

What's the problem with non-conventional technology?

The Stockholm Local Investment Programme and the eco-cycling districts

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Keywords

urban development, technology, sustainability, energy efficiency, resource efficiency, policy, barriers

Abstract

This paper analyses barriers towards implementation of non-conventional energy and resource efficient technology in the context of urban development. It gives tentative conclusions based on an ongoing Ph.D. dissertation project. The case is the measures the city of Stockholm launched with the help of a Swedish Governmental subsidy program – the Local Investment Program (LIP). The LIP runs from 1998 to 2003 and is intended to help municipalities nationwide adapt to the demands of an ecologically sustainable society. Measures that uses new, or in the terminology of this paper, non-conventional technology are explicitly supported in the program. Stockholm was granted 67 million Euro to subsidize different projects, among them the eco-cycling districts of Hammarby Sjöstad, Östberga and Skärholmen. Experiences reported by the municipal LIP co-ordinators nationwide are that only half of all the programs are realized as intended in the applications. As the project is work in progress this paper will try to answer the following questions: Why are some projects successful and others not? Why are sustainability-measures in these projects not carried out completely? Which agents and mediators do help or hinder the subsidies to become a realized and working technology in the city? What is the problem with non-conventional technology really? What parts does politics, policy and ad-

ministrative practices as well as 'rational' economical behaviours play? Some old obstacles, but are new solutions dependent on unorthodox practice or simply more money? Knowledge on these issues is (still) important for subsequent policies and programs on energy and resource efficiency.

Introduction

The Swedish Government launched a subsidy programme in 1998 to speed up the adaptation to ecological sustainability in the Swedish society. The programme was explicitly concerned with the implementation of cutting-edge energy and resource efficient technology. This paper analyses the processes in some of the projects initialized and subsidized by this programme in Stockholm and it gives tentative conclusions based on research in an ongoing Ph.D. dissertation project.

Just as no technological project is 'technological first and foremost' (Latour 1996:32) the investigation of a policy based on the premises of ecological modernisation must tackle the question of what innovations really are and the existential conditions of technological artefacts. This calls for a symmetry in accounting for both human and non-human actors. The actors involved in this analysis, which is delimited, are the Stockholm Real Estate and Traffic Administration (GFK), the Stockholm City Planning Administration (SBK), public housing companies, private housing companies and builders, the Council for the Stockholm Local Investment Programme (the SLIP-Council¹),

1. This acronym is not a formal term, but is a way of distinguishing the Stockholm part of the programme from the rest of the Swedish LIP.

one energy utility company and the district administrations of the existing areas. These are the human organisational characters, other nonhuman factors are solar cells, energy efficient windows, 'requirement controlled' ventilation-systems,² individual measurements in apartments. The investigation uses in-depth interviews where the stakeholders recount their experience with the projects, as well as reviewing documents and analysing discourses inherent in these processes.

As the paper derives from ongoing research, it is in progress and still a bit asymmetrical. It does not fully open up the technological artefacts that is one main focus for the subsidy programme investigated. They are still to a large degree confined to their black-boxes as actor-network theory jargon would have it. Although this paper tries to evade this theoretical terminology, it might be sensible to quickly outline the central ideas that has informed this investigation. Actor-network theory was developed to handle investigations of socio-technological issues. The artefacts are seen as taking part in events, they act and are given agency, just as humans act and are given agency in any situation (see Law 1999; Law 2001).

The following section outlines the setting in terms of what the subsidy programme is and the part studied. The third section is an account on what the stakeholder dialogue reveals in terms of experienced barriers. It is a list of themes that plays a part in constituting barriers in the projects.

The fourth section is a reflective discussion on the theme of the laboratory, the experiment and the commodity. The hypothesis is that the conflict over where to experiment runs through the whole strategy and is one answer to why (monetary) economics is merely indirectly causing the barriers. To do this the section broadens the sense of what may have agency in these projects. Reflecting on the stakeholders' testimonies it could be argued that the themes are really only facets of an interweaving phenomenon in the Stockholm cases of implementing non-conventional technology.

'Non-conventional technology' is a term used to describe the stakeholder's meaning of 'new technology'. Non-conventional technology frames artefacts that are not used in normal practice but are not necessarily 'new', i.e. unknown (or unconventional) from the actor's view.

The Local Investment Programme has a strong relation to the ecological modernisation discourse which tries to shift the laboratory 'outside': to use everyday life spaces as testing ground for new solutions. The section then sees the Stockholm part of the programme as having an inherent spatial dilemma with unstable non-conventional technology. The unstable or weak forms of non-conventional technology are contrasted to strong, or fairly stable, forms of non-conventional technology, in that the former has more of the experimental setting associated with its implementation and are seen as entailing more risk by the stakeholders.

