procurement project has been identified in Norway, the relatively recent procurement of gas driven ferries (described below). However, the Norwegian grant system for Public/Industrial Research and Development Contracts (OFU/IFU – Ofentlige/Industrielle Forsknings- og Utviklingskontrakter) has in a similar way stimulated innovation within the context of procurement, but without being part of an open procurement process.

A contributory reason for the lack of suitable cases can be the structure of Norwegian industry with a strong focus on primary sectors (energy, metals and foodstuffs) and relatively limited production of manufactured goods, primarily manufactured by relatively small enterprises with limited development resources.

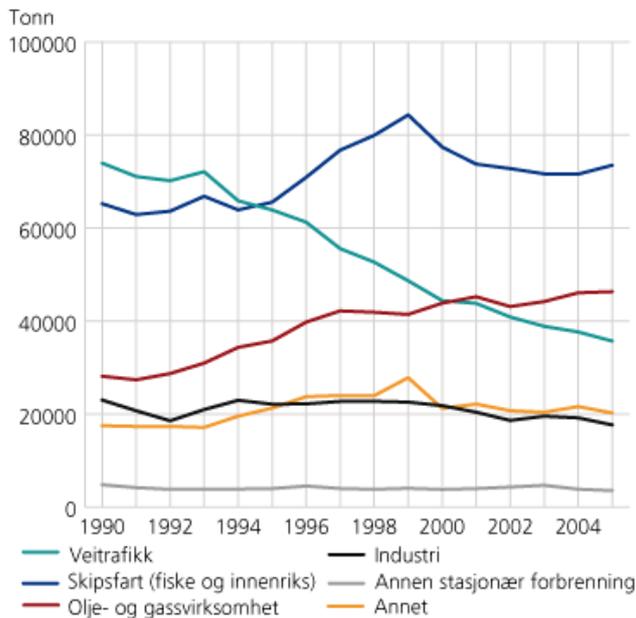
The main organisations relevant to technology should be the Ministry of Government Administration and Reform and its underlying, as yet to be formed, directorate, which will have overall responsibility for Public Procurement policies, including the environmental aspects, together with the Ministry of the Environment. The Panel for Environmentally Conscious Procurement represents procurers and suppliers and has an important advisory role. Innovation Norway, a public body under the Ministry of Trade and Industry, is the central organ for promoting innovation and has a network, funding and competence that should be very relevant in following up technology procurement.

The main relevant strategies/policies are 1) the action plan for Environmental and Social Responsibility in Public Procurement (published June 2007) and 2) the coming White Paper on Innovation.

4.1 Specific experience with technology procurement

4.1.1 Gas driven ferries

The vast number of Norwegian ferry services is run by private companies providing a service that is purchased by the Norwegian Public Roads Administration (NPRA) on an open competitive basis for a specified time period (usually ten years). The ferries are owned by the operating company, in this case Fjord1. The ferry services contribute significantly to the considerable emission of NO_x from Norwegian shipping.

Utslipp av NO_x, 1990-2005*. Tonn

Kilde: Utslippsregnskapet til Statistisk sentralbyrå og Statens forurensningstilsyn.

The dark blue line represents emissions from national shipping incl. fishing.

A small ferry fuelled by liquefied natural gas, LNG, was put into operation in 2002 and demonstrated an 80% reduction in NO_x and 15–25% less CO₂ compared to conventional diesel. Acknowledging the benefits of this engine, the challenge was to develop and introduce the necessary technology and supply chains for running full-sized ferries.

The two ferry companies (that later merged to become Fjord1) took the initiative to the technology development process by sending a letter in 2002 to the Norwegian Public Roads Authority (NPRA) indicating that interest for manufacturing LNG fuelled ferries. In April 2004, the NPRA issued a request for tender for ferry services based on LNG fuel (single fuel). This was a competitive procurement open for negotiation.

Fjord1 won the contract and ordered five ferries worth about 150 million euro from Aker Yards.

At this point of time, the safety issue was particularly challenging as the regulations necessary to allow mounting of the engines below the car deck only existed in draft form. Negotiation took place on the basis that NPRA took responsibility for changes that would have to be made if the final regulations differed significantly from the draft.

Rolls Royce in Bergen were willing to cover the development costs for the new marine engines in view of the volume of the contract (16 engines). A third supplier, Gasnor, was willing to take the responsibility for the supply of LNG, as the ferry contract implied a mainstreaming of business that allowed for significant expansion – especially on the production side.

The ferries were delivered in 2006 and 2007 and all actors seem very satisfied with the solution. A new contract has been signed with Fjord1 for operation of three new ferries for the period 2010–2019 further North on the Western Coast.

Introduction of this technology has required the development and market introduction of:

- new products (marine LNG engines)
- new design methodology for passenger ships (safety considerations)
- new production and distribution facilities for LNG.

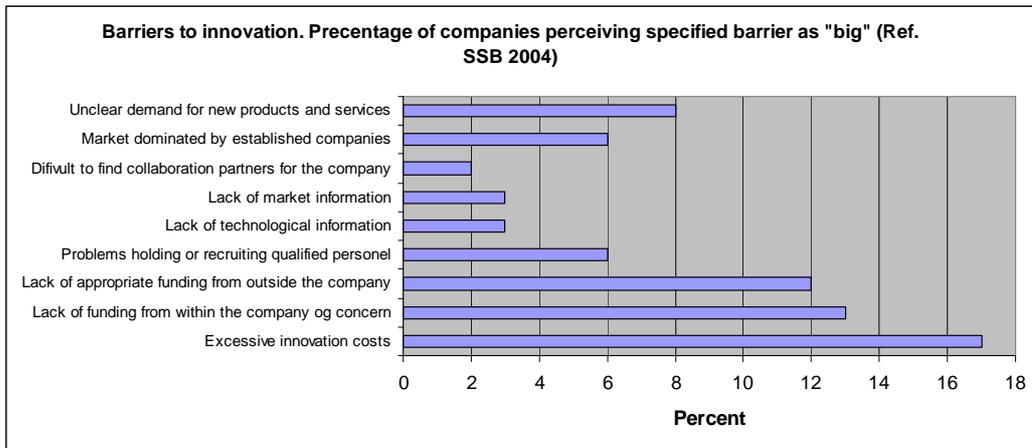
Other actors are now taking the technology into use. The results have been achieved without direct public subsidies, although it is unclear whether the price that the NPRA has to pay for LNG-fuelled ferry services is higher than diesel or not.

4.1.2 OFU – Public Research and Development Contracts

The Public Research and Development Contracts can be seen as an equivalent to technology procurement. The OFU system gives grants to the development of new products when this occurs in collaboration between a public procurer and a supplier. The total budget for IFU/OFU grants is about 220 MNOK/year, but only about 10% of this was public procurement-oriented (as opposed to business to business) in 2005, a percentage that has been decreasing gradually from about 80% ten years earlier. ECON points out that this change in percentages reflects the change in the relative number of applications from the public vs. private sectors. This is partly attributed to the emphasis that is being placed on ensuring that public procurement follows the procurement regulations, combined with uncertainty as to the status of the OFU rules with respect to the procurement regulations and the resulting risk-avoidance by public sector procurement officers. It seems to be clear the uncertainty felt by procurement officers needs to be addressed when technology procurement projects are initiated (e.g. through training, support, economic guarantees).

