Looking Inside the Box of Market Transformation

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Experiences from the efforts to improve programmes for energy efficiency mostly indicate an opportunity to use the market forces better. Market transformation has recently come to be an expression for the wilful act to change the marketplace; to add more choices and varieties of goods for the customers, to reach a higher levels of market penetration, and to get a quicker and earlier uptake of new products on the market. Mechanisms for wilful changes of the marketplace include changes of institutions, technology and actors.

Technically speaking there are a lot of unexploited opportunities which make economic sense to industry. They are however barely recognized, greatly depending on the dominant way of analysis concentrating the interest on supply side issues. Even Demand Side Management (DSM) has been defined in relation to energy supply side function and deficiencies rather than being treated as a tool to first meet customer needs and in addition improve energy system performance.

The necessary product innovations will however need a shift in focus and require conscious institutional changes to come forth more easily.

INTRODUCTION

Market mechanisms can be used more consciously to get the market to better support energy efficiency and sustainability. Exercising the market mechanisms in this respect means institutional improvements which goes beyond the use of only financial mechanisms for correction and goes further in combination of persuasive instruments.

General treatment of economics in shaping of programmes forgoes that systems considerations and the learning effects can be systematically exploited to favour the programmes. Programmes are mostly targeting market failures and disregards active interventions to reduce the more common market barriers. The major institutional instrument for such a Market Transformation is the Technology Procurement which, however, has to be combined with other activities to give full impact. Market Transformation will here be regarded as an act taking place by use of the demand side as the motive force.

The extensive debate and effort to work with Demand Side Management in recent years has largely been based on the assumption that Supply Side was working economically correct but had to be balanced. With this view there are only two ways to correct the situation. Either to establish a perfect market with deregulation of the supply side or to introduce correctives such as taxes or subsidies. DSM-activities are generally perceived as utility instruments to bring balance into the energy system. Corrections on the demand side are then only remedies for shortcomings on the supply side which ignores that the demand side will continue to underinvest in energy efficiency.

THE DYNAMICS OF CHANGING TECHNOLOGY

Programmes for DSM and energy efficiency are mostly made on basis of static marginalistic analysis and often with data input reflecting present state technology. Most real world changes also comprises costs or benefits which can raise or lower the actual costs. Such dynamic elements should not only be taken into account but also, if possible, systematically exploited.

Systematic Interactions

The traditional way of analysing changes is to make supply curves for energy efficiency improvements which are compared against the actual energy price. Such curves can differ considerably depending on available information and on the designers beliefs in how changes can be obtained (Fickett, Gellings, Lovins 1990, 15). The analysis are mostly made ‘‘ceteris paribus’’, i.e holding all other things (than energy use) equal.

Most real life measures are interdependent and therefore there is a risk that the same efficiency gain is accounted for twice in such an analysis. Typical such errors is when not taking into account that heat losses from equipment reduces the need for heat supply. This has been brought to attention recently in a study advocating that packages of measures should be used for calculations and not itemised (Stoft 1995, 120). If part of the efficiency gains from measure II, in figure

1, is already accounted for in measure I the supply curve for Energy Efficiency will shift from S1 to S2. The Efficiency measures to the level A, which earlier were found profitable, are now unprofitable.

The observation has however still more to do with corrections of static approaches than with dynamics. The more pressing and important issue of dynamics is that the calculation should have been made ''mutatis mutandis'', i.e all things that changes should be changed also in the analysis, and the extra benefits occurring should be accounted for (Turvey, Ralph. 1971, 78). Most cases where energy efficiency is considered also means changes in the overall performance of the system. An energy efficient lighting, using HF equipment also affects the human behaviour towards the better; less headache, better work performance, less stress etc. The same goes for Improvements in office machinery which affects the climate system of the house and for windows which affects the installations for heating. A mutatis mutandis calculation should hence compare the added investment (Ia) to the less energy use (Er), but also take into account the less investments in systems (ΔIs), lower maintenance costs (ΔM) and the benefits in productivity (ΔP). Profitability requires that: $\mathbf{Ia < Er + \Delta Is + \Delta M + \Delta P}$