So the question that inspires this paper are: where is it legitimate for laboratories to transform into the market place? Is an energy efficient market advanced under the discourse

umbrella of ecological modernisation dependant on real-time experiments?

The case studies

The case studies are the energy and resource efficiency projects the city of Stockholm launched with the help of a Swedish Governmental subsidy programme – the Local Investment Programme (LIP). The LIP runs from 1998 to 2002 and the intention is to help municipalities nationwide adapt to the demands of an ecologically sustainable society. Or as Baker defines it, the LIP '... is a broad programme of investments to stimulate the modernisation of buildings, infrastructure and energy systems at the local level, while at the same time providing jobs' (Baker 2002:109). And, in comparison with other EU-states, it is an unusual operation when most member states typically use 'regulatory mechanisms backed up by market instruments', rather than promoting sustainable development through 'large-scale, state-funded, investment programmes' (ibid.). Measures that use non-conventional technology are explicitly supported in the decree, which further states that profit-making actors applying must invest in 'what could be presumed/supposed to contribute to new technology or new working methods' (SFS 1998:16§; see also RRV 1999).

Organisations applying for a LIP-subsidy had to present an application describing their projects to the municipality. The municipality in turn applied to the Government and the Ministry of the Environment.³ According to Hanberger *et al.* the most common measure granted subsidies in the country as a whole is conversion to renewable energy by public organisations (municipal departments or companies) as principals in the projects. Public organisations also constitute 72 per cent of all grant-aided projects (Hanberger *et al.* 2002:96-97). Experiences reported by municipal LIP co-ordinators nationwide are that only about half of all the programs are realized as intended in the applications (ibid.:16). Moreover, Hanberger *et al.* also conclude that there is no knowledge of why LIP has a positive influence in some municipalities but not in others, and that the LIP in itself and the evaluation of it is moving through unexplored ground (ibid.:19-20).

Stockholm was granted around 635,1 million SEK (ca. 67 million Euro) in subsidies to the Stockholm Local Investment Programme (SLIP). Until 2001 around 276 million SEK (ca. 29 million Euro) of the subsidy has been disbursed. In addition to this there are agreed projects where the subsidy has not yet been paid out (where the money is 'fixed'). The prognosis points at a total result for 2001 of the programme of around 529 million SEK (ca. 56 million Euro) (SLIP 2002).

2. The actors and stakeholders refer to this system as requirement controlled ventilation (*behovsstyrd ventilation*), and it is both an automatic and a user controlled system, e.g. the fans are automatically guided by out-door temperature sensors and load/pressure, but the tenant can also switch to a 'not at home'-mode and the air-turnover is then lowered except in 'humid spaces' (bathrooms, etc.).

3. As of 2002 the LIP is located to the sectoral authority, the National Environmental Protection Agency.

In the SLIP the Ecocycling Districts (EDs) is one of four kinds of projects.⁴ During the period 1998-2002 the EDs had a part of the subsidy amounting to around 400 million SEK (ca. 42 million Euro), and the total sum of investment for the city and actors in the EDs is around 1,900 million SEK (ca. 200 million Euro) (ibid.). The EDs comprises the districts of Hammarby Sjöstad, Östberga and Skärholmen. Hammarby Sjöstad is under construction. Östberga and Skärholmen are existing suburban districts, mainly built in the 1960s and 1970s through the Million Programme⁵. There is some new construction in the two areas of existing stock. In these areas the city, with the help of the SLIP, supports development and demonstration, technology and joint procurement, knowledge diffusion, Environmental Load Profile (*miljöbelastningsprofil*; MBP) and 'technology competitions' to stimulate new thinking and development (ibid.).

One of the basic ideas in the Stockholm application to the Government was that Hammarby Sjöstad would be the pacemaker for the other two districts. The new production site was to come up with ideas and solutions out of which some certainly could, it was thought, be used in the other two areas. In the case of the SLIP Hammarby Sjöstad was conceived as a giant test-field, a laboratory. The argument was that this large-scale development could be used to develop ecologically sustainable building methods and lifestyles for people living in large cities (or dense urban areas). The geographical scale and the order volumes would give the project a unique possibility to 'pull out' ecologically sensible technology, which later could be used in other projects – as retrofitting and redevelopment in existing areas presupposes proved technology and products at reasonable prices (SLIP 1998:6).

What the stakeholder dialogue reveals

This is a summary and analysis of the different explanations the stakeholders have given in the interviews.⁶ This 'listing' of themes outlines what the stakeholders experienced in connection with the SLIP and it gives a context for the discussion in the next section. The themes presented in seven headings intertwine considerably and they do have synergistic effects in obstructing the projects.