The OFU instrument generally aims at increasing value creation in Norway, while subsidiary goals include promoting internationalisation and development of specific business sectors. An evaluation report recommends that OFU should be more focussed on one goal: Innovation.

Statistics Norway (Statistisk Sentralbyrå – SSB) investigated in 2004 the perceived barriers to innovation seen by Norwegian companies:



SSB: Barriers to innovation 2004.

It is interesting to note that the barrier that is most closely addressed by technology procurement (guaranteeing a certain market) is perceived as major hindrance by only 8% of respondents, although one should also see that the barrier “excessive innovation costs” and “lack of funding ...” would also be addressed by technology procurement by a) reducing the need for capital and b) reducing the risk related to investment.

Whilst the objectives for OFU overlap those for technology procurement in general terms, the systems differ:

	Technology procurement	OFU
Regulatory framework	Public procurement	Grant system/Subsidies
Financed by	Supplier (based on guaranteed volumes)	Ministry of Trade and Industry via Innovation Norway
Financing in the form of	Profit margin on expected sales	Direct subsidy of innovation costs
Competitive?	Yes	No
Involvement of buyer in development process	Low – the buyer specifies the requirements only	High – tight dialogue and exchange of knowledge during the development process
Clarity of specifications	High – must be adequate for a public procurement process	Low – enough to satisfy the needs of a grant application. Detailed specifications can be developed during the project.

4.2 Stakeholders involved in technology procurement

New technology often poses challenges related to regulations and standards, as the case above demonstrated. The authorities concerned will differ from product to product.

The ministry responsible for the procurement law in Norway is the Ministry of Modernisation, established in October 1st, 2004. As of today,

responsibility for general policy for public procurement in Norway has been with the *Ministry of Government Administration and Reform*.

The Policy for Green Public Procurement has, until now, been formulated by the Ministry of the Environment. The ministry established in 2005 the consultative *Panel on Environmental Aspects of Public Procurement* to recommend measures to stimulate green public procurement. The panel has issued a number of concrete recommendations ranging from the development of product specific environmental criteria that can be used during the procurement process (selection of suppliers, mandatory product requirements and award criteria) to improving the availability of training and support for procurement officers.

The Ministries of the Environment and of Government Administration and Reform, together with the Ministry of Children and Equality, published in June 2007 an Action Plan for Environmental and Social Responsibility in Public Procurement 2007–2010⁵ that includes many of the Panel's recommendations and also includes a chapter on innovative aspects.

A new Directorate under the Ministry of Government Administration and Reform will start up in January 2008 and will have, amongst others, the responsibility for coordinating public procurement policies, including the Environmental aspects, although work in this area it will be financed by, and reported back to, the Ministry of the Environment.

Innovation policies lie under the *Ministry of Trade and Industry* and are made operational by Innovation Norway, which is the state owned company responsible for promoting nationwide industrial development profitable to both the business economy and Norway's national economy. Innovation Norway operates the OFU/IFU (Public and Private R&D) mechanisms, employs more than 700 people and has offices in all the Norwegian counties and in more than 30 countries world wide. A White Paper on Innovation is under preparation.

Concrete procurement coordination is carried out by several sub-national and reportedly 19 inter-municipal collaborations, which could form the basis for user groups for concrete technological procurement projects:

- *The Norwegian Association of Local and Regional Authorities* established in 1996 the Municipal Procurement Forum, KSI. Among other things, this organisation has been responsible for education in public procurement for its members.
- *Helseforetakenes Innkjøpsservice AS*, HINAS, is a centralised procurement service for the hospitals in Norway that are owned by the Regional Health Authorities – semi-autonomous state financed foundations.

⁵ http://www.regjeringen.no/Upload/MD/Vedlegg/Planer/T-1467_eng.pdf

- The City of Oslo is gradually coordinating and centralising its procurement activities, strengthening the central procurement staff and establishing mandatory framework agreements.
- The intercommunal procurement system *Nedre Romerike*, IINR, is a commitment of municipalities to coordinate their procurement.
- *Tradinghouse* is a broker of goods and services offering companies procurement contracts with renowned suppliers of non-strategic goods and services (office supplies, ICT-products, office equipment, transport, etc).
- *Atento* offers shared electronic services for procurement for more than 550 public procurers, mainly at the IT-tool level (invoicing, contract administration)

4.2.1 Public and private professional procurement officers

Little is known about public procurement officers at present. The Ministry of Government Administration and Reform is having an analysis made by Research Partner, and the results are expected to be presented in June 2007.

It is generally accepted that procurement officers vary widely in the role that they play in procurement, their status, formal education and experience. The City of Oslo has established an internal ten day long qualifying scheme for procurement officers.

4.3 Findings, Norway

- No vision or dedicated institution for technology procurement, but.
 - Increasing focus on environmental/social public procurement (national action plan published in June)
 - Relevant policy institution under establishment (new directorate)
 - Potentially relevant funding agency exists (Innovation Norway)
- Innovation White Paper under preparation is an opportunity for making the connection with technology procurement
- Norwegian Industry focuses mainly on the primary sectors and produces relatively few manufactured goods. The major industrial sectors lie in areas that are related to petroleum, maritime, fishing, agriculture and forestry, with some ICT-related areas like eCollaboration and furniture as secondary areas.

5. Danish experience

Technology procurement has only been utilised in a very limited number of pilot projects in Denmark and no authority or organisation has worked to more firmly introduce the methodology as a tool for green innovation.

In the early 1990s technology procurement was discussed in a Danish context as a tool for achieving energy-savings. Even a Danish term for technology procurement was invented namely “køberpolitik” (policy procurement). One pilot project was initiated by the Danish Energy Agency, but no further projects were conducted. From then on, the activities of the Electricity Saving Trust are about the only examples of technology procurements available in Denmark.

5.1 Danish experience with technology procurement

5.1.1 Case study on Technology procurement

In 1995 a case study on technology procurement was carried out in the Danish housing sector, financed by the Danish Energy Agency and with the purpose to investigate whether energy-savings could be accomplished through technology procurement. Representatives of governing boards of the involved housing associations formulated the requirements to an energy-efficient oven to be manufactured by VOSS/Atlas.

VOSS/Atlas received a product development grant of DKK 400,000 from the Danish Energy Agency. The technical solution turned out to be so successful that the concept was used in all new ovens produced by VOSS/Atlas. The total energy-savings was assessed to be 750 MWh per year. As ovens are quite expensive, the project showed no economic argument for replacing an oven before due time with a view only to obtain energy-savings. If, however, the energy-efficient oven is purchased as part of a general oven replacement, the energy-savings and CO₂ reduction are obtained ‘free of charge’ so to speak.