Such a calculation could then end up as in the figure 2 showing that energy efficiency improvements carried further to the level B gives a higher profitability than at the level A. Stoft acknowledges such factors (Stoft, S.E. 1995, 127) but concentrates on backdraws such as slow turning in CFLs and high noise in compressors. Such problems do exist but can be cured and be used in an offensive way, as have happened in technology procurement projects for washing machines where concentration has been on both noise level and energy efficiency (Westling, Hans. 1995, Appendix 4). When refurbishing buildings such effects can be discovered and used as happened in the headoffice for Södra Skogsägarna in Sweden. They reduced electricity use for lighting and heating with 50%, but had an conventional pay-off period of 8 years, which was unacceptable to them. They made corrections for better lighting and reduced noise, which affected work performance. The calculation was remade but now with a subtraction for an estimated improvement in work performance, measured as less absence from work due to sickness. They then came out with pay-off 6 years which was accepted because the project also added to the corporate profile and image (Lundberg, F 1995, 3).

Figure 1. *Corrected Energy Supply Curve (Ceteris Paribus)*

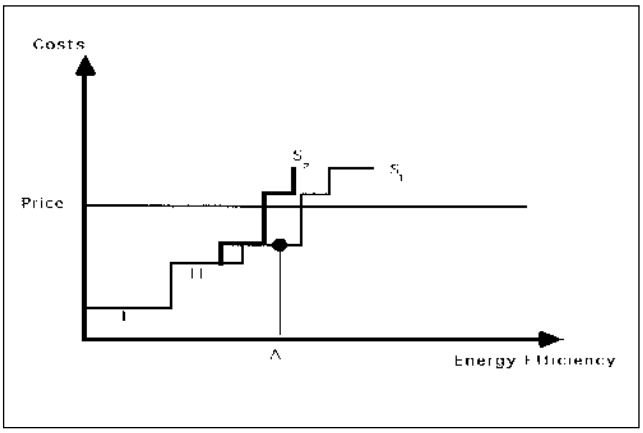
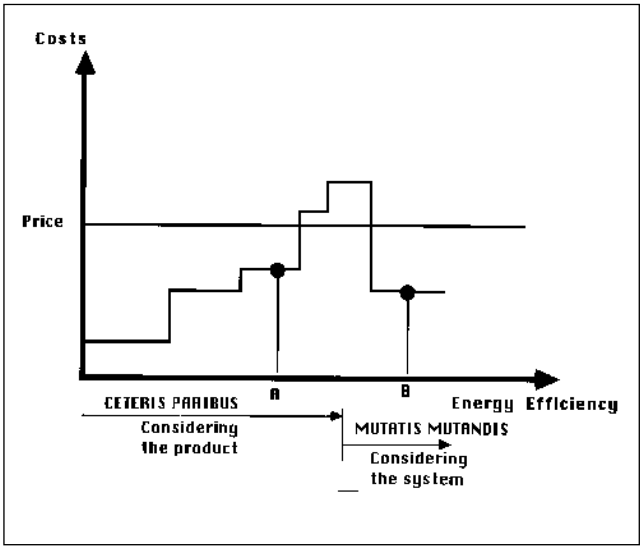


