

Experiences with Technology Procurement as an Instrument for Changes on the Market.

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EXPERIENCES WITH PROCUREMENT AS AN INSTRUMENT FOR TECHNICAL CHANGES ON THE MARKET.

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Experiences with Procurement as an Instrument for Technical Changes on the Market.

Introduction.

Procurements, initiated and/or led by the public sector, have been more and more used as instruments to get sustainable changes in terms of performance of goods sold on the market. Such procurements are used both to launch new products to the market and to raise the volume for products with superior performance characteristics. The procurements might have to be accompanied by other activities that are aimed at making market actors more apt to participate in the process of change. Such a process eventually requires a total change of the market and will entail **NEW** products, **MORE** of good products and **LESS** of bad products, see figure below.

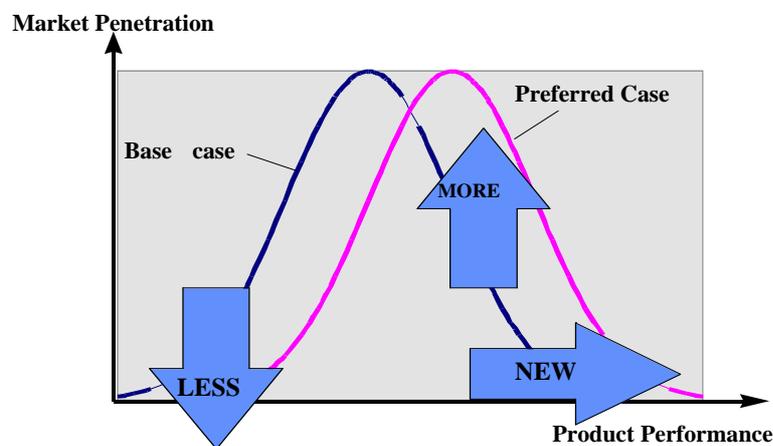


Figure: Effect of market transformation on product performance (Source: Nilsson (1996))

Procurement of this sort has been used for the specific purposes of defence material in most countries for a long time but also for development of large infrastructure systems such as power supply, telecommunication, road building water and sewage treatment etc., all characterised by having one or a few large buyers and equally large suppliers of equipment and systems. The new element in procurement is the application to “fragmented markets” with many buyers and also many (potential) suppliers. This change again has been motivated both for the reason of the buyers who need to aggregate their capacities to get the attention of the suppliers to produce things more suited to their needs, and for the suppliers who need “well informed” and able customers for development of products of such a sort that will get a demand. Naturally not all buyers and not all suppliers have such interests, which sometimes causes discussions over the need for public intervention. It is therefore necessary to remember that a procurement in principle should be open to all to participate but will only apply to those who have the will and the skill to do so. It is further essential to remember that the final goal is a change of total market behaviour and that the participation of those who spearhead as buyers and suppliers is a vehicle to pull of the change.

1. Technology Procurement Achievements.

There are numerous examples of the forcefulness of the instrument, when it comes to the development aspect. The following are those from the Swedish Technology Procurement Programme that was launched in the late 80's. This illustrates several things:

- Applicability to a multitude of sectors, technologies, systems and purposes
- Fairly short time from announcement to delivery of first series (typically 2 years)
- The required performance was mostly surpassed with a good margin by the winner
- The comparative performance whether measured towards best available, average product in market or (average) of existing stock was typically very high (double digit percentages).

Programme		Announcement	Delivery	Required performance	Winner	Improves performance (%) compared to....		
						Best available	Average in market	Existing stock
Domestic	Fridge+Freezer	90	92	1 kWh/liter and year	0.79 kWh	26	32	61
	Central utility room Washing machine include drying	92	94	1.35 kWh/kg of dry washing good	1.2 kWh	-	48	67
	Apartments Washing machine include drying	94	96	0.7 kWh/kg of dry washing good	0.6 kWh	50	80	-
Commercial	HF-Lighting	91	92	Replacing magnetic ballasts	-	-	20	30
	Ventilation Unit	94	96	SFP 1.5 kW(m ³ /s)	Complied	-	50	63
	Ventilation Filters	95	97	-	-	-	-	-
	Refrigerated Displays Racks in Foodstores	96	97	2600 kWh/metre run and year	1745 kWh	50	65	-
Detached houses	Windows	93	95	1.0 W/m ² , K	1.0 W/m ² , K	17	44	-
	Heat Pumps	93	95	Saving 8 MWh/year for a specified type of house	8.3-9.0 MWh	-	-	30 ¹
	Radiator Control systems	94	96	1 MWh (as above)	Complied	-	-	10
	Water Heaters	96	97	Max power loss 70 W	58 W	30	56	60
	Detached houses complete	94	95	Maximum use 8 MWh per year for heating and domestic energy (for specified surface)	Complied (8 entries)	43	50	68
Transport & Industry	Traffic Lights (LED)	-	-	8W per unit	Complied	87	-	-
	Electric cars	94	96	0.2 kWh/km and tonne	Complied	-	-	67
	Factory doors	94	96	18 MWh/year	13 MWh	-	50	-

Table: Technology Procurement Programmes in Sweden (source: Suvilehto and Öfverholm,1998)

¹ The winning heat pump was also 30% cheaper than its best competitors before the procurement.

Also from United States there are some very interesting experiences that goes in the same direction as the Swedish.