The project concluded that from a technical and organisational point of view the housing sector provides a good platform for technology procurement, not least as the project team observed a widespread positive attitude among the tenants towards energy and environment improvements. The project recommended that The Danish Energy Authority introduced technology procurement methodology as a widely used concept. It is also recommended that The Danish Energy Authority points out re-

levant sectors in which future technology procurements could be a relevant means. Apparently these recommendations have not been followed.

Elspareskinnen (The Electricity Saving Trust)

In 2003 an employee at the Electricity Saving Trust originated the idea for a socket/extension lead that can be turned on and off by a pc, hereby switching all the energy consuming equipment for the pc (e.g. speakers, printer, scanner etc.) on and off when the pc is shut down.

The Danish Technological Institute prepared the technical specifications for the product based on a Dutch model not approved for the Danish market for safety reasons, and the specifications were made accessible to the potential producers. Furthermore, the Electricity Saving Trust announced that they would buy a minimum of 5,000 units (for promotion purposes) and that the logo of the Electricity Saving Trust was to be printed on the packaging.

Two manufacturers (Nissen-Gruppen Aps and EWAY) put the socket/extension lead into production, and the demand for the product has exceeded the expectations. An evaluation of the project concluded that a market for the new product has been created at a very low cost. The process is perceived as a win-win situation by all parties involved.

5.1.2 Design competition "Fixtures for private homes"

In 2004 The Danish Illuminating Engineering Society carried out a design contest for development of energy and environmental correct fixtures for the private consumer market, encouraging consumers to demand environmentally correct and energy-saving fixtures and at the same time enhancing the lighting sector's focus on energy-saving and environmentally correct fixtures.

The contest was carried out in cooperation with three major Danish producers, who agreed on certain conditions to put two or three of the submitted designs into production and market these in a joint campaign targeting the private consumers. The contest as well as the possible product development and the campaign were financed by the Danish Environmental Protection Agency's Cleaner Product Programme and the participating lamp producers.

The potential energy-savings from replacing incandescent and halogen lamps with CFLs was estimated to 1076–2151 MWh/year.

The contest received 88 entries and three were awarded with a prize, but no fixtures reached the manufacturing stage as the manufacturers assessed that none of them possessed the necessary qualities to commence product development. Furthermore, the fixtures did not match the company style and that the potential did not align with the companies' other product ideas. A group of designers were offered the possibility to find other manufacturers, but they did not succeed.

From a technology procurement point of view the fact that a buyer group was missing might explain the lack of interest from the producers.

5.1.3 Urban light in the municipality of Albertslund

The municipality of Albertslund is well known in Denmark for its green profile. In 2006 the municipality launched a project aimed at developing the use of LEDs for outdoor lighting. The project is divided in to two:

- The development of a fixture for urban (or park) lighting prepared for LED lamps. This makes the transition from traditional light sources to LED easier and less costly. This part of the project is also devoted to the development of a flexible energy-saving fixture that combines the LED and traditional light sources.
- The municipality has about 100 tunnels. The second part of the project is aimed at developing tunnel lighting using LEDs that are more efficient than the existing tunnel lighting. The problem of the existing tunnel lighting is the loss of efficiency due to need to secure the light fixtures against vandalism (e.g. heavy impact-proof plastic cover and iron grids).

5.1.4 Pivot light

The Danish Energy company DONG Energy delivers street light to Danish cities. For many years the company has requested a light fixture for street lighting that limited the loss of light to the surroundings, e.g. the gardens along the road in a residential district. In 2004 Philips' Danish branch contacted DONG Energy with a design for the fixture. The fixture was available on the market in 2006.

The Pivot fixture or "Eco-fixture" distributes the light asymmetric thereby concentrating the light to the road. This makes it more efficient than the traditional fixtures. Combined with intelligent light management systems it is possible to save 40% percent of the energy used for street lighting. Furthermore the fixture can be easily disassembled and all parts can be recycled.

One year after market introduction the sale of the Pivot fixtures topped the 1,000 mark. An illustration of the market potential is that roughly 70,000 old fixtures will be replaced in Denmark during the next years.

5.2 Stakeholders involved in technology procurement

Very few institutions have been directly involved in technology procurement. The following list includes some of the most relevant institutions for future technology procurement efforts.

- The *Danish Ministry of the Environment* has since the 1990's required all public procurement officers to take account of environmental and energy considerations when performing their jobs. In May 2007 the Ministry launched a proposal for the Danish government's plan for promoting environmental technologies, focusing on strengthening innovation and a closer cooperation between the government and companies in selected sectors.
- The *Danish Environmental Protection Agency* has limited experience with technology procurement (see example "Fixtures for private homes" above).
- In 2003 DEPA established the *Panel for Professional Green Procurement* with the aim to promote green procurement in both the public and private sector. Panel members count both private and public purchasers and the DEPA.
- The *Danish Energy Authority* financed the technology procurement case study on ovens mentioned above. DEA tried without success in the period 1994–1999 to attract interest among Danish purchasers to a technology procurement project on vending machines.
- *The Electricity Saving Trust* was created by law in 1996 to encourage electricity conservation in housing and public institutions. The EST can contribute to the development, marketing, procurement and use of energy-saving devices and equipment with finances from a tax on electricity consumption (0.006 DKK/kWh giving a budget of 90 million DKK per year).
The EST strategy is based on the push-pull theory. The trust carries out activities to increase the demand (the pull effect) for energy sound products and also supports manufacturers and suppliers in lowering the prices and expanding the supply of energy sound products like the "elspareskinne" described above (the push effect). Four other products have been or are being innovated through a similar process
- *National Procurement Ltd. – Denmark* SKI was established with the goal to secure public sector savings and benefits through better prices, safer purchases, more efficient working processes and coordination of public procurement initiatives. SKI draws up annual procurement framework agreements of almost DKK 4 billion to be used by government and municipalities. SKI is very much involved in green procurement and emphasise environment and energy parameters in their framework agreements, based on recommendations from the Danish Environmental Protection Agency, the Occupational Health and Safety Service and the Energy Agency. However Technology procurement is not at part of the current strategy.
- *Danish Industries* organises more than 7,000 companies. DI has no knowledge of members who have been involved in a technology procurement project. They believe that well prepared purchasers who

are well aware of their own needs and requirements is a positive aspect of a procurement process.

- *Danish Technological Institute* occupies a crucial position at the point where research, business, and the community converge. DTI's mission is to promote growth by improving interaction and encourage synergy between these three areas. The institute is working together with The Electricity Saving Trust on developing energy wise products.

5.3 Findings, Denmark

- The 1995 case study (ovens) is the only genuine case of technology procurement in Denmark. Good results were achieved and the study showed potential in the housing sector for further technology procurement projects.
- The Danish government's action plan for promoting environmental technologies demonstrate a strong believe in Danish Environmental technology and the potential for innovation.
- The well organised central effort for green procurement opens a potential for cooperative technology procurement between different institutions. SKI has extensive expertise in public (and green) procurement and a strong network among public purchasers and the suppliers – but no incitement for using technology procurement since their aim is to secure public sector savings and benefits and not (green) innovation.
- The Electricity Saving Trust has a close collaboration with specific producers and innovators and can develop to become an important promoter of technology procurement.
- There is no deep experience and knowledge of technology procurement among key actors as The Danish EPA and the SKI.