The division of stakeholders into the public sector, private and public companies for this analysis is a usage of the terms the actors themselves use, even if it could be argued that these categories are an artificial distinction between the State and industry and too blunt a tool for analysing these kinds of processes (see Latour 1996:42). The public actors are non-profit groupings representing public interests, private actors are representing their profit interest and customers; public companies are for example public housing companies – owned by the city but has to or is allowed to do profit, they more or less act as private profit oriented companies do.

CARROTS AND STICKS

A *carrots and sticks*-theme is the external force and motivation upon the project-owner (cf. Olerup 2001), and comments concerning this is found in fourteen interviews, i.e. not only in the opinion of the project-owners. In the SLIP case the stick is built into the carrot: the subsidy was presented as an incentive but the demands on accounting was clearly a bit of a surprise for the private stakeholders at least.

This barrier overlaps with the themes of competence and information deficits: The carrot then depends a lot more on the competence of the actor whether it is considered enticing or not. There is also a difference here between the EDs. Hammarby Sjöstad had different rules from the other two, an area-based stick in the form of the Environmental Program (e.g. the targets discussed in contested reality). And in the early stages the stakeholders got the word that there was a subsidy coming. Some of the actors were discouraged when the Government said that the subsidy ratio for private or hybrid actors was to be 30 per cent on the investment difference between conventional and non-conventional technology. This ratio later changed to the more generous 30 per cent on the whole investment sum.

The applications also demanded a lot of time for some actors. One commented that they took the time and did the applications, and then they waited and waited for answers. The route the application must take before it even lands on the Government's table contains four stages: A reference group; the County Administrative Board; SLIP writes a suggestion; the City Director scrutinizes the suggestion. This route was commented by a civil servant as 'This way could scare the most toughened developer'.⁷ The handling-time did not fit into the stakeholders' renovation cycles or rhythms, it was not in phase. An additional factor is that the price formations and tenders could become out-dated.

COMPETENCE AND MOTIVATION

The theme of *competence and motivation in the organisation* occurs in thirteen interviews. This is about the importance of knowledge and routines within and between organisations and it has a direct influence on the reason for doing it. The skills needed are both the ability to handle administrative issues concerning the applications to SLIP and the non-conventional technology that they must use in order to get the subsidy. At the same time it is an organisational angle: who and from where in the organisation says that they have to apply, to initiate a project or a part in the project formerly not thought of? The mixture of these competences in a given organisation influences the motivation to initiate and complete a project in the SLIP. In other words, a question of both the organisation's and the individual's will to do it and does s/he think it is worth it.

For example, as one actor put it, concerning projects they as a public body tried to push together with private and public companies on the people they met in the companies: 'It's

4. The other three categories are: Ecocycling Teams, education of residents on ecology and resource efficiency in three districts (of which one is Skärholmen); Ecocycling Projects, ecology and resource efficiency educational efforts in all Stockholm districts; and Managements and Companies, specific projects they themselves answer for.

5. A Swedish national public housing programme initiated in the 1960s to build around 1 million dwellings between 1965-74.

6. So far eighteen in-depth interviews have been conducted, each ranging from 1/2 to 2 hours. The interviews were designed as conversations with four topical questions asked of each interviewee. All translations from Swedish to English are mine.

7. Toughened or tempered in the sense of tempering metals or glass, from the Swedish *hårdad*.

important that they are really interested too, and can promote [the project] in their executive bodies.' There is also the example of a public housing company where the project manager (who also was the manager for the housing stock in the district) got the orders to apply and think up some project 'from above' in the organisation, even though at the project manager's place in the organisation they did not believe it was worth the effort to apply for the subsidy.

Actors on the public side have expressed that the will to do projects is important and that there is a lot of ignorance around. This was captured by one public actor as 'doing things with your left hand', starting and doing projects with sloppiness and a lack of interest.

In some cases competence and motivation is closely tied to continuity in the projects. One of the private companies changed project managers a couple of times. This eased neither the management of know-how capital accumulated in dealing with the bureaucracy surrounding the subsidy nor with the technological artefacts themselves. In this case the organisation has changed a lot over the years: from hierarchical to flat-organisation, which did not work very well so they had to re-organize two or three times after that: 'At the end you didn't know who to ask and who's the boss anymore.' But, ironically, this is mirrored by chaos, turbulence and high turnover of personnel experienced in the early phases of the SLIP.

Problems concerning the applications and the accountancy routines that follow the decision to apply seems to be an organisational issue. It is clear that the actors who did not complain much about the application procedure had great support within their organisation for 'environmental work'.