Figure 2. *Calculations with all Benefits Taken Into Account (Mutatis Mutandis)*



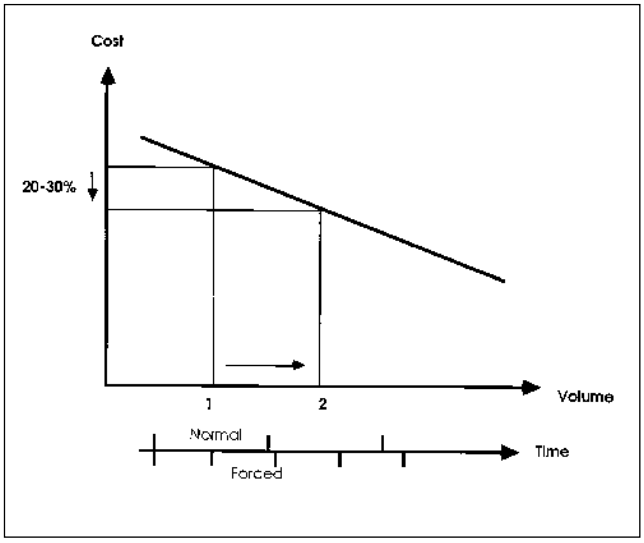
The Learning Curve

Changing conditions for delivery when larger scale activities are considered or when a longer time period is overlooked can be subject to exploitation. The effects are mostly captured in the ''learning curve'' which says that the bigger the volume the less the cost. A rule of thumb says that double the volume reduces unit costs by 20–30%. The reason is that scale of economics occur in production and that competitors with new technical concepts are entering the scene. (Flavin, and Lenssen. 1994, 304–05)

This learning effect can be exploited systematically. A projected growth in volume will have effects on the costs and the prices. A forced growth in volume will make these effects arrive sooner. Such force is at hand when procurement is made by central purchasers or by a group of co-operating local purchasers.

The actors on the market learn differently depending on their role in the system. According to one typology the users

Figure 3. *Learning Curve*



are ''learning by using''. A process that is headed by some lead customers. The engineering and marketing departments of the producers are ''learning by failure'' and the manufacturing department is ''learning by doing'' (Maidique and Zirger 1988). Such topologies can be very useful in trouble-shooting programmes for wider dissemination of products.

ACTORS AND INSTITUTIONS. BUSINESS AND INCENTIVES

If there is a way to reallocate resources to achieve more satisfaction for at least one actor without harming that of others, it would be desirable to do so, according to the Pareto theorem. In this part we will show that there are reasons to believe that there are institutional failures on the market that, if they can be removed or reduced, will work towards a greater welfare.

Innovation is Forced by Balancing of the Powers

There is a general unbalance between suppliers of commoditites and the buyers. Customers are free to buy what the producers offer but have few possibilities to excersise influence over product development. In studies of the innovation process it has been noted that consumers traditionally play a passive and reactive role. Producers try to foresee how consumer learning will affect future demand and the consumers try to catch up with the initiatives of the producers. The exception is professional users who are well focused and ''controls'' their sub-suppliers (Lundvall 1991, 450–51).

The user of energy is seldom interested in Energy Efficiency in its own right but more interested in what kind of satisfaction the product brings him. The evaluations made of the Swedish Programme for Technology Procurement (Teknikupphandling, cf US Golden Carrot Project) are investigating the arguments used by purchasers and suppliers in their mutual contact and decisions (Göransson and Faugert 1994). For Energy Efficient Lighting, equipped with HF ballasts, nine arguments have been listed, of which six were related to comfort and work performance (flicker, dimmer control, heat, sensor control, novelty, easy maintenance) and three to economy (costs, lifetime of tubes, grants).

For companies supplying energy-using equipment there must be sufficient economical incentive and financial ability. Textbooks often quote that neither perfect competitors nor pure monopolists have the incentive to undertake necessary research, but oligopolistic firms have. Under perfect competition there is furthermore lack of financing abilities in each of the companies. Thus under the ideal welfare conditions of perfect competition there is no self-motivated dynamic growth on the market (Ferguson and Gould 1975, 359–60). A more qualified view on dynamics is saying that: ''. . . . . a rapid technical progress needs a subtle blend of competition and monopoly with more emphasis on the former than the latter.'' (Scherer and Ross 1990, 660)

Present trends towards more international markets and improved competition widens the gap between the customer and the producer and reduces the motivation for producers to innovate. Circumstances that call for institutional correctives.