6. Finnish experience

Technology procurement has in Finland mainly been used as a means for reducing the use of energy and mainly in connection with large EU programmes.

The main driver for technology procurement in Finland is the government owned Motiva. They have initiated and run all technology procurements in Finland. Motiva is part of a government working group who is presently discussing the potential benefits of using technology procurement.

During the inventory eight technology procurement projects have been identified, of which half have been a part of larger international programmes. Most of the projects were carried out in the late 1990's, and "Energy+ -Pumps" is the only active project. There is currently no development of new projects.

National projects:

1. Innovative thermometer
2. Pump auditing
3. Energy-efficient windows
4. Cold appliances in shops

International projects:

1. IEA Hi-Motors (International Energy Agency)
2. Cold appliances – Energy +
3. IEA Copier of the Future
4. Pumps – Energy +

6.1 Specific experience with technology procurement

6.1.1 Energy-efficient windows

Motiva's competition on energy-efficient windows in 1994–96 can be seen as a follow up to the Swedish commercialisation of super isolated windows. The target group was house-building contractors who could win a manufacturing contract of 15,000–20,000 m² window. Out of 28 bids 14 window models were selected for testing.

The technical specifications urged for a U-value of 1.3 W/m²K which was somewhat higher than the best available technology (0.9–1.0). Evaluations and interviews indicate that having this relatively modest level of ambition was well justified as it gave manufacturers a proper option for avoiding major technical problems at that time.

Two winners were nominated in each class. The price on the windows ended up being 20–25% higher than on normal 3-glass windows. The committed buyer group installed more than 10,000 windows following the competition. The assessed amount of energy saved directly due to the competition was around 4 GWh. The long-term objective was yearly to save approximately 1,5 TWh.

The competition added to the development of windows in Finland and the energy-efficient windows market share was drastically increased after the competition.

6.2 Stakeholders involved in technology procurement

The main stakeholders involved in technology procurement in Finland are the following:

- *Motiva* is a government owned non-profit organisation that provides services to promote energy efficiency and use of renewable energy. The company has operated as a state-owned limited company from the year 2000, and its services are utilised by public administration, businesses, communities and consumers. Motiva is the main carrier of practical knowledge regarding environment oriented technology procurement in Finland. Motiva has been the operating unit in the technology procurement projects identified, including one presently in progress (June 2007).
- *Hansel Ltd* is the central procurement unit of the State of Finland. The company clusters together the State's procurement volume and establishes through competitive tendering framework arrangements for procurement of products and services. Hansel's framework agreements can be utilised by the State's procurement units such as ministries and ministerial offices as well as State agencies and publicly-owned enterprises. Hansel is much involved in green public procurement and environmental issues have a high priority, but do not have experience or specific knowledge within the field of technology procurement.
- The *Ministry of Trade and Industry* is responsible for the follow-up of reforms and topical issues relating to public procurement. The Ministry is further responsible for the drawing up of national legislation on procurement and on monitoring the compliance with it. MTI has published recommendations on energy efficiency in public procurement, embracing energy costs during the life-cycle as well as environmental impacts that influence the total costs positively. MTI is the main financier of Motiva's activities including technology procurement projects.

- The *Ministry of Environment* and the *Ministry of Trade and Industry* started in 2007 a working group with municipalities, SYKE, Motiva, Efeko, HAUS, and selected companies and organisations dealing with greening of public procurement policies in Finland. A Green Procurement Action Plan (expected late 2007) will set objectives and criteria for the central groups of products and point out ways to promote environmental aspects in public procurement. The working group is presently discussing the potential benefits of using technology procurement as a means in the national action-plan but has not reached any conclusions at this stage.
- *Efeko Ltd* is a training organisation and management consultancy that has created an internet-based decision support system for environmentally friendly procurement in Finland (Efeko, 2007) in cooperation with 13 Finnish organizations, including the Ministry of the Environment and six municipalities.
- *The Finnish Environment Institute (SYKE)* is Finland's national centre for environmental research and development, and is also responsible for certain administrative tasks. SYKE compiles, processes and publicises a wide range of environmental data, while meeting Finland's reporting obligations related to EU environmental legislation and other international agreements. SYKE also looks after various aspects of the management and use of water resources in Finland.

6.3 Findings, Finland

- Eight technology procurement projects have been carried out. Half of the projects were in a national context and the others in international cooperation; two of them IEA (International Energy Agency) projects; the others EU-projects.
- Motiva's practical knowledge and experience create a good starting platform for new technology procurement projects.
- The potential of technology procurement is presently being discussed by a working group for a national Green Public Procurement-plan under the Ministry of Environment.
- Lack of knowledge on the methodology among important institutions. Some of the important stakeholders regarding public procurement didn't recall the term technology procurement or had any knowledge of the Finnish projects.
- Funding exists for classic technology development, but it is difficult to get funding for technology procurement.

7. Icelandic experience

During the inventory no examples of technology procurement in Iceland were identified. However, Iceland is a small society and the country has a tradition for networking across sectors and institutions through individual relations providing an informal culture for corporations. Thus, it is relatively easy to establish workshops, seminars and ensure communication to all relevant stakeholders. This has formed a basis for establishing technology forums.

7.1 Specific experience with technology procurement

Icelandic industry associations have taken lead in establishing structured innovative cooperation between public purchasers and suppliers. These activities have several similarities to technology procurement.

7.1.1 Technology forums

The Federation of Icelandic Industries (SI) has – together with the Ministry of Finance, Ministry of Industry and the State Trading Centre – established “Technology Forums” as a concept for cooperation on public procurement with focus on innovation and development. The European Union IPP framework is a base for the technology forums.

Technology forums concern cooperation between user and supplier. The Forum facilitates development of an objective and a joint strategy during intensive seminars. The projects are financed on a commercial base, depending on the particular interest.

The participation in technology forums is not static. In the early phases determining the overall vision and opportunities, top level decision makers take part in the work. In later phases with detailing the contents specialists and more companies are involved.

The methodology is especially appropriate when up to 40–50 persons participate in the seminars. SI is working on development of a web-application as a solution to long distance companies.

One of the benefits from the technology forums is that the consensus process prepares the market for the tender. By communicating procurement budgets and future needs, the market can prepare it self for upcoming need and tenders. Otherwise, if the manufacturers are not ready when a tender is issued it is often too late for the market to respond properly.

The technology forum concept is theoretically based on Michel Porters Diamond model.

SI has been running a technology forum project within the healthcare sector. The project was granted by Nordic Innovation Centre and ended in 2005. The project report emphasised the need for further development of the concept on Nordic level.

A strategy on technology forums has been developed in May 2007 involving all relevant public procurement and industry stakeholders. Specific areas for further development have been identified:

- Improved transport and logistic in Iceland.
- Improved (geo-)thermal energy supply.
- Improved healthcare sector, focusing on improved life quality and more effective solutions.

SI is project manager for the actual technology forum project.