CHANGING OBJECTIVES IN THE CITY COUNCIL

Although it concerns mainly the existing areas formal politics plays its part in this case as well, as it is found in ten interviews. Within this theme there are really two sub-themes. One is the consequence of acting out the political substance or ideology by the majority in the city council. This is demonstrated by the order from the City Hall to privatize the public housing stock, i.e. to sell the buildings to the tenants. In Östberga this led to a halt on every renovation/refurbishment project because the public owner of the stock did not allow any expenditure on the houses until all the deals were done. As a result only 168 of originally 1 171 apartments are being renovated (DN 2002).

The support effected by ideological sympathy in practice has to do with environmentalism in political discourse – trends in awareness and consideration of ecological questions. It is a complex theme, not either-or, since it is hard to discern how much of environmentalism and sustainability discourse is stabilized or naturalized, and how much is actually fallen out of (political) consciousness. Several actors, mostly the public ones but private ones as well, were of the opinion that in the early and middle 1990s the issue had a larger presence on the political agenda.

The other sub-theme is political power shifts in general which are not a direct matter of politico-ideological substance. The shifts cause great insecurity in the city's admin-

istrations and offices. One actor commented that there is always chaos following elections and 'nobody knows anything anymore' among the civil servants. The point here is that political colour does not matter, because the bloc 'inheriting' a project wants to give it some of their own nuance.

CONTESTED REALITY

In nine of the interviews the actors ponder a theme that might be described as *a fight over reality*. Actors blame each other for not being realistic – e.g. having bad models that do not correlate with reality. Clearly, this theme draws on the definitions and the conceptions of what non-conventional technology (an issue discussed in the next section) is, what an innovation is and the feasibility of different policies or rules.

One example is the controversy over Hammarby Sjöstad's energy-use targets. The targets were contested by what is called 'the Builder's Report' (i.e. Kellner *et al.* 1997). Here the question is how to calculate the targets, on what grounds and how realistic they were. The goals for Hammarby Sjöstad were set at twice as good as new production in 1996⁸, but not the average of new production – 200 kWh per square meter; it was half the cutting-edge at the time – 120 kWh per square meter. In the builders' reality the figure 60 kWh per square meter is very skewed, because they thought they had to work hard just to reach the figure 120. One actor commented: 'I don't know what such a house would look like, to be honest.' This is interesting, taken together with the theme of aesthetics below: if you do not know how to build energy efficient to reach this target then you have to experiment with form, and Hammarby Sjöstad had very narrow frames for such an aesthetic experimentation.

THE BUILDERS' CONSERVATISM

A theme that seven stakeholders commented upon was *the builders' conservatism*, understood as the whole sector of building. This theme is articulated through the aversion towards experimentation, but then through morals, profit and the 20th century history of building in Stockholm and Sweden. Sweden and Stockholm has relatively few actors in this sector, since the People's Home project in the post-war era let a few grow big (see Hall 1998:873). Today there are scandals now and then because of the cartel-character these politics and national economics have led to (e.g. Tonell 1999).

Here a suspicious attitude is commented upon because they have to tackle problems with energy and resource efficient solutions that arise financially. This suspicion is articulated as a stance of 'not taking the lead' and not to spearhead development. This has an odd resemblance to what is often referred to as the precautionary principle in some environmentalist discourses. To precede the discussion below, the builders do not want to move the laboratory out into their practice.

One stakeholder commented upon the Builders' Group in Hammarby Sjöstad that there is only one woman and that she is probably the youngest. But the stakeholder also questioned whether the conservatism solely depends on gender and age, that it is more of passing on a tradition – which in

8. These goals were passed as the *Environmental Programme for Hammarby Sjöstad* by the municipal council June 17th 1996 (Hammarby Sjöstad 1998:2-3).

this case also was ‘doing things that work’, i.e. proven routines of practice and a scepticism towards innovations. This conservatism is also the reason why there is a certain ‘peer pressure’ at work among the builders in the district.

INFORMATION DEFICITS

One obstructive element in the SLIP history is the deficit in *explaining the intention of what measures LIP was allowing*. There was a lack of clarity in the early phases of LIP and at least five actors explicitly complained about this: private builders, public housing companies, offices and departments in the city administration and even the SLIP-council itself had problems with this.

This informational deficit is connected to some questioning of the rationale when the SLIP-council was set up as an obligatory point of passage in administrating applications and distributing subsidies concerning the projects. It is also connected to the deadlines for the applications in the early stages. The National Swedish Audit Bureau has also criticised this informational deficit (RRV 1999:90). The draft of the decree was the only available text in the municipalities’ application processes throughout 1997-98. This draft was different from the legal version that came into force February 3rd 1998 – two weeks before the application deadline (February 16th 1998) for the municipalities. The Ministry of the Environment’s information was not clear and sometimes even contradictory between verbal and textual information.

