USER-DRIVEN INNOVATIONS TO DECREASE CLIMATE IMPACTS – FINNISH PROCUREMENT CASES

Ari Nissinen, Maija Mattinen and Katriina Alhola*

ABSTRACT. User-driven innovations can promote large changes in products and services, which are needed if we are to address the aim to decrease greenhouse gas emissions by 80–90% in industrialized countries by 2050. Certain specific purchasing choices of individuals and companies but especially of public organizations have for over 20 years served to promote environmentally friendly products and services. The focus has been on environmental criteria developed by, for example, eco-labeling systems and advice centers for greener public procurement. Recently, innovation policy and the role of public procurement have gained considerable interest in EU countries. The paper describes innovative procurement cases which can decrease the climate impact of Finnish public organizations in brief, and one example of an innovative design competition is presented in greater depth.

* *Ari Nissinen, Ph.D., is a senior researcher working at the center for consumption and production at the Finnish Environment Institute. His teaching and research interests are in green public procurement, eco-design, environmental impacts of products and services, life-cycle assessment, and sustainable consumption. Maija Mattinen, M.Sc. (Tech.), is a researcher at the center for consumption and production at the Finnish Environment Institute. Her teaching and research interests are in sustainable consumption, the environmental impacts of products and services, life-cycle assessment, and carbon footprint. Katriina Alhola, MSc, is a researcher at the center for consumption and production at the Finnish Environment Institute. Her teaching and research interests are in green public procurement and eco-efficiency.*

INTRODUCTION

Great changes in products and services are needed if the aim of decreasing industrialized countries' greenhouse gas emissions by 80–90% by 2050 is to be met. Green public procurement (GPP) is one important policy instrument for reaching this goal, since the public sector is a significant buyer of goods, services, and work. For example, in the European Union, public procurement represented as much as 19% of the union's gross domestic product (GDP) in 2009 (EC 2011). Indeed, purchases by individuals and companies and, especially, by public organizations have for over 20 years been means to promote environmentally friendly products and services. The focus has been on the use of environment-related criteria for various products and services the public sector buys; the criteria are developed by eco-labeling systems, national advice centers for greener public procurement, and European Commission.

Recently innovative public procurement has raised interest in the fields of both innovation policy and procurement policy (EC 2010 and 2011, ICLEI-USA 2012). In innovative procurement, the predetermined product-group-specific criteria do not play such a dominant role as in "normal" GPP and the aim is to find a new kind of solution (i.e., innovation) to meet the needs the public organization expresses. It is obvious that also national goals, such as decreased climate impact for the public sector, influence the goals the public organization expresses in the procurement process. But often these cases can be classified as related to user-driven innovations, as it is the public organization that ultimately sets the goals for the procurement. At the same time, it gives a push to the supplier's side to develop new kinds of products and services while itself striving for the most economically advantageous solution to match its needs and challenges (Edler and Georghiou 2007, Aschhoff and Sofka 2009, Uyarra and Flanagan 2010).

In this paper, several cases of innovative procurement that can decrease the climate impacts of Finnish public organizations are

described in brief, and one example of an innovative design competition is given more thorough analysis.

MATERIAL AND METHODS

To find cases of innovative procurement, we went through many cases of public procurement related to innovation that have received funding from the Finnish Funding Agency for Technology and Innovation (Tekes), which has had a special funding instrument in place for this purpose (Tekes 2012). The material on the Takes Web pages and that produced by the procuring organizations (Tekes 2012†) were inspected (see Table 1).

In addition, a recent building design competition in Finland was examined in more detail, the Synergy design competition. The analysis is based on material found online (SYKE 2012) and in the literature (Nissinen et al., 2010; Rintala & Nissinen, 2011). The Finnish Environment Institute (SYKE) had for several years looked for possibilities for having its office premises and laboratories in the same place, rather than spread over three separate locations in the Helsinki Metropolitan Area. Since no suitable premises were available for this purpose in the metropolitan area, a building process was outlined in spring 2009 in collaboration with Senate Properties, an enterprise that provides property services to governmental organizations (Nissinen et al. 2010; SYKE 2012).