7.2 Stakeholders involved in technology procurement

In the following the central Icelandic institutions and other stakeholders are described briefly in accordance to their experiences with activities with similarities to technology procurement.

- *SI – The Federation of Icelandic Industries* – with its 1,160 members, both companies and employer organisations, is the largest and most influential employer organisation in the country. SI has initiated the technology forums and is the project leader.
- *The State Trading Centre (Ríkiskaup)* operates under the auspices of the Ministry of Finance. The role of the State Trading Centre is to handle procurement on supplies and services in domestic and foreign markets for state institutions and state corporations. The centre examines joint needs for supplies and services, collects information about the procurement needs of the state institutions and state corporations, and coordinate procurement through framework agreements. The Centre participates in a working group on green public procurement and development of a National Action Plan for green procurement and also takes part in the technology forums.
- The State Trading Centre has no experiences with technology procurement as such but has a certain continuous dialogue with the market. The Centre has a procurement strategy that must be followed by all public institutions, including considerations on environmental issues in public procurement.
- *The Ministry of Environment* has no explicit experiences with technology procurement or tradition for involvement in “green”

innovative procurement processes. The MoE has established a workgroup together with Ministry of Finance, the State Trading Centre and two large municipalities concerning development of a National Action Plan on Green Procurement. The NAP will contain environmental criteria for products and approaches for green public procurement. At a later stage it is planned to have dialogue with the market in order for the suppliers to prepare themselves on the initiatives for green public procurement. No legislative initiatives are considered.

7.3 Findings, Iceland

Iceland has no experience with technology procurement, but some interesting initiatives have been taken. The workgroups for a NAP for green public procurement might be a useful platform for introducing a discussion on technology procurement.

A central experience for SI is that those technology forum projects which end up being successful are characterized by good cooperation between user and supplier. And opposite – those projects, where only one side (purchaser or supplier) is well represented, lead to poor results. This experience has led to that clear precondition, that both sides have to be well represented, when new corporations are established.

Technology procurement may be combined with the experiences from SI on technology forums. Thus technology forums could serve as an initial step prior to the tender process of a technology procurement.

Furthermore a dialogue with the market requires a high degree of transparency and trust among the stakeholders.

8. International experience

Technology procurement has been used internationally both in the European Union and in, e.g., French, German and US projects. Four international initiatives of particular interest to this project are described below:

- The Energy+ and the Energy+ Pumps Project
- The European Commission's expert group report "Public Procurement for Research and Innovation – Developing procurement practices favourable to R&D and innovation".
- The International Energy Agency DSM Implementing Agreement and its Annex III "Co-operative Procurement – Market Acceptance for Innovative Energy-Efficient Technologies"
- The U.S. Department of Energy's Emerging Technology Programme

8.1 Energy+

The Energy+ procurement project was conducted under the auspices of the SAVE Programme of the European Commission. The Energy+ steering group was composed of representatives from the European Commission and thirteen national agencies. The project ended in 2004.

The goal of Energy+ was to reinforce the emerging trend towards energy efficiency on the domestic cold appliances market. Addressing both the supply and the demand side, Energy+ created significant markets for existing products with good qualities and at the same time sped up the introduction of new technologies. Qualifying appliances were very scarce at the start of the project in year 2000, but four years later the Energy+ success was materialised by a list of almost 900 models from several manufacturing groups complying with the new Class A+ and A++ on the European Energy Label.

Domestic refrigerators' and freezers' electricity consumption in year 2000 accounted for some 62 million tonnes of carbon dioxide emissions, corresponding to about 2% of the European Union's total greenhouse gas emissions. The Energy+ achievements show that actions organised by governments can be effectively combined with individual and corporate environment-friendly awareness to contribute to the reduction of carbon dioxide emissions thanks to energy-savings.

Energy+ in brief

- Manufacturers were free to choose technical solutions to meet the improvements demanded by purchasers
- The A+ and A++ appliances are from +25% up to 64% more efficient than basic Class A models
- Maximum energy consumption 280 kWh/year
- Almost 900 different models in 8 cold appliance categories at European level
- 21 manufacturers, 49 brands and 49 retail groups
- +15,500 retail outlets in the Energy+ retailers network
- +1 million dwellings in Europe managed by 17 Energy+ institutional buyers
- 46 supporters Europe-wide
- Energy+ showed that a sufficient demand-pull to influence such markets can be created by a voluntary common approach from purchasers throughout the European Union.
- Information about the project was provided at the Energy+ website, including product descriptions and lists of participants, and through Energy+ Bulletins and mailings to the professionals and institutions, various meetings, workshops and conferences throughout Europe.
- The highly recognised Energy+ general design and logo are used through various promotion tools available to manufacturers and buyers to support them self-advertising their participation.

8.2 Energy+ pumps

In the EU-27, the more than 100 million circulators for heating purposes in households consume more 50 TWh of electricity per year, 5–10 % of the private household's electricity bill. If new pumps with electronically commutated (EC) motor pumps are used, a reduction by 60 % or more can be achieved, more than 30 TWh/year.

The short-term objective of this ongoing project is been to bring more products to the market, to support their rapid break-through and thereby to reduce their prices through mass production. The goal will be achieved through the methods of technology procurement that have been successfully tested in the European Energy+ project for energy-efficient refrigerators and freezers. The methodology is as follows:

- Particularly large institutional buyers will be invited to sign the *procurement declaration* to express their serious intention to invest in energy-saving and ecological technology of Energy+ products.
- National, regional and local energy agencies, environmental and consumer NGO, energy companies, and other organizations interested

in the subject are asked to sign the *supporter declaration* for dissemination of information and campaigning activities.

- Energy+ invites *manufacturers* of circulators or condensing boilers to induce the development or integration of high-efficiency circulation pumps, to list these products and to present them for the Energy+ Award.
- Energy+ grants three different *awards*: first, for the best energy-efficient circulator, second, for the best energy-saving condensing boiler, and third, for the best supporting campaign.
- *Dissemination* will be achieved through presenting the project at the ISH fair in Frankfurt, by information folders and posters about the project, listing of the product, partners and supporters on the Energy+ pumps website (www.energypluspumps.eu).
- Finally, *installation contractors* will be involved receiving easy-to-us materials about the new technology and being trained how to sell the high-efficient pumps based on life-cycle costs.

8.3 Public Procurement for R & I

In 2005 the European Commission published an expert group report named “Public Procurement for Research and Innovation – Developing procurement practices favourable to R&D and innovation”. The expert group explored options for good practice and policy in ‘procurement for innovation’ – that is the purchase of goods and services that do not yet exist, or need to be improved and hence require research and innovation to meet the specified user needs. The work of the expert group aimed at helping policy-makers understand the potential benefits and at helping procurement professionals to change their practices so as to achieve those benefits.

The expert group stated that

“a major opportunity exists for European governments to advance the Lisbon agenda for competitiveness and at the same time to engage with the pressing need for improved public services and productivity. However, achieving these goals through procurement for innovation requires changes in the mindset and in the detail of practice in the procurement process.”