- *Super-Efficient Refrigerator Program, SERP* – a project implemented by a consortium of electric utilities whose primary intent was to induce a refrigerator manufacturer to introduce to the market a new, highly efficient refrigerator that exceeded U.S. government minimum energy efficiency standards by at least 25%, yet cost no more than similar refrigerators with normal energy efficiency.
- *Apartment-Sized Refrigerator Purchase* – organized by the Consortium for Energy Efficiency (CEE), the New York Power Authority, the U.S. Department of Energy (DOE), and the New York City Housing Authority. The purpose was to induce market introduction of high-efficiency apartment-sized refrigerators and to save energy costs in public housing in New York and other cities by holding a competition to supply a large number of identical high-efficiency refrigerators to replace out-of-date ones.
- *DOE Sub-Compact Fluorescent Lamp (CFL) Technology Procurement* – a project whose primary intent was to introduce shorter, brighter and more affordable sub-CFLs to the marketplace. These new screw-base CFLs were significantly smaller than the current generation of CFLs, and available in volume prices.
- *Recessed Downlight Fluorescent Fixtures* – a procurement designed to elicit new technologies that would permit compact fluorescent lamps to operate reliably in airtight recessed fixtures installed in insulated ceilings, where heat build-up can seriously degrade performance.

Box: U.S. Experiences with Technology Procurements. Source ACEEE 2002

The experiences related to the Sub-Compact Fluorescent Lamp and the one on Recessed Downlight seem to be the most relevant ones for the Chinese Green Light Programme.

In early 1998 the US Department of Energy set out to develop the market for a new generation of smaller, brighter and less expensive CFLs – a sub-compact lamp. A multi-stage consultation was organised with representatives of the initial target market and a comprehensive list of related stake-holder groups. This included building owners and operators, housing trade associations, lighting suppliers, energy efficiency specialists and retailers. The initial sales goal of one million lamps was exceeded by more than 50 percent and five manufacturers commercialised new products; as a result of the programme, 16 new lamp models have been introduced into the US market at reasonable prices. This programme departed from the usual practice of procurement programmes intended to build markets for new technologies in an interesting way, in that it did not guarantee purchases of newly-developed products in advance.

Results:

- Volume growth: The goal of one million lamps was exceeded by 50%.
- Volume and price/cost: Prevailing prices of 15-22 US\$ dropped to the range of 5-8.5 US\$ (depending on quantity purchased)
- Attribution of impacts to measures: 16 new models were brought to the market, enough to ensure supply capacity. Five manufacturers commercialised new products.

- Performance improvement: A CFL of smaller size to fit into fixture was developed.
- Programme cost: 342 000 US\$ (for research and preparations, no incentives given)

Remark: This very inexpensive technology procurement programme was highly successful in facilitating the development of modified products and their uptake. It involved the conscious building of relations across the product distribution chain.

Box: Sub-Compact Fluorescent Lamp Source: OECD/IEA 2003

Recessed downlight fixtures. Residential recessed downlights have been identified as an energy-intensive product in need of design improvements, so DOE is sponsoring a program to introduce new, highly-efficient residential recessed downlights into the market. Recessed downlights are by far the most popular residential lighting fixture for new construction in the United States. The Census Bureau reports that 20.4 million of these fixtures were sold in 1999. Although precise numbers on the installed stock are not available, 150 million or more downlights are probably now installed in American homes. Virtually all use incandescent light bulbs, so a cost-effective equivalent designed to accept hard-wired CFLs represents an opportunity for energy and cost savings. The difficulty lies in designing recessed downlights that are airtight, rated for insulated ceilings (type IC), and at the same time do not overheat and degrade the fluorescent lamps and ballasts.

The program, implemented by PNNL, applies the technology procurement approach to induce manufacturers to offer downlights that can be installed in insulated ceilings, minimize air leakage, and meet a set of requirements for proper operation of CFLs. RFPs were issued in November of 2000 and July of 2001. Proposed products from those solicitations are currently undergoing laboratory testing in a simulated insulated ceiling environment. Qualifying fixtures will undergo field-testing in new and re-modeled homes starting in the summer of 2002. PNNL plans to offer ordering agreements to manufacturers of products that pass required laboratory and field tests. A recently developed web site (www.pnl.gov/cfl-downlights) houses the technical specifications and information about the project. Products should be available for purchase early in 2003.

Box: Recessed downlight fixtures. Source ACEEE 2002

There are also experiences from International Technology Procurements in which several countries have joined forces to get new improved products to the market and mostly with results, in terms of performance, equal to those from the national procurements. The difference between national and international procurements as far as the result goes is that the interest from suppliers to participate is a bit higher in the international procurements especially from the side of the large multinational companies. It is however very much dependent on the market structure and the level of competition, see below.

Procurement of... ²	Energy Reduction	Critical lessons learned
Tumble dryer	50%	A market Plan for introduction and dissemination should be accompanying the offer

² All projects related to the IEA DSM-Programme and Programme for Solar Heating and Cooling except EnergyPlus that is an EU-project

Incandescent lamp (with IR-reflection)	30 %	Only one entry and this did not meet the criteria. Manufacturers concentrates on CFL.
Copiers	70%	The IEA-Award was very attractive for the companies
Electric Motors	20-40% (of losses)	
Solar Water Heater	Improvement in Cost to Performance. Nationally based procurements to exchange results between themselves	
Refrigerator (EnergyPlus)	50% to BAT	The project is in an early stage. Suppliers and retailers have shown remarkable interest.

Table. Overview of International Co-Operations for Procurement. Sources www.ieatsk24.org and OECD/IEA 2003.

2. Aggregated Purchasing

There have also been attempts to gather purchasing power in a more general way and direct it to the products that have a defined performance characteristic as being best on market.