† There is more information in Finnish at the web-site than that found in English.

RESULTS

Finnish Innovative Public Procurement Cases

Altogether 19 projects were presented at the web-pages of the funding instrument for innovative procurement (Tekes 2012‡). Each project usually belongs to a Tekes program, which has focus on the product and service development in companies (e.g. Sustainable community technology 2007-2012 programme, and Innovations in social and heathcare services 2008-2015 programme). The typical funding for each project is 100 000 – 200 000 euro (Tekes 2012).

The projects do not use the project money for the actual purchase, but for the preparation of the procurement process. For example in the Synergia project (which is described in more detail below) the funding has been used for the work to clear out good building examples in Finland and internationally, to buy expert services on recent developments in the eco-design of buildings, prepare the selection criteria for the design teams, prepare the environmental requirements and award criteria to the design competition program, check the environmental information given in bids and to analyze them for the award, and spread information about the procurement case and design competition case (SYKE 2012).

The public procurement projects that have received funding for the preparation of an innovative procurement process have been divided by Tekes into the categories “energy and the environment,” “built-up environment,” and “health and wellbeing” (Tekes 2012). But clearly two main groups can be seen: energy-efficient and need-based building solutions (11 cases) and services for elderly or disabled persons (4 cases) (Tekes 2012). Table 1 lists such projects that can decrease greenhouse gas emissions and subsequent climate impacts.

‡ Later it was found that only part of the funded projects were described at the web-pages, and altogether 38 projects had received such funding (unpublished source material from Tekes).

Table 1: Recent innovative public procurement cases in Finland, striving for energy effiency and other objectives that help in the mitigation of climate impacts (Tekes 2012)

Case	Procurer	Main innovation focus	Means to decrease greenhouse gas emissions
Energy production plant, with ORC technology	Energy production company owned by a municipality	Implementation of a small CHP power plant based on ORC technology and planning of the associated process and procurement	Use of wood-based pellets (and peat) instead of fossil fuels
Timber-framed residential area	A municipality	A residential area promoting timber construction and designed to meet the needs of the municipality	Wood-based materials are a storage for carbon dioxide (CO_2), and thus their use mitigates the climate change
Developing two tourism centres to examples of low carbon footprint, i.e. "ecological tourism industry"	A municipality	Vision and actions for developing the area, by drawing up a procurement (i.e. competition) program and award criteria	Competition program and award criteria will include multiple types of low-emission solutions
Innovative public procurement solutions for functionality, energy saving and other requirements	A municipality	Developing and reinventing a procurement process that enables the implementation of functionality and life span requirements	Energy saving, space efficient premises
Using a design competition to procure new types of services: Design competition for a program to reduce homelessness	Three municipalities	Design solutions for three different sites and service models will be produced. The features of the service will guide the design of each building.	Energy efficiency and space efficiency of the buildings
Energy-efficient and needs-oriented supported housing	Company mainly owned by a municipality	Energy-efficient solutions, control and regulation technologies, space solutions, and promotion of independent living for the elderly	Energy efficiency and space efficiency in housing
Energy-efficient and needs oriented supported housing	A municipality, Social Services Department	To improve the productivity and to develop the structures of social services, combining the skills and innovations of the public,	Energy efficiency of buildings and in housing

		private and third sector is essential.	

Although decreasing the climate impacts of the procurement was not the main goal for the procurement cases, many of them had this goal and focused on means to decrease the greenhouse gas emissions (Table 1). The means included choice of biomass based renewable fuel instead of fossil fuels, high energy efficiency and energy saving, increased space efficiency in housing and in premises for different organizations. Although these may sound as being 'traditional' means to mitigate high energy use and emissions, new insights were brought by introducing advanced new technology, even tailor-made and designed especially for the project, and ways to organize e.g. services that elderly people especially need.