AESTHETICS AND CITY BUILDING

The decree on LIP (SFS 1998) explicitly mentions the consideration of cultural and architectural qualities and values. But in this case the theme of *aesthetics and city building* is a barrier, as the comments in five interviews make evident. Aesthetic ideals have had an effect and they offer obstacles mostly in Hammarby Sjöstad and Östberga.

In Hammarby Sjöstad the aesthetics did circumscribe what was possible to experiment with, i.e. either blocking out solutions completely or making them much more expensive than otherwise. There is no inherent contradiction between ecology and energy efficient solutions and aesthetics, but they come in conflict in some cases. The SBK holds a tight leash on the design of façades in Hammarby Sjöstad.⁹

Because there was a large amount of negotiations with the SBK concerning aesthetics, this also took time, space and money from other dimensions in the project causing one actor to complain: ‘It’s very beautiful and I’m very satisfied with our projects down there, though economically you can’t build that way’.

In Östberga it was the detail-plan and the question of preserving a typical style of urban design, which has e.g. flat roofs and the prohibition to alter this design too much circumscribed what energy- and resource-efficient measures could be applied (e.g. sun panels or solar-cells).

Translating ecological modernization into a collective experiment

At first the obstacles thematized above seems to be the good old barriers that go with many other socio-technological projects. At second glance they are no less ‘nothing new’ – although they give a necessary background of what the stakeholders found problematic when proceeding with their projects – but the hypothesis presented here is that they could be seen as varied symptoms of defining and contesting where we want to experiment. This section, then, discuss how the LIP in the Stockholm case became a collective experiment and not simply an issue of implementing ‘new technology’.

During the 1990s the frame for Swedish environmental policies and official rhetoric concerning ecological sustainability was set in the ecological modernisation discourse, and the LIP is a policy tool in this frame (Lidskog & Elander 2000:213; Baker 2002:110). The belief in ecological modernisation as the way out of an unsustainable condition could be described as an optimistic approach with the ‘conviction that the ecological crisis can be overcome by technical and procedural innovation’ (Hajer 1999:366) without endangering ‘the profit margins of the business and the industry’ (Davoudi 2001:87). To conjure these innovations the call goes to:

Engineering sciences... to devise the technological equipment necessary to achieve the necessary ecological quality standards respecting existing social patterns. In a similar vein, the social sciences’ role in solving the puzzle of ecologisation is to come up with ideas of how behavioural patterns might be changed and to help understand how ‘anti-ecological’ cultural patterns might be modified. (Hajer 1999:369)

The policy could thus be described: the State wants the actors in the municipalities to get acquainted with non-conventional technology, because the State sees ecological sustainability as dependent on ecological modernisation. In other words, there was a translation of the ecological modernisation discourse into the Swedish setting, whereby the unintentional need for experimentation or shifting the laboratory became inscribed in the programme. As a policy-tool LIP implies experimentation since it is a new kind of strategy in terms of how it operates. The strategy has a central theme in the focus on the municipalities to think and act differently than they are used to (RRV 1999; Hanberger *et al.* 2002).

However, there is a snag with the ecological modernisation strategy itself because it relies on the innovation or technological artefact to be as a commodity or product ready for implementation. ‘New technology’ is seldom ready to take on that role: it is rarely completely detached from the innovative process which could be understood as the laboratory setting. (Depending on the definition or conceptualisation of what is ‘new’, I return to this question below).

9. Noteworthy is that ‘aesthetics’ is explicitly a fourth element added to the usual triad of ‘ecology, economy and the social’ in sustainability discourse in the Stockholm Comprehensive Plan (Cederschiöld & Söderlund 1999).

Hence, it is not only the municipalities who are forced to experiment in the SLIP-case.

To trace this I have to outline the origins of this problem, namely from the conception of what technological artefacts are. The story could be explained thus: 'Research on innovation in the 1960s and 70s perceived the process of innovation, with few exceptions, as a linear process from knowledge, through production, to a more or less unproblematic phase of diffusion' (Aune 2001:8). This assumption that the trajectory of a technological artefact is a smooth process of diffusion where the engineers 'design technology, managers produce it, salespeople sell it, tradespeople distribute it, users use it' is argued by Bijker to be simply wrong (Bijker 1992:75).

Rather, as Aune states on presenting the findings by researchers in investigating the shaping of technology and societies: 'These studies, which combine a technology/constructivist approach with elements of cultural studies, have shown that further development of the product takes place when it is put into use' (Aune 2001:8). Although Aune is interested in the end-user and argues that they do not relate to or use technological artefacts passively, this quote points to the fundamental phenomenon concerning inventions: products and technological artefacts tend to keep on developing and the innovative process is not restricted to and finished in the laboratory. The inventions keep developing even when they have diffused into the market.