US Presidents George Bush³ and Bill Clinton have issued "Executive Orders" calling for government energy management activities. Co-ordination of this is made by The Federal Energy Management Program (**FEMP**) who helps other agencies identify and systematically pursue their energy-efficiency opportunities. FEMP is responsible for supporting all agencies with information and education, energy audits, and data monitoring that allows performance comparisons. The mission of FEMP is to reduce the cost of government by advancing energy efficiency, water conservation and the use of renewable energy. FEMP's aim is not only to achieve those goals set forth in law and several Executive Orders, but also those which are inherent in sound management of Federal financial and personnel resources. (Borg)

The Federal Energy Management Program (FEMP) has developed a number of initiatives to support energy-efficient purchasing by the federal government. The Energy Policy Act of 1992 (EPAAct) and Executive Order 12902, issued March 1994 directs federal agencies to purchase energy-efficient products based on minimum life-cycle cost criteria. The Executive Order directs agencies to purchase products in the upper 25% of energy and water efficiency for comparable products, or at least 10% more efficient than U.S. DOE national standards, see figure below. (Johnson, McKane, Harris)

³ President #41

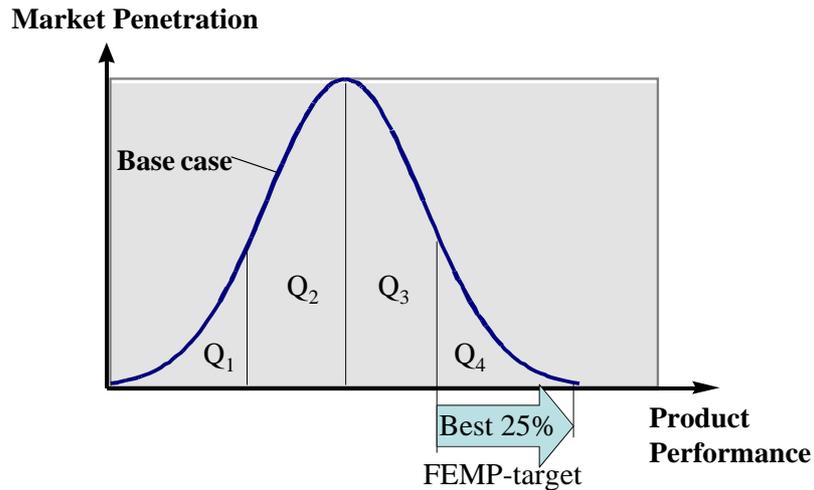
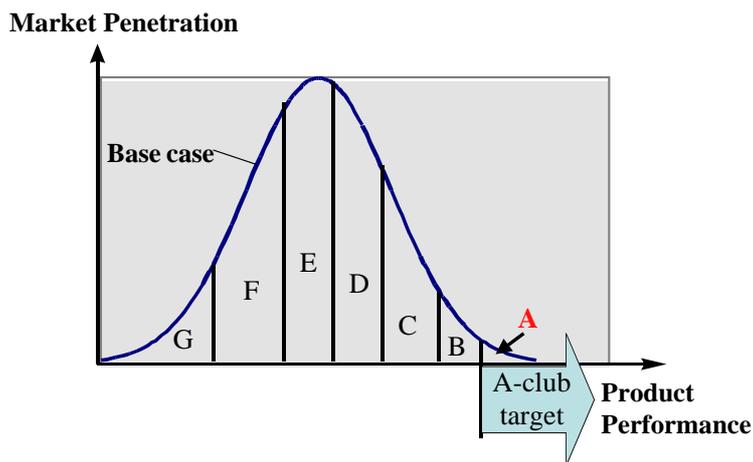


Figure: Target area for FEMP.

Although headquartered at the US Department of Energy, the Federal Energy Management Program serves all Federal agencies. FEMP provides technical assistance for project identification, alternative methods of financing projects, technical support and training necessary to successfully implement projects, and transfer of knowledge about successful projects to encourage others to take similar actions.⁴ FEMP relies heavily on the DOE National Laboratories to provide technical support. A long-term benefit of these activities is building an infrastructure in Federal agencies that institutionalises energy efficiency as a good business practice. (Borg)

Another example on how purchasing can be aggregated and organised is the **Danish “A-club”**. The club is open for municipalities and companies who subscribe buy only A-labelled equipment and in return gets assistance for making Request for Proposals (RFP), lists of equipment and suppliers, calculation assistance and exchange of experiences. The activity is organised by the Danish fund for electricity saving which is financed by a levy on the prices for electricity.⁵



⁴ See example on support as regards e.g. CFL lighting on http://www.eere.gov/femp/procurement/compact_fluor_lamp.html

⁵ An **RFP** is a “Request for proposal” that specifies what product a buyer want and what business conditions he has. The **Proposal** (also called **Bid** or **Tender**) is the response from those companies who want to participate and deliver.

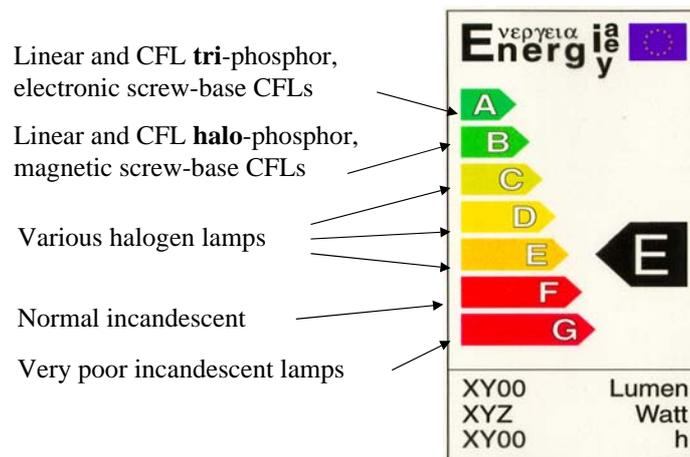


Figure: A-club target and The European Label for household equipment and lamps.