Considering Innovation and Climate Impacts in the Synergy Building Design Process

When SYKE and Senate Properties started the building process, many and varied aspects of environmental and other sustainability were raised in the first discussions (Nissinen et al. 2010). However, soon it was realized that phase-related focusing was needed. In the planning of the design competition, many factors were left to later phases and just mentioned to the design teams. For example, preliminary benchmarking was done in relation to "green building" rating systems such as LEED, BEEAM, and PromisE. They included many criteria that are already fulfilled by the site of the building or that can be met relatively easily in the actual design phase or the construction phase. Many of the criteria would be met naturally through the high demands for energy-efficiency. Therefore, it was found reasonable to inform the design groups that high classification levels would be set as targets for the final building, but benchmarking in terms of the ratings was not expected. It was deemed more important to concentrate on the specifications for energy-efficiency and energy production as well as material-efficiency and ecological sustainability of the materials (as indicated especially by the carbon footprint of the main structures), and give some room also for their own vision and knowledge of the most important aspects and solutions of green buildings.

The recent resolution of the Finnish Government encouraging all public actors to adopt sustainable procurement and setting the goal for new public buildings as being to fulfill passive-house criteria with very low energy use by 2015 (Finnish Government 2009) was taken as one starting point. It was decided that Viikki's Synergy Building, a workplace for around 625 employees including both office and laboratory premises, would become a pilot and example of an energy-efficient, ecologically sustainable, and amenable work environment, at the same time accounting for cost-efficiency targets and the economic realities of SYKE (Nissinen et al., 2010; SYKE, 2012).

What would be the ways to promote innovations in energy-efficiency, ecological sustainability, and an amenable working environment in the design competition? Two major means were outlined: First the design team should have excellent competence to strive for the best solutions. Second, it should be given ambitious goals, though without excessive constriction to creativity. These two approaches are described below.

Requirements set for the design teams in the public procurement notice

A public call for tenders invited design teams to submit professional qualifications of teams with such a mix of competencies as would assure design services for a highly eco-efficient building offering a good work environment (see Table 2). It was required that the working group feature expertise in at least the following areas: architecture (principle designer), structural engineering, HVAC design, electrical and lighting design, the design of laboratory facilities, energy and condition simulations, and the design of ecologically sustainable buildings or related planning solutions. At least three references were required, addressing the kinds of designs for buildings or solutions that can generally be considered examples of ecologically sustainable construction. As award criteria, also participation in research and development projects related to the subject was considered, as were articles concerning the ecological sustainability or environment-friendliness of buildings published in the relevant sector's professional journals or scientific publications.

A recent design competition, “Low2No,” coordinated by the Finnish Innovation Fund (Sitra) for the design of the new Jätkäsaari area in the city of Helsinki served as inspiration for employing a procedure of this sort (Sitra, 2012). It was a concrete example of requiring expertise and experience in issues of sustainability from the design team. However, in the Synergy case the selection criteria were developed even further, clarifying in detail the specific kind of information needed.

Table 2: Key specifications in the public procurement notice for the Synergy design competition (some of these were further developed and expanded upon in the later competition program)

Title of the notice:
Finnish Environment Institute's eco-efficient office building – Viikki Synergy Building, design competition

Brief description of the procurement:

The project will result in an energy-efficient and ecologically sustainable building forming an excellent working environment, as well as an example of office building construction outstanding in terms of its cost-effectiveness and overall economy.

The purpose of the competition is to find an innovative and integrated COMPREHENSIVE SOLUTION that optimally meets the goals set for it and:
- is ecologically sustainable, energy-efficient and ecologically sustainable, at the least complying with the requirements for passive energy buildings,
- forms a workable and effective working environment that promotes well-being at work while supporting the many types of continuously evolving working methods suiting the nature of the operations,
- is high-level from the townscape and architectonic perspectives,
- is cost-effective and feasible in terms of its overall economy.

In this project, ecological sustainability means:
- energy efficiency (passive energy building requirements),
- production of locally renewable energy,
- materials effectiveness, the lifecycle environmental effects of the building's surface materials (the competition task includes an assessment of the building's quantities of main materials),
- compliance with the justifications presented for the building's environmental classification to achieve a higher environmental classification.