Institutions and Institutional Changes

Innovations can be regarded as the introduction into the economy of new knowledge or new combinations of existing knowledge and most innovations are the result of interactive learning processes (Edquist, Johnson 1995). This is essential to fully understand the Market Transformation as being something more complicated than just a new product released and delivered.

There has been an increasing attention on the role of institutions in the economic system though the concept of institutions varies (Edquist, Johnson 1995). In everyday language institutions are not distinguished from organisations but Edquist and Johnson arrive at a definition of institutions as ''sets of habits, routines, established practices or rules which regulate the relations between individuals and groups.'' (Edquist, Johnson 1995, 11). This way of looking upon institutions opens for rather different policy options.

The institutions described as rules of the market are in constant change. Among the more important changes are the deregulation of markets. Changes of the organisations are

then a necessary adjustment to ensure that basic goals and intentions with the changes are met.

Deregulation and Demand Side programmes.

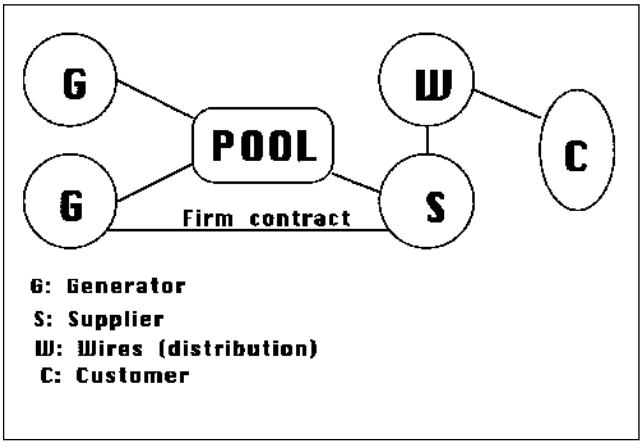
With the emerging competition among utilities many hope that energy efficiency will be the competitive edge. There is little evidence that such should occur, at least in the short run, both because of the actual incentives and because of the culture in the companies. Electric utilities perceive the wish for energy efficiency in and use to be an external demand to which they respond in favour under external pressure but abandon easily when the pressure is relaxed (Olerup 1995, VI 20).

The operational consequence for national administrations should then be to either maintain the pressure or to turn to another body deliver the services. The ongoing restructuring of business in the world is one such response to maintain pressure. Basically it is a lighthanded pressure where it is assumed that energy efficiency should mean business to the utilities and in some countries the pressure has been attenuated by setting up funds formed for utility involvement such as the Energy Saving Trust in UK or the Regional Energy Information centra in Norway.

The roles for utilities in a restructured market will be more distinct but also more fragmented. The generators sell in competition via a pool or a firm contract to a supplier who, in competition, sells to a customer and delivers via the wire company.

The opportunities for companies, to find incentives or relevant pressures, under different organizational structures of the market are shown in this table as interest for specific outcomes.

Figure 4. *Company Relations on the Deregulated Market (Principle)*



THE INSTITUTIONAL FRAMEWORK OF MARKET TRANSFORMATION

Studies of different programmes for energy efficiency show that information, incentives and standards all have their place (Robinson 1991, 640). Complexity calls for a move away from pure market-based or attitude-based concepts towards programmes more aware of institutional factors and requiring active comprehensive roles in delivery. It also indicates a significant need for substantial government leadership (Ibid, 641–42).

The market is, however, the only instrument we know that works well in distributing commodities according to people's wishes. The distribution mechanism has to be used fully but the allocation might have to be adjusted. The following will not be a prescription for how programmes are shaped but an outline for target issues for market transformation boiling down to the need for institutional restructuring in line with Robinson's findings.

To have a lasting change induced to the market there is a need to have changes in three areas:

- Performance of products; to ensure that superior characteristics are favoured and that inferior ones are changed or are leaving the market
- Penetration to the market; to ensure that market uptake and response is either secured or tested
- Partners in dissemination are participating in, rather than slowing down, the processes.