3. Supporting activities

As have been seen aggregation of purchasing power has been successful to bring new products to the market and to get substantial improvements in performance. These activities has also been good in focusing interest from several stakeholders to the better products available but, as indicated in the case with FEMP and the A-club, there is also room, and need, for activities to support the Market Transformation. In this section there will be shown a variety of such supports. (Suvilehto and Öfverholm)

List of activities:

- **Active buyers group.** The driving force is the purchasing power, which is represented by the buyers group. This group creates a set of common performance requirements for a given product. There are a few procurements were such a group has not existed, due to the fact that such a group has not been identified or the technology has not implied any incremental cost. Some of the procurements have had a buyers group consisting of intervening actors such as utilities and could therefore not represent the same level of purchasing power.
- **Media,** the technology procurement programmed have been presented in the media mainly through press releases and interviews with the project managers. One powerful and fairly new media to reach several interest groups has been the internet.
- **Targeted information material;** includes brochures, newsletters etc. The material focuses on specific group of decision makers, e.g. single family households.
- **Labelling,** consists of positive labelling.
- **Advice to professionals,** is a set of programme requirements for professional buyers, consultants or for decision makers. These requirements are available for lighting in office, school, hospital, and industrial premises. The requirements are set on visual comfort and energy efficiency.
- **Consumer advice by telephone,** is a service for house owners and households. The main target group has been those living in single family house with electric heating. So far the main emphasis has been on questions for heat pumps, windows, radiator control systems and water heaters.
- **Exhibitions,** trade exhibitions are used for presentation of the procured products for those professionals who are not active.
- **Education,** there is an education programme on energy efficient lighting and

ventilation for maintenance personnel in local government premises such as schools.

- **Voluntary agreements**, consists of incentive agreements and industry agreements. The incentive agreements has a subsidy for the incremental cost when purchasers choose more efficient technology according to the programme requirements. The Industry agreements, aims to implement an energy and environmental policy such as ISO 14000 certification in a manufacturing company. The process includes commitment on management level, followed by an agreement, energy audits, education on to purchasing according to life cycle analyses.
- **Active manufacturer.** The aim is to bring energy efficient products with compatible prices in to the market. In all the procurement programmed where the market penetration is accelerating manufacturers are highly committed to the procured products.
- **Other actors on the market.** Other actors representing some interest group in the society that could help to disseminate information and products to different target groups. Utilities have been an active actor on disseminating information of a wide range of products. The office workers labour union has spread information of ergonomics and energy efficiency for lighting and office equipment's The NGOs for Nature Conservation has actively can argue the environmental benefits of using energy more wisely.
- **Subsidy** for the first trial batch, covers a part of the incremental cost for choosing the procured product and aims primarily at compensating the customer who participate in the trial for their possible discomfort or problems
- **National campaign.** The campaigns include television advertisement, information leaflets, and posters.
- **Regional/local campaign.** A concentrated programme with higher local commitment.
- **Demonstration,** this activity has not been used widely. It has mainly been used when the technology has either been very new or specific to one application.
- **Environmentally Sound workplaces.** The energy use in offices has increased rapidly due to increasing number of office equipment's, climate cooling etc. The project focuses on how to reduce the environmental impacts of the office premises with even better ergonomics. The aim is to inform people so that they can require and implement an over all environmental policy in their working place. More over the focus is on purchasing policies. The purchasers are provided with information on how to reduce the environmental impacts of energy use and which material or production processes contain environmentally hazardous waste.

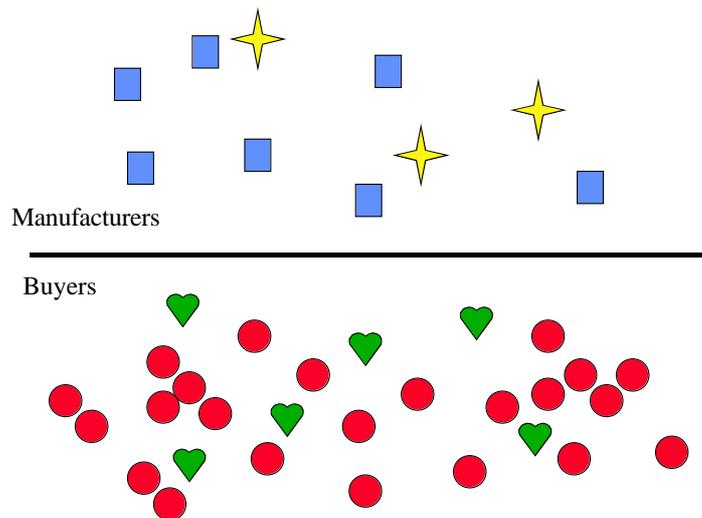
4. Finding the champions for the process

From these experiences we have seen that the two major stakeholders and actors naturally are the manufacturer and the buyer/user of the equipment/system, but also that we have to be more careful in identification of these as well as in finding other partners in the value-chain to support the technological change. The active element in the process is the competition and the possibility to gain from the change. If they do they will gladly support the process but if they don't they could oppose it and even ruin the change against their own interests. In the following there will be brought some of the more important things to keep in mind.

4.1 The main actors

On the market place there are always a few manufacturers that have the ability and the interest to do better (the stars) and a few customers (with green hearts) who would like to buy

something better. The first task is to enable for these to identify each other and to open a communication.



The buyers are gathered and organised in buyers groups and should be those who drives the process further. The y should also do so based on their need for a total function in the product and that energy efficiency is only one of the characteristics required. Primarily the product should deliver the service and do so with an efficient (lower) use of energy.