INSIDE/OUTSIDE: SHIFTING THE LABORATORY

One way to deal with the problem is to re-define the borders of the laboratory setting and this is what the LIP-policy in effect tries to do. This re-definition stems from the heart of all modern planning, understood as the dream of rational control over development and existence (e.g. Healey 1996; Mabin 2000). The problem is that you cannot plan the development in a laboratory. It may be possible in a workshop, when you assemble according to a routine done times and times over, but in a laboratory? The innovations, the 'new technology', that are called into existence are not that static (see Law & Callon 1992).

In the case of the SLIP the inside/outside of the experimental setting then becomes central (Law & Bijker 1992:295 ff). If you believe it is morally right to experiment among people (i.e. to use 'society' as laboratory) then you also have to believe in that the parameters are controllable. Here the idea enters that politicians actually have that power and control: i.e. that you know all the possible influences on the project (but not necessarily how they influence) and that you thereby can defend the different costs that shows up to a public that influences budgets.

The LIP-decree pushes the limits and re-locates the laboratories and experiments to the outside, to what in contemporary social science jargon is called everyday life. History shows several examples of public financial policies that shifts this way, as in urban planning and design the ideals of functionalism and 'social engineering' (e.g. Lilja 1995; Hall 1996; Hall 1998).

The application routine in the SLIP is important here. One civil servant articulated this in a comment on the rules for handing out the money and the situation in Hammarby Sjöstad:

"If you want to hand out money for development, and at the same time says that you have to know exactly what you're going to develop, then you lock so much of the thinking... It's crazy, two years to develop. It's almost impossible to make improvements during the development phase, because then you depart from what you stated in the application. And then you have to account for everything meticulously – even as you're not finished!"

These procedures either contradict the intention of LIP to support 'new working methods' or the experimentation needed to develop and implement non-conventional technology.

To see what defines this imaginary border that delineates what is inside and outside a laboratory (or the workshop where innovations are given material form), Callon's (2002 [1998]) analysis of the market is useful. The argument could be stated: the laboratory border is constituted by economical considerations through the practice of framing an object. The risk, and the consequential distrust, in non-conventional technology could be traced to the non-calculable and frankly, in the terminology of the stakeholders, the fear of *negative externalities* when investing in or implementing these systems or artefacts.

Most of the time the implementation of technology is really seen as synonymous with the mobilisation of technological artefacts to do a job, like hiring someone or something for a specific task (as the ecological modernisation discourse would also agree upon). It becomes a question of the agent's (as organisation or individuals) competence and/or confidence in entering the path wholeheartedly. Callon defined negative externalities thus:

What the notion of externality shows, in the negative, is all the work that has to be done, all the investments that have to be made in order to make relations calculable in the network. This consists of framing the actors and their relations. Framing is an operation used to define individual agents which are clearly distinct and dissociated from one another. It also allows for the definition of objects, goods and merchandize which are perfectly identifiable and can be separated not only from other goods, but also from the actors involved, for example in their conception, production, circulation or use. (Callon 2002[1998]:7-8)

Now, the crux, according to Callon, is the 'impossibility of total framing' – that all frames inherently run the risk of or are subject to 'overflowing' (ibid:8). The risk may be put in this way: non-conventional technology is a risk because the actors who must use it cannot frame it as a commodity. It is too entangled in the relations associated with an experiment or the laboratory, and therefore seen as having no clear, failsafe function. This renders non-conventional technology less calculable in terms of profit and good-will. The actors then want better or bigger insurance against non-conventional technology failing to do the work it is supposed to do. Compare to Callon's argument on what constitutes a market transaction:

To construct market transactions, that is to say to transform something into a commodity, it is necessary to cut the ties between this thing and other objects or human beings

one by one. It must be decontextualized, dissociated and detached... If the thing remains entangled, the one who receives it is never quits and cannot escape from the webs of relations. The framing is never over. The debt cannot be settled. (ibid:9)

To sum it up: inside the laboratory – the artefacts and their functions are not stable; outside the laboratory – they have few, if any, relations to the laboratory and has a higher reliability of doing their work. The webs of relation and the debt are, in this case, the costs of making the artefacts and systems work. The more the objects are still considered to be in an experimental state, the more they will cost both in terms of resources of good-will (from the tenants) and money (from the stock-owners to obtain the competence of the stakeholder to experiment and to cover the unending negative externalities) to maintain their intended function or to tend their development in practice.