Improved Performance Widen the Choices

In order to have a large scale change towards energy efficiency the first thing is to ensure a wider variety of choices for customers. Very good products should be made even better and the sufficiently good ones should be supplied from more manufacturers. Customers must find that products suite their special tastes or needs and are easily available if the price reducing volumes should be attained. The measures to get this are technology procurement and labelling. At the other end of the scale inferior products should leave. Standards have to be used, if those products do not exit the marketplace voluntarily (Nilsson 1995, 23).

Minimum efficiency standards can be used to work on the front end or force it forward. This has been the case in the U.S. (Swisher 1996, 12). It is however hardly a matter for

Table 1. *Supply Side Actor's Interest in DSM and Energy Efficiency Activities*

	Avoid new capacity	Use existing capacity	Positioning on market
1. Vertically integrated companies	NO (INTEREST)	YES	NO
2. Deregulated Market			
a) Generators		NO	YES—
b) Suppliers	NO	NO	SOME
c) Wires (T&D)	YES	YES	NO

Figure 5. *Market Transformation in Terms of Performance*

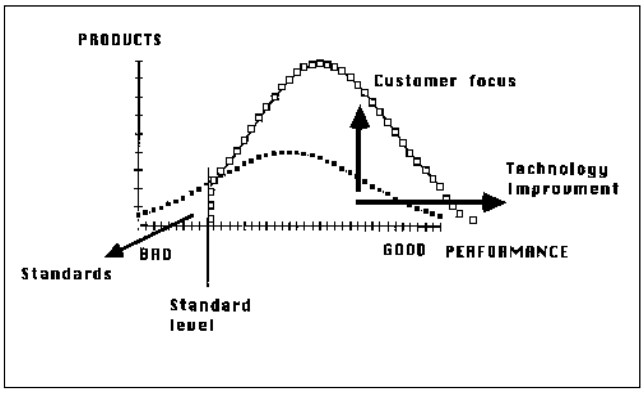
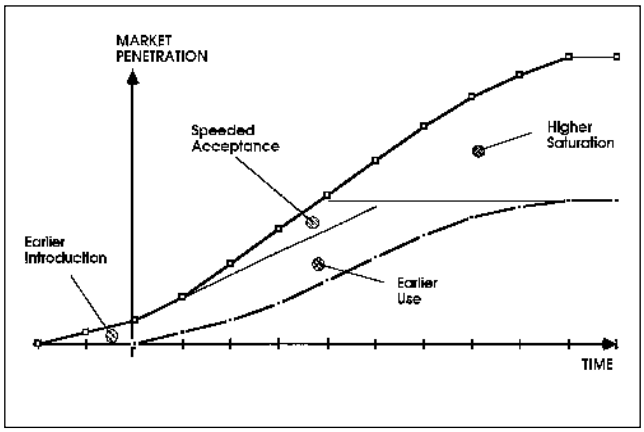


Figure 6. *Market Transformation in Terms of Penetration*



debate which instrument is most useful as long as one keeps in mind that the essential thing is to make good products the preference of the buyers, i.e to have wider variety for choosing the better alternative.

Penetration to Exploit Dynamics

The actual response from the users in the market is measured by market penetration and the speed of change (Nilsson 1992). Introduction, building up and saturation in the market are three factors which can actively achieve market transformation.

- Earlier introduction and earlier use apply to new products on the technology front. Technology procurement and technology demonstration are means to achieve these goals. In some cases the earlier introduction could encompass introduction of products which otherwise never should have reached the market. A monitoring and evaluation programme will ensure that the ''learning by failure'' process is fully used.

- Speedy acceptance can be obtained once the proper function of the product is secured. Certain user groups, which can be assumed responsive sooner than others, should be targeted.

- Higher Saturation is the most well-known and tried goal and financial incentives have been used extensively. The incentives for companies having the necessary products should however be good enough to support a market and give reasonable profits. There may be certain niches of customers or certain actors which need to be given support to extend the use of the products.