The manufacturers are “tempted” to deliver to these “frontline” buyers since they represent an emerging market. For competition to work it should be possible for ALL manufacturers to participate in the bidding for the contract but some may have to selected on grounds of capacity to honour services over a longer time, on financial capacity etc. Such selection may require a stepwise procurement and solicitation.

Note that most of the capable potential manufacturers do NOT need a guaranteed delivery to the buyers but have to believe in that the buyers on their part will buy and continue to do so if the product delivered is satisfactory to their needs.

4.2 Niche markets

In this process of staging and selecting participants it is necessary to remember that all buyers and manufacturers also face differences in opportunities, which could constitute “niche market” behaviour. In the following this is shown in terms of the “learning curve”, i.e. the curve that shows that costs/prices for technology lowers gradually with the volume of technology produced, see example of PV-modules in figure.

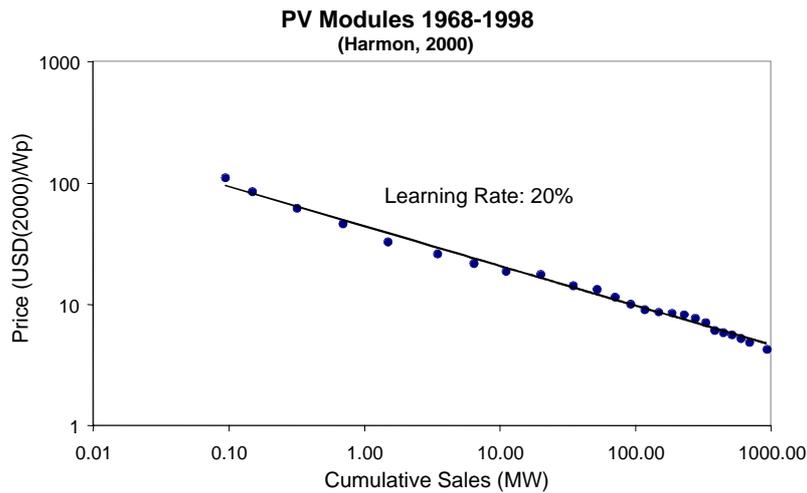


Figure: Learning Rate for Photovoltaic Modules

In this process it is also possible to identify buyers with a higher willingness to pay and manufacturers with a higher propensity to act. The niche market is fairly well segmented and can be addressed by the policy maker in identifying certain actors in certain phases:

- A, the cost of the challenger-technology is still higher than the willingness to pay in the niche market. A subsidy can provide the difference between the actual cost and the price in the niche market. As demand at the upper end of the niche market is satisfied, the price on the niche market is reduced, but learning has also reduced the cost of providing the product.
- A', When the "first mover" company on the market could envisage that the product will be Useful to launch. Basically because the costs can be capitalised and gained back in terms of sales, marketing or image
- B, cost is below the willingness-to-pay in the niche market and no public money is needed to finance learning investments, though it may still be necessary to assist with indirect support (e.g., labelling schemes and other information devices).
- C and D, the market leader may be in the enviable position of being able both to brand his products for a niche market that is very profitable (C) and to let one of his lesser brands to feature a low-price version of the product that competes with the incumbent technology (D), the early stages of the dissemination curve up to the chasm

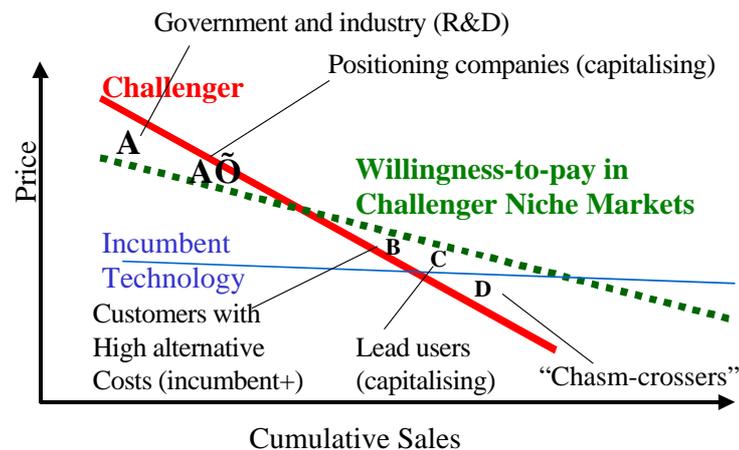


Figure: Niche market segmentation (Source: developed from OECD/IEA 2003)

Note that in the area A it is possible to argue for a societal engagement in putting up “learning investments” as well as leveraging private resources for the same purpose.

4.3 Supporting actors

But the manufacturer and the buyers/users are not alone on the scene. A product runs through many hands on its way from the production to the use and it is influenced by many on its way by many others. These companies, organisations, persons, can be very helpful in underpinning the process but could also be those who stop it. Any activity should carefully analyse these peoples role, ensure their support and also keep an eye on the development and if necessary act to avoid problems.