THE RANGE OF NON-CONVENTIONAL TECHNOLOGY

This problem can be solved through the interpretation of non-conventional technology as merely higher standard variants of conventional solutions. This loophole is really given within the decree, and the stakeholders use it to evade (more or less) the imperative of moving the laboratory into their everyday practice. Even if the LIP and the Government uses the notion of ‘new technology’ in the decree, it is rarely the case that the projects have tried to implement ‘new’, in the sense of formerly unknown or unused technology. That there is seldom ‘new technology’ in the projects nationwide is also evident in the National Audit Bureau’s survey and that a definition on what ‘new technology’ means is lacking (RRV 1999:70, 92-93).

Rather the ideas and the artefacts exist: it is the standard, system or particular solution that is not commonly used. It is difficult to make this distinction between new and non-conventional technology when the actors use the terms more or less as synonyms. Most actors understood – when explicitly asked about it – ‘new technology’ as developed more or less in this minute for this particular project or that they take active part in developing it (not only through procurement specifications). When defining for example white-goods with a better energy efficiency standard as conventional technology, and that the difference in standard was subsidized by the SLIP, one actor put it: ‘No new technical solutions, more about choosing a more energy efficient product, really, that exists on the market.’ Although it is better than nothing at all in terms of energy use, this runs directly against what is stated in the LIP decree.

The suggestion here is that there is a weak and a strong form of non-conventional technology. So the usage of the term non-conventional technology follows from the range between ‘pure’ innovation on the one side and ‘merely’ higher standards on the other. The former being new or emerging and often very unstable objects, whereas the latter has a more stabilized character in its usage, and thus easier to frame. Another way of putting it is that the latter is the outcome of the negotiation or compromise with the pressure on new technology and ‘doing things that work’.

In the range of non-conventional technology the stakeholders also act or speak on the behalf of their tenants com-

binning economic considerations in explaining their aversion towards experimentation. One stakeholder, or two representatives of an organisation interviewed together, stated:

A: “What we’ve done is to choose solutions that are at the front lines, but they have to be reliable enough, it must be tested technology and easily manageable technology. We are, after all, a public company...”

B: “Exactly, we don’t want to go into pure unproven technology. But, on the other hand, we are collaborating with [an energy utility company], as I mentioned, for Individual Measurements... That’s quite a new system.”

A: “The sun panels have an area of 390 square meters. [The interviewee comments that the sun panels are a reliable technology on villas and one-family houses and have worked really well:] They cover, for 125 apartments, half of the yearly need of tap water ... Otherwise we’re maybe not that ‘top of the line’, we’re not really there, because it’s the tenants’ money and we are a municipal company, somewhat more responsible.”

Another stakeholder even forwarded a fairly prejudiced argument for not using cutting-edge technology, when speaking for the people that are to use the solutions. This actor considered implementing an energy efficient measurement system. But some controls were too sensitive to damage, so for management reasons they turned the project down. It would only make a profit if it ran without trouble, and they judged that it was too sensitive and even ‘too intelligent for the tenants’.

Yet another example is to be found in connection with the SLIP procurement on ‘requirement guided’ ventilation. One actor thought that the systems SLIP was procuring were ‘bad and too advanced’. The reason for this was the argument that customers do not want a lot of buttons to push and ‘electrical technology that breaks down a lot’. The actor made a simplification of their own seen as more ‘robust’ and which was not subsidized.

The actors know that this interpretative manoeuvre sometimes turns out to be a green façade on their business, but that they also must show interest in taking part in the experiment, especially in Hammarby Sjöstad. One way to handle this dilemma of non-conventional technology is to simply categorize it as a demonstration project. One actor, on solar cells used in public areas in a couple of houses in Hammarby Sjöstad (stair cases, basements), said the technology works but:

“...it isn’t cheaper energy than buying it from [an energy utility], it’s rather more expensive. It’s not something we’ll build into another project unless we get subsidies for it. To be honest, it’s a little bit of a play for the galleries. But if no one tries it, the technology won’t get cheaper anyway.”

Demonstration projects are promoted by the SLIP (SLIP 2002). They are located somewhere in the middle of the non-conventional technology range as they are to prove and show the reliability of unconventional technologies. For example, one private actor talks about doing ‘pilots’. Pilots are a way of ‘legitimate’ experimenting outside the formal perimeters of the laboratory through real-life/time testing. Al-

though demonstrating innovations is not supposed to be a testing – it is supposed to work – it is rarely so when the public is watching (cf. Latour 1996:56; Law & Callon 1992:34; also the various JAS-aircraft demonstrations for the press and the public in Sweden with its spectacular crashes). Thus, setting the project as a pilot does not escape the impossibility of total framing either. An actor commented this on what technology they got subsidies for:

“[It is] really not new technology... it’s developed technology. I mean, this with subsidies for increasing the insulation thickness of the walls and such, it’s not an innovation in that sense. To do windows could be, as you’ve tried to lead the technology development. But it’s really no new technology, only *improved existing technology* and made the windows better. When it comes to the competition, solar cells you could say is *a technology in progress, it’s perpetually improved* – you get solar cells with better and better efficiency. But it’s, no, it’s only *an exhibition, an attempt, a test*. It’s nothing that, and that’s known, is self-financing on a long term. It costs [the company] a lot of money and they’ll never get it back, ever. But one wants to join in and try, how it works and somehow [be] a part of the development.” (Emphasis added)

Doing demonstration projects or pilots is a way for the stakeholder to defend the experiment and to acknowledge the entanglement of the laboratory with the technological artefacts while trying to comply with the ecological modernisation discourse acting through the LIP-policy.

SLIP as a bridge over troubled waters?

The LIP was explicitly conceived as a programme to help the implementation of environmentally sensible new technology in Swedish municipalities, i.e. as a bridge from lab to customer. What the Stockholm case shows is: if the bridge is built upon an idea that when a product leaves the laboratory it works and can be framed to a high degree as a commodity it will not bridge the conflicts in reality – the troubled waters of non-conventional technology. In general the barriers working against the bridging between the laboratory and the end-user is a troubled water of efforts to frame non-conventional technology in a workable way for all actors. The questions we have to ask are: how much experimentation is needed, how much of the laboratory must be located ‘outside’? And how do different actors negotiate this redefinition of the laboratory’s borders?

The negotiated definition and implementation of non-conventional technologies stems from the actors being boxed in by the programme. This leading them to implement not-so-exciting artefacts in terms of innovativeness (though still a small contribution concerning the overall energy and resource efficiency in Stockholm). All the stakeholders and actors are quite open on that Hammarby Sjöstad will not reach the environmental targets and that in the existing stock very little actually happened in terms of technology implementation – compared to the visions in the applications. Successful projects are either mobilizing the negotiated definition of ‘new technology’ – higher standard – or the competence, motivation and resources within their organisation and to some degree supplied by the SLIP (e.g.

through joint procurement) to experiment – i.e. to shift the laboratory to their assembly line. Or it is too early to say if the projects were successful or not – in experimenting perhaps yes, but as viable, efficient and economically rational for the actors it may take a while.

How could LIP and SLIP have been a bridge between laboratory and end-user? In this case the contextualisation of the setting also shows the barriers to the implementation of non-conventional technology: they are as much orthodox thinking among actors, as incompetence in some cases to follow the accountancy routines (which makes the projects cost a lot), as formal politics redefining the setting or stalling the projects (which in this case had a window of only four years), as policy in the city concerning urban design, as a mix of economic rationality and emphatic reasoning on behalf of the end-users, as a problem of how to handle the imperative of ecological modernisation when the means (non-conventional technology) escapes the definition of a commodity. It is hard and not realistic to pin down one key element in these processes.

Otherwise this programme, this policy tool, is a one-hit wonder, because it does not lead to an exploration of the weak form of non-conventional technology in the near future, which was really the *raison d’être* in the ecological modernisation discourse. Some actors comment that the cost of the solutions used were too high and not covered by the savings, so these are not successful for the actor (maybe in the know-how gathered for the future, but this could also be a deterrent). Here the explanation – in this particular case – of the private and public companies’ profit interest as a hidden agenda effecting merely a greening of their façade and not to seriously implement non-conventional technology is too simplified. Business-as-usual stems from the lack of competence, resources or will to accommodate the laboratory into their everyday practice.

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Glossary

EDs: The Ecocycling Districts in the SLIP, Hammarby Sjöstad, Östberga and Skärholmen.

GFK: The Stockholm Real Estate and Traffic Administration.

LIP: The Local Investment Programme initiated by the Swedish Government in 1998.

Million Programme: A public housing programme that built around 1 million dwellings between 1965-74.

SBK: The Stockholm City Planning Administration.

SLIP: The Stockholm Local Investment Programme funded by LIP but run by the city.

Acknowledgements

Goes to Nils Borg and Borg & Co for moral and material support. And to Judith Utz and the Hedonist Geographers in Berlin (Katharina, Tom, Matze) for draft comments and sounding-board.

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ICE – International Consulting on Energy, Paris, France

Proceedings layout and production

(in co-operation with the editing team)

Nils Borg, Ylva Blume, Therese Lindström
Borg & Co, Stockholm, Sweden

Yrsa Westerlund
TypaText, Stockholm, Sweden

Lars Johansson
Template Publishing, Uppsala, Sweden

Cover design

Klas Björkman
Björkman & Mitchell, Stockholm, Sweden

Printing

ABA Kopiering, Stockholm, Sweden
Åtta.45, Stockholm, Sweden (cover)