Participants Influence Each Other

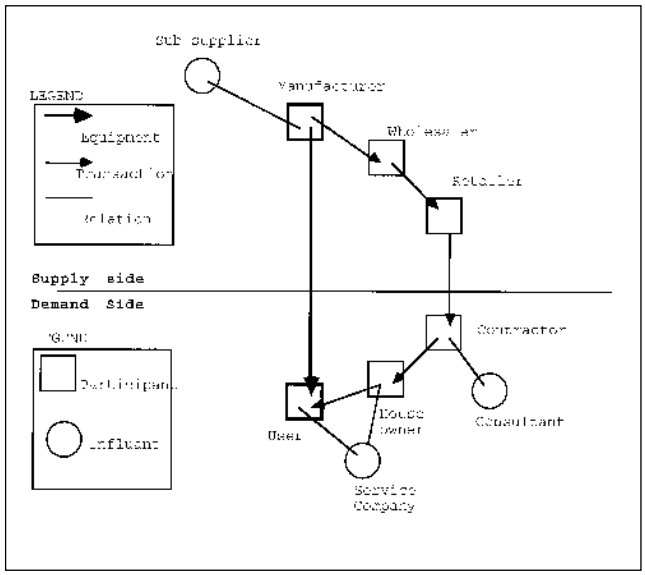
There are many participants in moving equipment from the manufacturer to the user and all of them have to make their living from the transfer of goods. Any one can halt or even stall the process of dissemination if he finds his business in jeopardy. This feeling frequently occurs when planning for a technology procurement and shows that the preparation of tendering companies before a bidding is essential. If preparation time is sufficient most prospective participants get time to adjust both minds and management to the new situation.

Also after a procurement there is a risk that a participant might have doubts about the new technology. The dissemination of HF-ballast equipped luminaries has been somewhat

halted by installation companies which found it risky to make installations where one or two follow-up inspections would wipe out their profit.

The chain is highly relevant to the ''learning by failure'' concept and the policy implications might be necessary for demonstration and training, however, the companies must find it in concordance with their business idea and not only react in favour of an external demand they do not fully accept at heart (Olerup 1995, VI 15–21).

Figure 7. *Participants in Dissemination of Technology*



MARKET TRANSFORMATION TRACED

The following cases have all been picked from picked from the experiences of the Swedish Energy Efficiency Programme. The main difference between these and the most quoted U.S. cases (e.g. the super efficient refrigerator and horizontal axis clothes washers) is the role of the utilities in market transformation.

Combined Refrigerator and Freezers

This procurement was initiated by some of the major building companies in Sweden which have a large stock of flats built during the sixties that now need to be renovated. The companies equip the flats with combined refrigerator and freezer although the tenants are responsible for operating costs. In spite of this split incentive many of the companies argue that, when they are providing the equipment, they want it to be modern and to comply with a general view of environmentally friendliness.

The performance requirements in the RFP meant improvements with 25% measured to the best product on market at that time, 35% to the average sold and 55% to the average installed. The winner in the competition actually performed even better by beating the RFP desired level with another 10%. The deliveries in the first series procurement are very small compared to actual market. In the end there were 780 units on a market of some 100 000 units a year. The delivered products also was higher priced than those already in the market. The programme compensation to the purchasers did not fully cover this price difference.

There is however a risk that the customers will have to pay more for this new equipment than they will save on their electricity bill. The variety of supply of combined Refrigerator and Freezers have been tracked over the time period 1991–95. The first year is the one where the design obtained by the Swedish program for technology procurement first occurred. In this analysis the ten best products have been put together for each year.

Comments: This case illustrates Market Transformation with good result in terms of Performance but less in Penetration as far as the winner is concerned. However, competitors have caught up and the change in supply has been remarkable. Among the retailers and the contracting companies the use of these better products is gaining ground. To assist them special campaigning material has been developed. For the manufacturers the important factor is their possibility to change models when retooling and thereby learn by doing which ends up in reduced cost with volume.