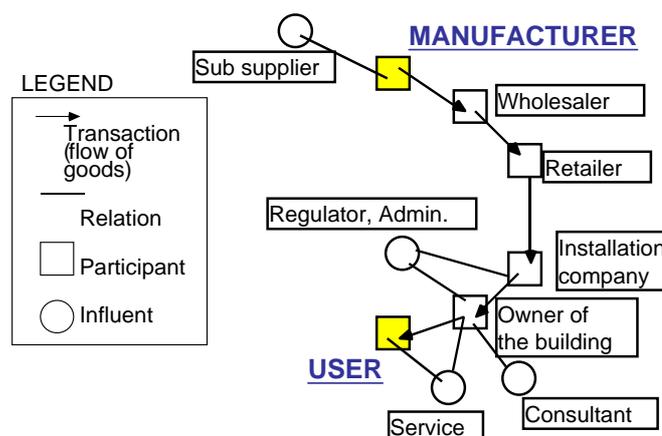


Figure: Distribution chain (value chain). Source Nilsson 1996 and OECD/IEA 2003

In the case of lighting many campaigns have been staged especially to make use of retailers and installation companies and done so with considerable success. This is especially

important when the product already has entered the markets and faces the challenge to take over the “leadership” and be the preferred choice of customers.

4.4 Moving into big market (crossing the chasm)

The aim of all the activities is to make a lasting change on the market and in this context it is essential to remember the time scale of such changes. The dissemination of a product towards market saturation is normally decades and not years.

Tests of CFL applicability for household purposes in Europe with the present configuration of fixtures and lighting show that an average of 8 light-bulbs could be comfortably replaced with CFL-bulbs (Palmer and Boardman). If we assume this as the saturation level and apply a standard product dissemination curve to the present level of market penetration it will indicate that full dissemination will occur only after some 30 years.⁶

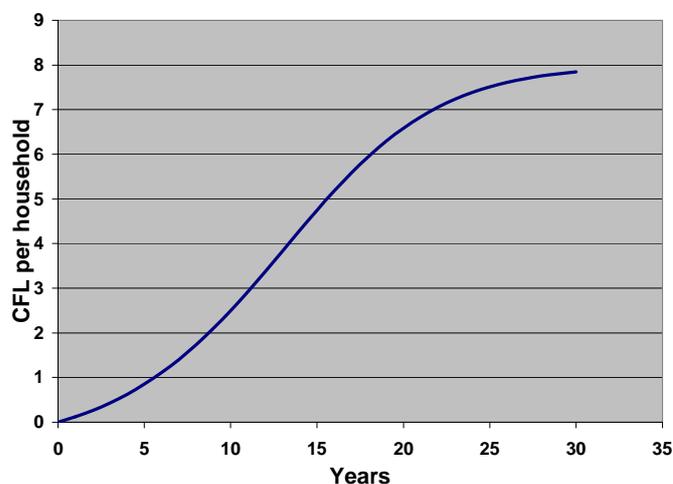
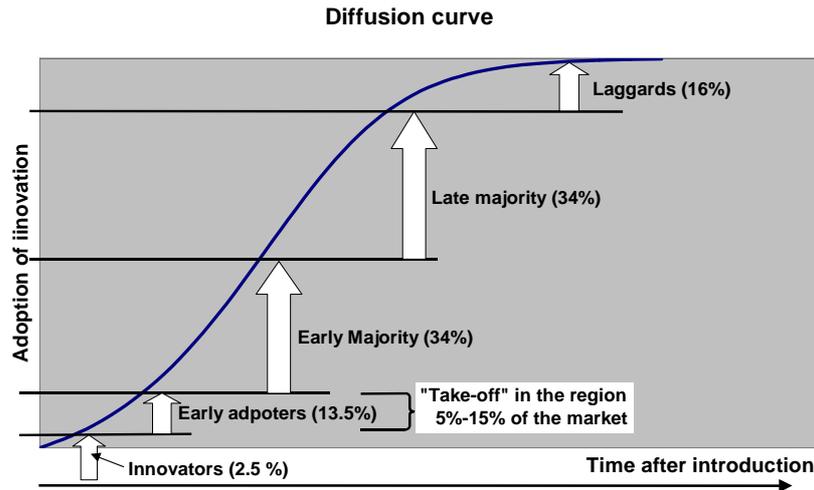


Figure: Dissemination towards saturation of CFL on the European Market. Note that the level 1997 was 2.8, ten years after introduction

And in this context it is important to come back to the issue of the buyer and the decisions to buy. In the earlier text we have focused on those early buyers but when we finally want to make the market change totally we have to turn to the mind-set of bigger populations. Targeting the audience for measures require knowledge about customer/user attitudes. The diffusion curve describes the market reactions, the up-take, of innovative products and services and especially enables a structured view on the individual attitudes and how those guide the response and the need for marketing and development of product (Rogers 1995 and Moore 1991).

⁶ Diffusion of innovations to the market follows the "Bass curve" where the penetration N_t at a given time t is calculated as: $N_t = N_{t-1} + p * (m - N_{t-1}) + q * (N_{t-1} / m) * (m - N_{t-1})$ where m is the market potential; p is a factor for external influence (the likelihood that somebody start to use the product due to e.g. media influence); q is a factor for internal influence the likelihood that somebody start to use the product due to "word-of-mouth")



Adopter type	Characteristic	Role and size
Innovators, enthusiasts	Venturesome; Enjoys the risk of being on the cutting edge; Demands technology	Drivers of the technology market. Want more technology and better performance. (16%)
Early adopters, visionaries	Respectable; Integrated in the main-stream of social system; Project oriented; Risk takers; Willing to experiment; Self-sufficient; Horizontally connected and acts as their peers	
THE CHASM (where marketing and distribution must radically change)		
Early majority, pragmatists	Deliberate; Process oriented; Risk Averse; Want proven applications; May need significant support; Vertically connected and acts as their superiors	Followers on the market. Want solutions and convenience. (68%)
Late majority, conservatives	Sceptical; Does not like change in general. Changes under "pressure" from the majority.	
Laggards, sceptics	Traditional; Point of reference is "the good old days"; Actively resists innovations	Could have economic or power interest from "status quo"

5. Issues for the design and monitoring

- The changes should be driven by demand (buyers). Their recruitment and selection is the major task
- The winning manufactures (suppliers) are first movers in the change but the goals is Market Transformation
- The choice of technology, level and requirements is crucial
- Procurements may have to be made with stepwise qualifications
- The volume for deliveries is important but not necessarily crucial. It could be compensated by the relative importance of the buyers
- Transparency in requirements and testing as well as choice of impartial evaluation is essential
- The technology development may have to be taken in subsequent steps.