Selection criteria, selected elements:

The working group shall contain expertise in at least the following areas: architecture (principle designer), structural engineering, HVAC design, electrical and lighting design, the design of laboratory facilities, the design of ecologically sustainable buildings or their related planning solutions, as well as energy and condition simulations. The experts shall have the sufficient competence to design the location in question.

Compliance with Senate Properties data modelling requirements, found at the address [elided], is mandatory (compliance with the instructions will ensure that the IFC file generated during the competition stage will be useable in energy and condition simulations, quantity calculations, and scope assessments).

More specific description of Selection criteria, which was given in an appendix:

Working group's composition: The following list describes the expertise required of the working group and is not a list of people; the same individual may represent expertise in several sectors.

- Architecture
- Structural engineering
- HVAC and automation design
- Electrical and lighting design
- Design of laboratory facilities
- Expertise and experience in the planning of ecologically sustainable buildings, or related design solutions, that can be considered applicable to this project (NOTE: Ecological sustainability as it applies to this project is described in Section II, 1.5. "Brief project description" of the procurement notification.
- Energy and condition simulation

Table 2 continues

The requirements for the information about each kind of expertise were further specified. The requirements related to experience in planning of ecologically sustainable buildings were as follows.

Information that was required:

3.6.1 References concerning the kinds of designs for buildings or solutions that can generally be considered examples of ecologically sustainable construction (including buildings of timber construction). Mentioned in this connection shall be the building object's name, type, scope, description (of solutions and targets deviating from conventional construction practices), design period, possible implementation period,

and the person's role in the project.
3.6.2. Participation in research and development projects related to the subject.
3.6.3 Articles concerning the ecological sustainability or environmental friendliness of buildings published in the sector's professional journals or scientific publications.

As a minimum requirement, it was stated, the working group shall feature expertise in at least the extent of 3.6.1, above (at least three references), and at least one of the working group's aforementioned experts should also have expertise in the subject area.

Environmental aspects specified in details in the competition program

The environmental elements, described in general terms in the public procurement notice for the design competition, were later specified in detail in the competition program. In addition to the benchmarking to the passive-house criteria, the energy requirement was presented as that for an "almost-zero-energy building," in line with the terms of the Proposal for a Directive of the European Parliament and of the Council on the energy performance of buildings (recast, Nov. 18, 2009). Accordingly, the consumption of energy purchased for the building, without user electricity, and weighted by the energy carrier factors given in the program (e.g., the factor for electricity is 2.0), was not to exceed 80 kWh per square meter per year (the area refers here to the program area, not the total or gross area). It was stated also that local electricity production from non-fuel-based renewable sources such as solar panels and wind turbines must meet at least 15% of the total electricity consumption need of the building (measured at the annual level). For more on the specifications for energy-efficiency, see Rintala & Nissinen (2011).

Carbon footprint – i.e., the greenhouse gas emissions resulting from the materials' manufacturing and maintenance over a 100-year review period – was selected as the main indicator of material-efficiency and ecological sustainability of materials in this competition. It was concluded that SYKE must have an estimate of

the carbon footprint of its new premises and there must be a goal for the designers to strive for a small carbon footprint. Although the energy use of the building represents a large part of the footprint, materials too account for a considerable share, especially for low-energy buildings. On the other hand, it was recognized that measuring life-cycle environmental impacts and carbon footprint is not a mainstream procedure in the design of buildings. Most architects and other designers can be presumed to lack experience of life-cycle assessment methods, and many material choices are made or at least essentially specified only after a competition, in the building's further planning. For these reasons, a methodology was developed[§] that is designed not to calculate accurate values for material amounts and carbon footprint but, instead, show the largest differences caused by such factors as the extent of the building and the material choices for the main structures of the building. The design teams were also informed that the material quantities and carbon footprints would be considered only indicative and would be taken as support in the expert evaluations by the jury.

Modifiability is, of course, one important aspect of sustainable buildings. In the design entries, it was to be taken into account by ensuring that the size of group work rooms can be adjusted or that they can be modified to form an open work environment. Correspondingly it should be possible to divide an open work environment into team rooms. Another requirement was that some of the office rooms be convertible into team rooms or open workspaces. Additionally, with respect to modifiability, the intent was to achieve a certain "universality" of spatial types, with the design taking into account the possibility of some offices or portions of them being leased to outside users.