Lighting

Lighting in commercial areas can be improved from both an energy perspective as well as ergonomically. One of the key elements is the use of High-Frequency Electronic

Figure 8. *Relative Changes in Price and Performance of Refrigerator/Freezers*

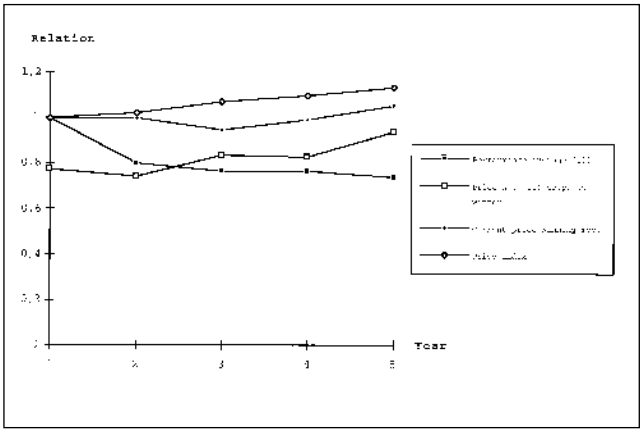


Table 2. *Market development for HF-ballasts in Sweden*

	1990	1991	1992	1993	1994	1995 (6m)
Thousand Units sold	10-20	50	100	220	320	350

Ballasts. These reduce the energy loss by some 15–20% and further enable improved control of lighting according to occupancy or to daylight.

The Swedish Programme issued a formal procurement for HF-Ballasts to bring up volume, thus reducing prices, and securing performance levels. The procured batch was 20000 units, but with the options for enlargement it totalled 46000 units. Almost simultaneously a demonstration programme was launched for office lighting where requirements were laid down for the fixtures and a programme enabling important buyers to get more hands-on experience from new lighting designed to their own circumstances. The units procured had their advantage mostly in the volume/price relationship. In the actual installations the reduction in energy use has typically been in the range of 50%.

As a result spreading of HF-Ballasts has multiplied by 10–20 in 3 years. They have captured approximately 30% of the relevant market today. Interviews show expected continuance in market growth.

Comments: This case illustrates Market Transformation with small results in terms of performance but excellent in penetration. The Participants were reluctant from the beginning but gained confidence when they saw the market niche for quality products remain and grow while the standard products market was reduced during the recession in the building industry. The installation companies are still a bit reluctant but today they receive more information and training through their business association. It is a clear case of systems applications with multiple advantages in use and with a clear learning by failure among the participants.

Windows

Improved windows where the heat transmission is reduced by better insulation (U-value $<=$ 1) have been procured from two winning companies, each of whom delivered 5000 m2 of windows installed. The technical requirements were set for entire window construction and not only, as usual, for transmission through the panes. After the delivery and complaints from architects that the winning concepts were ugly there has been a programme to improve the esthetics of the windows. Three more companies have joined the programme. The test installations have proven the basic assumption that use of these windows favourably affects the heating installation. The result is that houses equipped with these super-efficient windows have both lower investments and lower maintenance costs. A con-joint analysis on customers willingness to pay for improved windows shows that the extra cost for the windows (300–500 SEK per m2) is acceptable even if installation costs for heating is not affected.

At present a test series for new superinsulated detached one-family houses, using 50% less total energy, are under construction using these windows. The Road Administration also has started a programme using the windows because of their noise reduction capability.

Comments: This case illustrates Market Transformation with good result in terms of Performance and good prospects for Penetration when the business for building construction catches up again. Among the Participants the architects are extremely important and have to gain more experience as well as given the opportunity to add more of their own ‘‘values’’ to window construction.
The systems advantages are important but have to be experienced among more participants. The learning process has to be acknowledged among all actors.

Heat Pumps

A recent procurement of heat pumps specially designed to suit smaller houses equipped with electrical resistance heating or boiler heating has just been finalised. The result showed an improvement in performance by some 30% but also reduced costs by an equal proportion. This reduction brings pay-back down to approximately 7 years, which is essential to get a market response of some magnitude.