The expert group formulated 25 recommendations for achieving these goals, of which the following recommendations are of particular interest for this project:

Recommendation 5: Member States should conduct a review of current procurement practice against the best practice described in this report (European Commission, 2005) and develop appropriate action plans to improve practice.

Recommendation 9: Member States should consider the bundling or unbundling of procurement projects with innovation considerations in mind.

Procurement for innovation can take place at national, regional or supranational levels of government. Demand can be fragmented across or even within purchasing authorities. This fragmentation is a barrier for innovation (e.g. green innovation) because it is perceived by industry as a major weakness of European markets. The barrier may be overcome by coordination and 'bundling' of demand, i.e. by conducting cooperative procurement, thereby creating markets of a critical size intensifying the incentive for innovation. On the other hand, 'unbundling' may sometimes be necessary to create opportunities for innovative SMEs to obtain manageable contracts. Another aspect of managing the supplier base is the relative position of firms in the sector. Winning a contract can give a supplier a competitive advantage in terms of writing off an R&D investment at an early stage but this could lead to future exclusion of other innovative firms with different solutions.

Recommendation 14: All Member States should develop and implement proposals for training procurement personnel in the skills and knowledge needed for procurement for innovation.

Additional competences are needed when purchasing goods and services based on the newest innovative technology, which may not even be available elsewhere. Then technological knowledge is necessary to specify the needs, to complete the purchase, and to follow through and learn from the consequences of the purchase.

8.4 Co-operative procurement

The International Energy Agency, IEA, an autonomous agency under OECD, coordinates collaboration in research, development and demonstration of new environmental friendly energy technologies between its member countries. One example of such an Implementing Agreement is the 'The Demand-Side Management Programme' established in 1993 and terminated 1999 with eight countries (including Sweden, Finland and Denmark) and the European Commission as participants. A number of projects under this agreement have included technological development in the procurement projects, e.g., low power copier machines, 30% more efficient light bulbs with longer burning hours, energy-efficient TV sets, and energy-reduction opportunities for future vending machines (cold drinks and hot drinks).

The creation of buyer groups, the working out of performance specifications and the combination with different support activities have been stressed. It is especially important to include dominant, future-oriented buyers or users and, in many fragmented areas, to create a new network,

where trust will be built up between the participants. Efforts should be made to include as many stakeholders as possible in the process.

8.5 U.S. – Emerging Technology Program

The U.S. Energy Policy Act (1992) and Climate Change Action Plan contain a number of initiatives that have led to several technology procurement initiatives. A “Golden Carrot” programme was first used for the Super-Efficient Refrigerator Program, which initiated sales in 1994 with 30–35 per cent energy reduction.

The Energy Policy Act has also initiated the ongoing Emerging Technology Program (ETP). The purpose is to increase demand for, and to bring new highly efficient technologies to market for buyers, while assisting manufacturers, ESCOs⁶, and utilities. The program resides in the U.S. Department of Energy’s Building Technologies Program, under the Office of Energy Efficiency and Renewable Energy.

The focus of the ETP is on highly energy-efficient products for residential and commercial building applications that have the potential for large energy-savings on a national scale. The ETP has goals of achieving national energy-savings of at least 600 Trillion British Thermal Units⁷ (TBtu) per year and introducing 30 or more new technologies and products by 2015.

ETP uses several approaches to identify new technologies, evaluate their potential for significant energy-savings, and speed their market introduction and acceptance. These activities include technology procurement usually following these steps:

- Develop technical specifications for new products in cooperation with buyers and review them with potential manufacturers of the products.
- Issue competitive solicitations to potential suppliers that request bids for supplying new products meeting the specifications.
- Select one or more winning products from among these bids and enter into basic ordering agreements with winning suppliers that specify terms and prices under which target buyers can purchase new products.
- Promote the winning products to maximize purchases and help build self-sustaining markets.
- Facilitate the sale of new products at terms and prices specified in the ordering agreement. Suppliers sell directly to target buyers without DOE involvement.

⁶ Energy-saving service Company, A company that offers to reduce a client's utility costs, often with the cost savings being split with the client through an energy performance contract (EPC) or a shared-savings agreement.

⁷ 1 Btu ≈ 1060 joules

Apartment-Sized Super Efficient Refrigerator Project

Department of Energy (DOE) collaborated with the Consortium for Energy Efficiency and the New York Power Authority in a technology procurement initiative aimed at inducing manufacturers to develop and sell highly efficient, apartment-sized refrigerators to the multi-family housing sector. The project succeeded in having Maytag develop and sell a new-to-the-market unit that exceeded 4 DOE energy standards by 30% and cost about the same as standard efficiency units. The New York City Housing Authority purchased 20,000 and more than 100,000 units were sold during DOE's two-year involvement. The new refrigerators saved on average 543 kWh/unit/year while giving residents more cubic feet of storage space. The units are now well established in the market.



DOE and partners conducted a technology procurement to develop a new energy-efficient apartment-sized refrigerator.

Sub-CFL Technology procurement

After extensive market research and interaction with the multi-family housing industry and lighting manufacturers, Department of Energy launched a program aimed at speeding commercial introduction of smaller, affordable compact fluorescent lights (CFLs) that met a range of stringent performance requirements. The program succeeded in introducing 17 new sub-CFL models to the market. One of those models beat the program's aggressive price goal of \$5 per lamp. By the program's cessation in May 2001, over 3.3 million sub-CFLs had been sold, translating into over \$29 million per year in energy cost savings to consumers, and a wide range of non-program manufacturers had commercialized low-cost sub-CFLs as small as those in the program (See figure below).



Seventeen new models of sub compact fluorescent lights (sub CFLS) were brought to market as a result of DOE's Sub CFL Technology procurement.

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Annex 2: Practical Lessons Learned

The following practical lessons learned may provide useful inspiration for institutions aiming at introducing technology procurement.

- International network groups of public purchasers on procurement for innovation should be established in order to strengthen the knowledge about technology procurement. The networks should address e.g. best practice and training of purchasers.
- The evaluation of the U.S. projects emphasises the need for a buyer driven process. The success of a technology procurement project, e.g. in an inexperienced Nordic country, may therefore to a large extent be carried by allowing the purchasers, issues and concerns, market perspectives and willingness to buy determine development and design of the project.
- However the Energy+ case is also interesting since the purchasers are not obliged to buy the product. It might however be difficult to apply the same approach i.e. create sufficient demand-pull on a Nordic level since most suppliers operate on the EU or global market. This emphasizes the need for a thorough market study in the early stages of a technology procurement process.
- Another important aspect of the market study is addressed by the EU expert group. The ‘bundling’ and ‘unbundling’ of demand should be carefully considered. A large or strong buyer group is generally perceived as an advantage but it may not always lead to a successful technology procurement if the potential suppliers are SMEs. Furthermore smaller or ‘unbundled’ technology procurements may sometimes be necessary to create opportunities for innovative SMEs to obtain manageable contracts.
- Another point about the SMEs is made in the evaluation of U.S. technology procurement projects. The SMEs can be important agents of change in the market if the projects aimed at products that have relatively low capital requirements for starting new production. Thus, the initial market study of the technology procurement process should include a mapping of the potential suppliers.