The following environmental aspects were to be taken into account in the award: energy-efficiency and the fulfilling of the criteria given for "almost-zero-energy buildings," local production of renewable energy,

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§ An Excel-based tool: Carbon-footprint-of-SYNERGIA-main-structures_v-2010-05-17_L.xls, freely available via http://www.environment.fi/eco-officebuilding

the rough estimate of the carbon footprint of the main structures of the building, and other environment-related objectives stressed by the designers themselves.

Considering the three pillars of the sustainability

Multi-criteria decision analysis was used for finding balance with the other essential factors, such as work environment and cost-effectiveness. The personnel of SYKE and several other stakeholders (such as Senate Properties and the Ministry of the Environment) were asked to give their opinions about the new building; thus, the nature of the research and expert work was taken into account, and it was decided that about 50% of the work stations would be in private offices, 35% in group work rooms, and 15% in the open work environment. Employees will be placed in the various work environments in line with the principle of appropriateness, in view of the nature of their work. The work areas are not to express any manifestation of a staff hierarchy, and, for example, more representative spaces were not to be designed for management personnel. In this design competition stage, those social and ethical factors related to the product chains (i.e., elements such as work conditions in the production of the construction materials) were not yet covered. They were deemed to become crucial in later phases, in which the actual product choices are made.

The economic sustainability pillar was also accorded great weight, and costs were stressed. For example, the notice expressed this as one of the four main goals: "Is it cost-effective and feasible in terms of its overall economy?"

The award in the Synergy competition and the role of innovation

According to the competition jury's minutes, a particular merit of the winning entry, "APILA," was the original architectonic expression creating a new addition to the area's urban structure and townscape that tells of its users and reflects environmental values (SYKE 2012). The timber construction's facilities were grouped in narrow structural frames encircling covered, semi-heated interior courtyards that

significantly decrease the surface area of the exterior skin and improve energy-efficiency. The building's dimensions were well suited to timber construction and provide excellent natural lighting conditions for workspaces.

The jury also stated that the technical solutions presented form an excellent overall entity. The entry selected had the lowest energy consumption, as well as the lowest greenhouse gas emission levels when estimated for 30 years of energy use and in its main structural materials. This demonstrated that it is possible to obtain excellent energy performance in a large building mass cost-effectively.

Finally, the jury concluded that the demanding norms did not limit creativity. The environment-related targets inspired fresh innovations that create the conditions for a new kind of dynamic architecture reflecting our times.

DISCUSSION

Buildings and services for elderly people, forming two large groups of innovations in Finnish public procurement, certainly receive focus for several reasons. Buildings account for 40% of energy use and 30% of greenhouse gas emissions both in Finland and EU-wide, so mitigation of climate change and a need for better energy security necessitate reduced energy use and more local energy production based on renewables. The percentage of elderly people is rapidly increasing, and that of working people decreasing, both in Finland and in many other EU countries, and new solutions are needed to respond to the needs of older people. Buildings and services for this demographic are closely connected, since customizing buildings for elderly people often means large changes in the buildings (i.e., renovations) or even totally new buildings, with special spaces and functions.

The results indicate that the mitigation of climate impacts is well accepted to the user-defined objectives of Finnish public procurers

that strive for new type of solutions (i.e. innovations): The energy issues and mitigation of climate change impacts are in the agenda of many of these projects, although the Tekes programs cover a broad list of objectives that can be promoted by the innovative procurement processes. Energy efficiency and low emissions of greenhouse gases are thus understood as key properties of the future products and services, in the fields of services for ageing people and infrastructure like buildings.

Regarding the Synergy procurement case, it could of course be considered as a special case, because SYKE's research and expertise focuses on changes in the environment and ways to control these changes. However, environmental objectives are also becoming mainstream, in European Union on account of the recast of the building energy efficiency directive and forthcoming energy performance directive and, in Finland, also the government resolution on sustainable public procurement (Finnish Government 2009).