Throughout the staging of the project it should be kept in mind that the project in the end should deliver a remaining (lasting) change on the market. The project may very well turn out

to be successful in terms of use of resources but still leave the market untouched and hence have no effect. It is therefore necessary both to

- put up a goal that relates to customer satisfaction for the new products,
- design the project to reward customers accordingly and
- monitor changes that indicate the effect (the market transformation)

Market impact could be measured in Absolute Volume, Penetration to market, Performance improvement and lowering of Price/Cost or even in combinations thereof. It is however worth to keep in mind that several of these impacts take time to get and to register.

5.1 Volume growth

Establishment of a market for “new” products takes considerable time. Compact Fluorescent Lamps (CFL) has been one of the target products for many activities throughout the last decade. The accumulated output has between 1988 and 1999 doubled almost 6 times. The yearly sales are 1999 in the order of 500 million units worldwide, which represents a tenfold increase in sales since 1988. It is assumed that the total amount installed is some 1300 Million units.⁷

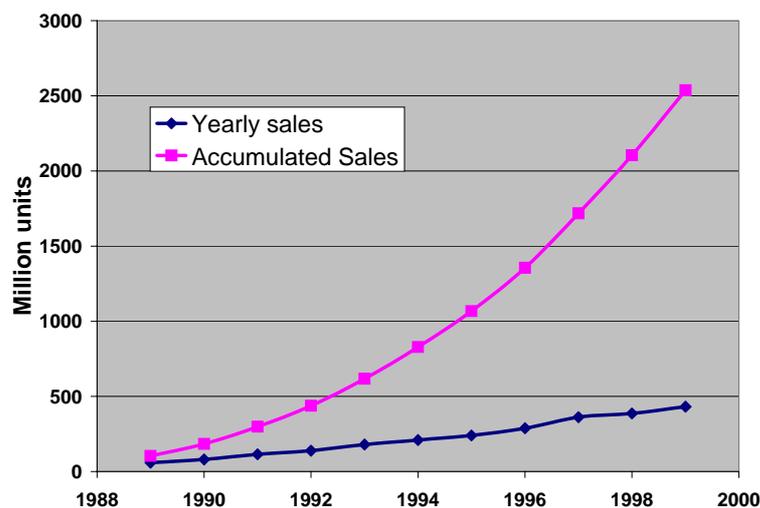


Figure: World Market volume growth for CFL

5.2 Volume and Market Penetration

In spite of the impressive volume growth for CFLs as shown above the market penetration is generally low. The total volume for light bulbs is estimated to be 10 –15 Billion units per year, which means that the sales of CFL is a share between 0.5% and 3%.

Across the European Union the average number of light bulbs in households is 24. The amount of households that has a CFL and the average amount of CFLs per household are recorded as follows, mostly 1995 data (Palmer and Boardman). The penetration to the market

⁷ *Soaring CFL sales*, IAEEL Newsletter 1-2/2000, International Association of Energy Efficient Lighting.

is on the average less than 5% and in the households that owned CFL a bit above 10%, see figure above under 4.4.

5.3 Volume growth and price/cost

When new products reach the market and gets accepted the growing demand and volume will start a process that attracts new inventors and producers. In this process the unit-costs for the products and hence the prices will be lowered. The phenomenon is captured in learning and experience curves and by measuring of the "learning ratio", see also above under 4.2. This ratio indicates how much the cost/price will drop in percent by each doubling of the cumulative production (OECD/IEA, 2000). One study from IIASA indicates that the learning ratio, LR, for CFLs is approximately 15%.

Application on data from the Chinese CFL market the market has doubled 5.4 times from 1990 till 1998 (from 3 Million to some 45 Million in yearly sales which represents some 130 million accumulated)⁸ and hence the price should have dropped to half. But price has dropped to be as low as 15%⁹, which seems unnatural unless there have also been severe changes in performance and quality. If the price today and 1990 was right the learning effect should have been as high as 45% (!), which is impossibly high. A third explanation could be that 1990 there was such a concentration of production to only a few manufacturers that resulted in an unnaturally high profit for them.

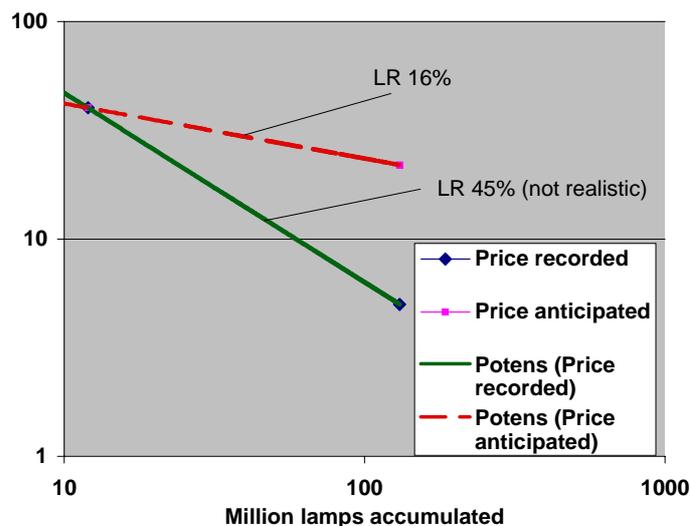


Figure: Chinese CFL market development 1990-1997

Depending on the market organisation it might be difficult to observe the result of lowering costs for some time since such data are generally not available. Normally only the price can be recorded and before the market has totally accepted the product and attracted the necessary competition the market leader and inventor may want to recover their costs for development in such a way that price reductions are not to the benefit of the customers. The experience