In 2002 the U.S. Department of Energy evaluated six energy-efficient technology procurement projects. The following lessons were drawn from the evaluation:

- The program development process should be buyer-driven. The interests of buyers, their issues and concerns, market perspectives and willingness to buy must largely determine development and design of a program.
- Even though program development should be buyer-driven, developers should nonetheless seek out suppliers and distributors to learn about their perceptions and motivations and to communicate effectively with existing players, especially companies that might perceive the program as a competitive threat.
- In procurement projects aimed at products that have relatively low capital requirements for starting new production, small manufacturers can be important agents of change in the market.
- Choice of target technology can strongly influence the success of a procurement project. Target technologies are more promising if they meet the following requirements:
 - Products or features are attractive to a large number of motivated buyers.
 - Products or features are not already widely available.
 - Products are standardized and mass-produced, not custom-designed.
 - More than one supplier is in a position to compete for the procurement.
 - Desired changes in products or processes are not so fundamental as to require long lead times for R&D.
 - The technology advances the developer's strategic goals, e.g., reduced energy consumption.
 - The technology brings with it partners and allies to help promote purchases.
- Unless circumstances strongly indicate otherwise, it is preferable to make more than one award in response to competitive solicitations.
- If market and technology conditions allow it, an initial phase solicitation can be very useful in identifying potential suppliers and buyers, appropriateness of specifications, and functionality of program logistics.
- Although technology procurement projects have heavily relied upon guaranteed sales or exclusive access to large financial awards (SERP, Apartment-Sized Refrigerators), DOE's clothes washer and sub-CFL programs have demonstrated that they are not always necessary to attract aggressive bids, especially when attempting modest incremental improvements in technology, not big leaps forward.
- Technology procurement programs that depend on sales to large volume buyers, particularly government agencies, should be designed to allow a long period of time (at least two years) for the target buyers to purchase product.

- Involving trusted institutions that are recognized for objectivity, consumer interest, or technical expertise in the development and implementation of technology procurement programs can contribute significantly to their success, but credible independent testing and evaluation of products can be costly.
- Technology improvement achieved through competitive procurements does not have to end with the initial market introduction of the new technology. Further technology improvements can occur during the implementation of the program, and programs should be designed to take advantage of them.

Annex 3: Swedish Energy Agency technology procurement initiatives

- Window with low-energy-loss 1990–1995
- Fridge/Freezer with low-energy-loss 1990–1992.
- Air treatments aggregate for Schools 1994–1996
- Small solar heating system for tap water heating 1999–2001
- Energy-efficient electric fittings for tap water in housings 2000–2002
- HF-lightning 1991 Proximity switch 1996
- Public lightning
- Biogas-and electric hybrid vehicles 2002
- Electric cars 1994
- Electric motors 1998
- Mine fans 1992–1993
- Measuring equipments for High pressure pumps 1994
- Factory doors 1994–1995
- Industrial Fans 1995
- Harmonic filter
- Surveillance system in casting bays 1993
- Demand control of towel driers
- Water heaters 1996–1997
- Ventilation Unit 1994–1996
- Ventilation filter 1995–1997
- Energy-efficient air cleaner for supply air units 2002
- Air aggregate in existing apartment buildings 1997
- Heat recovery system in small houses
- Refrigerator- and freeze Energy+
- Clothes washers and dryers for laundry rooms 1991–1992
- Refrigerated Display Racks in Food stores 1996
- New cookers for modern housings 2000
- Tumble driers 1997
- Wash and drying equipment for small appartements 1993–1994
- Fuel Cells in small scale electric- and heat generators 2001
- Individual measuring in apartment blocks 1999
- Electric heated day care centres 2000
- Solar heating in apartment buildings 2000
- Solar heating in small houses 2000
- Control equipment for electric heating 1994–1995
- Small houses in the 1900th century 1994–1997

- Energy calculation software (MEBY) 2002
- Copiers 1998–1999
- Self-put-out monitors 1992
- Refrigeration Compressor 1994
- Converting of central heating in small houses with electric heating 1997–1998
- Energy +2

Only pre-study:

- Compressed-air compressor larger than 30kW

No winner:

- A more effective bulb 1997–1998
- District central heating in individual apartments 2000
- Environmental adjusted dish in catering kitchen and restaurants 2000
- Control and surveillance system in rooms 2003–2004

Information is missing:

- Demand control of ventilation in apartment blocks 1999
- Surveillance system in roll works 1995
- Clever heat regulation 2002
- Wind Power Plant 1996

Local Investment Programme, LIP, technology procurements:

- Demand controlled ventilation in apartment buildings 1992–2004
- Environmental adapted concrete ground stone 1999
- Residential Fuel Cells for Small-scale Electricity and Heat generation 2001–2004
- Conversion of electric heated day care centres 2000–2002
- Double glass facades 1999–2002
- Electric, electric hybrid and biogas vehicles 1999–2002
- Energy calculation model MEBY 2002–2003
- Waste sorting and a vehicle for collecting the domestic waste 1999–2001
- Towel drier 2000–2002
- Logistic functions in Hammarby Sjöstad 1999–2002
- District central heating in individual apartments 1999–2002
- Park and street lightning 2000–2003
- Purifying plant technique a local purifying plant in Hammarby Sjöstad 2001–2004
- Solar heating 1999–2001
- Tap water heating 2000–2003
- Thermal relay functions 2003–2004
- Heat pumps in apartment buildings 1999
- Sensible investments.now/Klokainvesteringar.nu 2001–2004

Combined with contribution of investments:

- Purifying plant technique a local purifying plant in Hammarby Sjöstad 2001–2004
- Solar cells 1999–2002

Annex 4: Sammenfatning

„Technology procurement“, som på dansk kan kaldes „*miljøinnovativt indkøb*“, er en metode til at fremme innovativt offentligt indkøb med sigte på at opnå specifikke (og i dette tilfælde miljømæssige) gevinster.

Miljøinnovativt indkøb er en proces som stimulerer og fremskynder udviklingen og kommercialiseringen af ikke-eksisterende produkter eller services, som efterspørges af en købergruppe. Miljøinnovativt indkøb er altså et markedstransformerende værktøj, der stimulerer udviklingen og markedsintroduktionen af nye produkter, der lever op til specifikke krav (fx energibesparende), som ikke opfyldes af de eksisterende produkter på markedet.

Med miljøinnovativt indkøb formidles behov og krav direkte fra indkøberen til de potentielle produktudviklere i en organiseret form. For at processen skal være effektiv, skal afsætningsmulighederne være tilstrækkeligt til at motivere producenten – hvilket igen afhænger af den nødvendige udvikling for at kunne markedsføre produktet. Jo større udviklingsbehov (og omkostninger til udvikling), jo større skal afsætningsmulighederne være.