The producing companies have faced a ramp up in orders and in stock market value. The electrical utilities have shown great interest and use these concepts in their profile advertising. Their business interests are however to replace oil use with electricity rather than to replace portions of the electrical resistance heating.

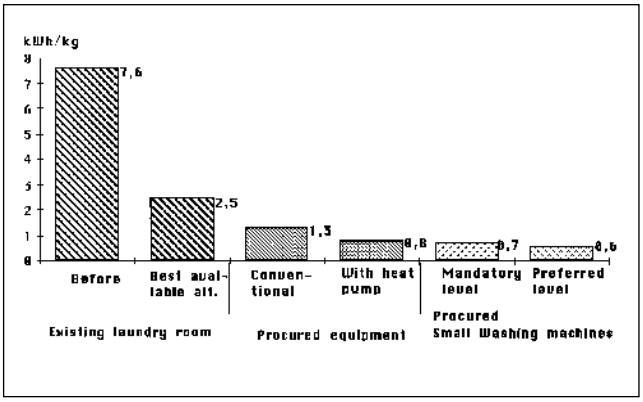
Comments: This case illustrates Market Transformation with good result in terms of Performance and probably also Penetration if the price (pay-back) can be reasonably well controlled. Among the Participants the utility interest and the wide spread interest among also installation companies is a good omen for the future. The important factor among the suppliers is the possibility for retooling and thereby using the learning by doing and reducing cost with volume.

Clothes washers and dryers

Procurement has now been made for both laundry machines and tumble dryers and for clothes washing machines and drying cabinets. Both alternatives are distributed also with some assistance from the electric utilities although the housing companies which were also involved in the refrigerator/ freezer procurement are the buyers. The laundry room equipment has been successful except for the tumble dryer with heat pump. It was designed for a niche market having underdimensioned ventilation capacity but has been too expensive for the market. The competitors to the winner responded immediately with similar equipment. One of the most important factors for the buyers has been the reduction in noise which extended the utilisation of the laundry rooms with nearby flats. The smaller winning machine has not yet reached the market but the biggest competitor responded with similar equipment which seems to have gained a good market share already.

Comments: These cases illustrate Market Transformation having obvious good results in terms of Performance and probably also Penetration. Among the Participants the utility interest is good for the future but the exiting distribution system, with retailers, works well enough. The important factor among the suppliers is the possibility for retooling and thereby using the learning by doing and reducing cost with volume. For the customer the combination of profitability and extended use of laundry rooms has been most important.

Figure 9. *Energy Intensity for Washing and Drying*



CONCLUSION

The market economy as a distribution system and a well functioning blood-stream in the body of the society, works in support of Market Transformation, but needs some fine tuning to adopt more of the efficient technology quicker. It basically also works as an allocation system but needs some new or renewed institutions to ensure that the learning process for innovation works at its optimum.

One such institutional improvement is technology procurement (Teknikupphandling) which has proven its abilities but needs to be carefully crafted for each single case or product and needs to be able to be adjusted according to information from monitoring of the market as it transforms. Other institutional improvements (e.g labelling, standards, product campaigns, design software, professional training, troubleshooting) have to be made to support the lasting changes among all participants. Such changes must recognise business realities for the participating companies. These need time to adjust but might very well end up being the champions for the change.

The new institutions will be perfectly in accordance with any way of economical thinking since their roles will be mainly to reduce risks, search costs and transaction costs for both suppliers and purchasers. The technical requisites exist, but full use of systems and of the learning processes finally coming down to further lowering of costs, must be emphasized.

The new institutions must find a base to work, not only as the concept here dealt with, but also in an organisational context. Such could, on a national scene, be extended cooperation between governments, consumer organisations, environmental organisations, buying industry, trade unions etc, all having a stake as buyers defining what they need and then turning this need to a demand. On an international scene this role could be found in already existing global organisations such as IEA/OECD which might have to set up ‘‘umbrellas’’ for market contacts between internationally cooperating buyers firstly and their prospective suppliers secondly.

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