Naturally, a building process of this sort may have a different model and different stages than this one does, with its progression "design competition – design – contract competition – construction – test use." The model for requiring environmental expertise among members of the design team can be generalized, though with awareness that it presumes such expertise also of the award/competition jury, as well as in the organization that manages the whole building process.

A long list of different factors and incentives (Edler and Georghiou 2007, Aschhoff and Sofka 2009, Rolfstam 2009) have been identified for innovative public procurement. As Uyarra and Flanagan (2010) conclude, policy for public procurement should aim to put in place the necessary incentives but also the necessary skills and capacity to allow public purchasers to make strategic decisions on a case-by case basis that will also stimulate innovation. In this paper, it is evident that a funding organization, that not only gives financial resources for the preparation stage of the procurement, but also creates networks to support the work and by the project rules also commits the organization to goal oriented and productive work. When

there has been so much interest in the procuring organization for an innovative procurement process that they decide to apply for the funding, they also by accepting the funding commit to the objectives and start to realize an innovative procurement process. Thus by this relatively small extra funding, the procurement process produces a lot of added value to the society: in addition to the procuring organization clearing out better it's real needs and possibilities for better innovative solutions at the market, the procurement process and the final procured solution will serve as an example for other public organizations, and the companies that strive for more ecologically sound products are motivated to keep on the product development work.

ACKNOWLEDGMENTS

Funding received from the Finnish Funding Agency for Technology and Innovation for the Synergy pilot project is gratefully acknowledged.

REFERENCES

Aschhoff B and Sofka W 2009. Innovation on demand – Can public procurement drive market success of innovations? Research Policy 38: 1235-1247.

EC (European Commission) (2010). Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the regions. Europe 2020 Flagship Initiative Innovation Union. SEC(2010) 1161.

EC (European Commission) (2011). Purchases as an engine for innovation. [On-line]. Available at http://ec.europa.eu/enterprise/magazine/articles/innovation/article_11008_en.htm [Retrieved July 13, 2011]

Edler J. and Georghiou L. 2007. Public procurement and innovation – Resurrecting the demand side. Research Policy, 36(7):949-963.

Finnish Government (2009). Resolution by the Finnish Government on sustainable procurement (in Finnish). Press release in English [On-line]. Available at www.ymparisto.fi/default.asp?contentid=319422&lan=fi&clan=en [Retrieved March 30,2012]

ICLEI-USA (2012). Examples of ICLEI's Consulting and Innovation Experience in USA. [On-line]. Available at www.icleiusa.org/action-center/tools/iclei-consulting-services [Retrieved March 27, 2012]

Nissinen A., Juvonen H., Kämäri J., Linjama J., Niemelä J., Muttilainen J., Rintala T., Etelämäki P. (2010). Identifying and assessing the critical aspects of eco-efficiency for a new Finnish office and laboratory building. SB10 Finland, Sustainable Community – buildingSMARTTM, 22-24 September in Espoo,

Finland, Conference proceedings electronic version p. 768-773. ISBN 978-951-758-506-4

Rintala T. & Nissinen A. (2011). Design competition for a near zero energy building –
implementation, results and lessons to learn. [On-line]. Proceedings of the Sustainable Building 2011Conference. Available at www.sb11.org [Retrieved March 30, 2012]

Rolfstam M 2009. Public procurement as an innovation policy tool: The role of institutions. Science and Policy 36 (5): 349-360.

Sitra (2012). Low2No. A Sustainable Development Design Competition. [On-line] Available at www.low2no.org [Retrieved March 30, 2012]

SYKE (2012). Eco-efficient office building. [On-line] Available at www.environment.fi/eco-officebuilding [Retrieved March 30, 2012]

Tekes (2012). Innovations in public procurements. [On-line] Available at www.tekes.fi/about/publicprocurements [Retrieved March 30, 2012]

Uyarra E and Flanagan K 2010. Understanding the innovation impacts of public procurement. European Planning Studies 18 (1): 123-143.