Processen for miljøinnovativt indkøb omfatter følgende trin:

- Valg af område
- Forundersøgelse
- S sammensætning af købergruppe
- Formulering af specifikationer til produktet
- Udbudsproces
- Evaluering af udbud
- Iværksættelse af produktudvikling
- Udbredelse af information
- Videreudvikling

Succesfulde eksempler på miljøinnovative indkøb er i projektet identificeret både i nationale sammenhænge og i internationale samarbejder vedrørende en række forskellige teknologier og produkter, herunder husholdnings- og erhvervsredskaber, belysningsystemer, byggekomponenter og kontor- og industriudstyr.

Siden 1990 har miljøinnovativt indkøb specielt i Sverige (med mere end 100 miljøinnovative indkøbsprocesser) været anvendt til at fremskynde markedsintroduktionen af energieffektive produkter, hvilket har ført til såvel økonomiske som miljømæssige gevinster. Sverige adskiller sig i øvrigt fra de andre nordiske lande ved at have både institutioner og regulering med specifikt fokus på miljøinnovativt indkøb.

Erfaringerne fra de andre nordiske lande er begrænset. I Finland er der gennemført otte projekter, i Norge og Danmark få, og ingen på Island.

Anbefalinger

Erfaringsopsamlingen fra de nordiske lande viser, at der er behov for en samlet organisatorisk tilgang til området, hvis miljøinnovativt indkøb skal vinde indpas i større omfang.

- En central institution skal tage rollen som national leder af miljøinnovativt indkøb, hvilket indebærer udpegning af retningen for området, formulering af vision og mål, og en accept af risikoen ved ikke at følge almindelig praksis
- De langsigtede mål med miljøinnovativt indkøb kan udtrykkes i en vision med temaer som „en mere bæredygtig offentlig sektor“ og en „mere miljøinnovativ hjemlig industri“.
- En strategi med mål og handlingsplaner er nødvendig for at effektuere visionen.
- En klar struktur mellem nationale og sub-nationale enheder skaber en ramme for processens enkelte trin.
- En afgørende vigtig faktor er motiverede og kompetente medarbejdere, hvorfor der må kommunikeres tydeligt og iværksættes træning i de enkelte trin i processen.
- Implementeringen af hensigtsmæssige systemer vil lette de innovative indkøbsprocesser. Relevante systemer inkluderer guidelines, opsamling af case-historier, spredning af god praksis og specifikke værktøjer til de enkelte trin i processen.
- Udviklingen af en offentlig indkøbskultur, som fremmer innovative grønne indkøb, kræver en langstrakt indsats hvorunder ledelse og kommunikation er vigtigt.

Specifikke anbefalinger er udarbejdet til Nordisk Ministerråd og fire nordiske lande.

Annex 5: Workshop noter

Workshop om Teknikupphandling d. 13. november 2007

Målet med workshoppen var at få drøftet mulighederne for at styrke anvendelsen af teknikupphandling på nordisk plan, herunder mulighederne for at få værktøjet forankret hos relevante medspillere.

Konsulenterne indledte med en redegørelse for erfaringer fra de enkelte lande samt et diskussionsoplæg omkring hvordan teknikupphandling kan styrkes i de nordiske lande og på fællesnordisk plan. Dernæst foregik en bred drøftelse af muligheder og barrierer.

Følgende kommentarer indkom til rapport og anbefalinger:

Forslag til tiltag:

- Gør de vigtigste spillere i hvert land opmærksom på potentialet.
- Der er på nordisk plan behov for at ensarte sprog og metodikker.
- Det er afgørende vigtigt, at en central institution bliver ansvarlig for teknikupphandling.
- Konkrete projekter kan være springbrættet for at implementere metoden mere grundlæggende i landene.
- Et fællesnordisk pilotprojekt kan afdække mulighederne på nordisk plan.
- En konference i NMR-sammenhæng kan afdække konkrete samarbejds muligheder.
- Kan Nordisk Innovations Center iværksætte en forundersøgelse og et teknikupphandlingsprojekt?

Kommentar:

- Der er behov for en nordisk platform for erfaringsudveksling.
- En række virksomheder har brug for hele Norden som markedsplads.
- Energi kan være et godt emne som nordisk indsatsområde.

Deltagerliste

Workshoppen blev afholdt i København.

Navn	Virksomhed - organisation
Bjørn Bauer (DK)	PlanMiljø ApS
Gert S. Hansen (DK)	Miljøstyrelsen
Ida Bode (DK)	PlanMiljø ApS
Karin Klingspor (SE)	Naturvårdsverket
Lena Stigh (SE)	Jegrelius Research Centre
Maria Louise Madsen (DK)	Kommunernes Landsforening
Martin Standley (NO)	Grip
Mette Bjørn Andersen (DK)	Dansk Industri
Peder Bentsen (NO)	Fornyings- og administrasjons-departementets Ehandelssekretariat
Thomas Hoff (NO)	Fornyings- og administrasjons-departementets Ehandelssekretariat
Micael Hagman (SE)	Miljödepartementet
Ulf Von Sydow (SE)	Jegrelius Research Centre

Annex 6: Spørgeguide

Spørgeguide anvendt som baggrund for interviews med videnspersoner i alle de nordiske lande.

Generel information

Inden for hvilken sektor blev teknikupphandlingen gennemført?
Hvilke aktører deltog?
Hvilket produkt, system eller proces omhandlede teknikupphandlingen?
Hvilken ny teknologi blev bragt i anvendelse?

Forstudie

Blev andre styremidler (f.eks. mærkning) overvejet i forbindelse med forstudiet?

Bestillergruppen

Var det en fast eller en ny bestillergruppe?
Hvad var baggrunden for sammensætningen af gruppen?

Kravspecifikation

Hvilke mål var opstillet?
Hvad var de direkte effekter?
Var der sekundære/uforudsete effekter?

Udbudsproceduren

Var der kontakt mellem bestillergruppen og producenter eller brancheorganisationer inden udbudet blev påbegyndt?
Var der tilstrækkelig tid for producenterne til at udarbejde tilbud/udvikle teknikken?

Tilbudsvurderingen

Levede de indleverede tilbud op til kravspecifikationen?
Var der grund til justering af kravspecifikationen?
Blev der fundet en vinder?

Spredning

Hvordan foregik spredningen af resultatet (informationskampagne, finansielt tilskud til nulserien, demonstrationsanlæg)?

Videreudvikling

Skete der en videreudvikling af produktet efter teknikupphandlingen var gennemført (eksempelvis pga. uforudsete behov)?

Om proces og metode

Blev de opsatte mål nået?
Gode og dårlige erfaringer fra processen, tid, økonomi, forhold vedr. de enkelte faser i processen.
Kan man sige noget om innovationshøjden i det vindende projekt?
Hvordan er resultaterne blevet anvendt?
Hvilke barrierer blev identificeret i processen og hvad blev gjort / kunne være gjort for at nedbryde dem?
Har processen givet anledning til et tættere samarbejde mellem de involverede aktører (eksempelvis dannelse af netværk)?
Blev der skabt forandringer i de virksomheder der deltog i udbudet (øget innovation, forandret organisation, ændret forretningsområde, ændret fokus på miljø mv.)?
Kunne et andet styremiddel have givet det samme eller et bedre resultat?
I hvilke andre sammenhænge kunne Teknikupphandling benyttes?