⁸ Based on data from the Chinese Green Light Office

⁹ From 40 Yuan to as low as 5 Yuan (inflation not accounted for). The world market has in the same time doubled four times (from 83 to 356 Million yearly sales which corresponds to some 1600 millions accumulated), which should explain a price drop to a level of approximately 65% on a world market.

curve provides an instrument to set targets for deployment programmes and also to evaluate the effects of such programmes.

5.4 Attribution of impacts to measures

The changes on the market and the measures to which they can be attributed are of course in the main focus of interest. Such an evaluation has to be made also to cover the period following after the project is terminated. The following example is from the Swedish case of Procurement, Quality Programme and related subsidies to HF-Ballasts in office luminaries (Neij 1999). The subsidy seem to have kicked-of a market response. Even after the programme the market continued to grow substantially. Whether this can be attributed to subsidies only or also to other parts of the Programme (Quality Assurance and Procurement) needs to be dealt with in e.g. interviews with participants. In this case the participants in the interviews gave as the first reason for their interest in this new lighting was that it rendered "flicker-free" lighting, which improved the comfort in the work-space.

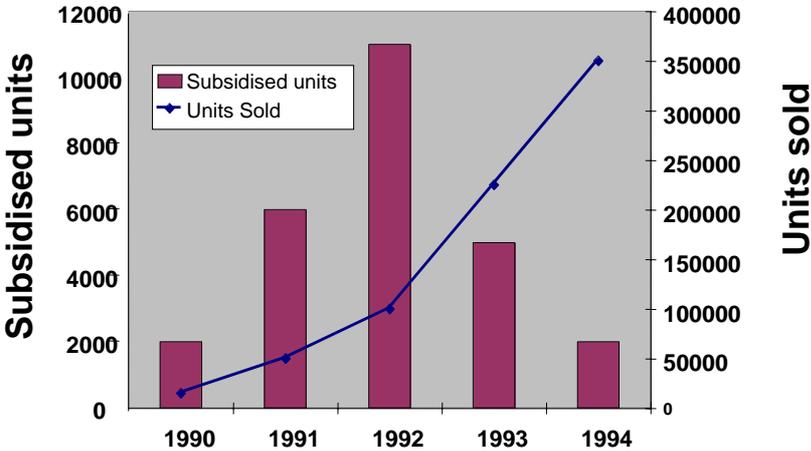


Figure: Result of Programme (subsidised units) and Effect (Units sold)

5.5 Performance

Performance improvements are to some extent a result of a "natural" improvements on the market, but also dependent on programme activities. In Europe the labelling of household appliances and the associated recording of sales show a drift from low performance to good performance over the years.¹⁰

¹⁰ *Energy Labels & Standards*. OECD/IEA. Paris 2001.

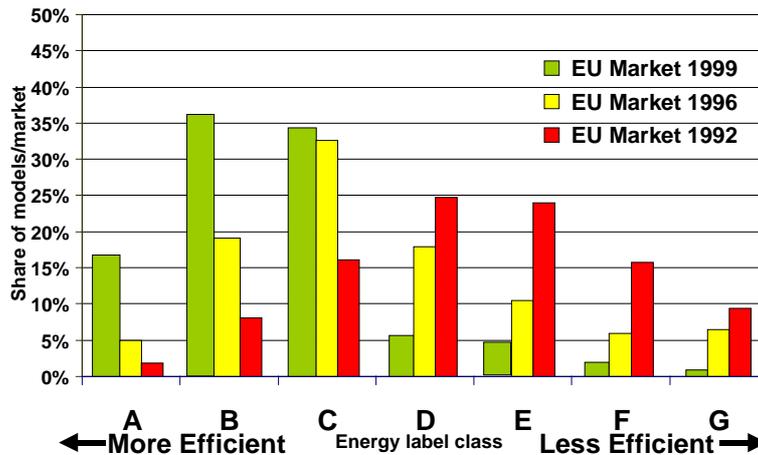


Figure: Market Transformation for classes of refrigerators on European Market

GENERAL CONCLUSIONS

Above all the procurement must be strictly neutral. There must not be any preferences for companies, their origin or the design of the product. This is after all quite natural since the driving force in a competition is the fairness, but nevertheless often forgotten by policy makers who would like to see their home country manufacturers to take the lead.

- The specification of the product must be made in terms of **function**. Restrictions can be made concerning some construction materials that should be avoided but even then preferably by specification of the consequences one would like to avoid from use of such materials.
- The specification should cover a **complete** product. Even if energy efficiency is the main focus it must be remembered that the product above all must serve its purpose. If this rule is violated one would easily end up with a demonstration of technological capability but not with a product that moves the market because it is desirable and functional at a competitive price.
- There must further be **full competition** between companies giving tenders in order to really get the best winner but also to give the opportunities for followers to later come up with similar or even better products. The only way to assure this part is to put them on the track from the beginning.

Finally there must be an operating agent to run the process and that agent should be neutral especially in terms of profit from the result. This mostly means that the agent should be a government agency or a part for which all the participants can feel complete confidence. This is essential since there will be negotiations throughout the process and all involved should feel that they can give away small secrets knowing that these will not be turned against them later.

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