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DESIGN FOR THE ENVIRONMENT IN PRACTICE — Development of the Hoover ‘New Wave’ Washing Machine Range

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[Photo of Robin Roy]

Design for the Environment in Practice

ABSTRACT

This article discusses the planning, development, manufacture and marketing of the Hoover New Wave range of washing machines, launched in 1993 and the first products to be awarded an EU Ecolabel for their low energy, water and detergent consumption and excellent wash performance.

Lessons about design for the environment from the New Wave project include:

- Incorporating environmental objectives into product development does not require a fundamental change to the process.
- Any successful 'greener' product must balance environmental performance against other design attributes wanted by the market.
- For most companies, design for the environment involves a learning process, e.g. the benefits of moving from a 'green' design approach focused on selected environmental issues to an 'ecodesign' approach aimed at balancing environmental impacts throughout the life cycle.
- Design for the environment is a dynamic process involving continuous technical change.
- The environmental improvement of products cannot be fully achieved by individual companies working alone.

DESIGN FOR THE ENVIRONMENT IN PRACTICE

Hoover is one of the best known manufacturers of domestic appliances in Britain and has made washing machines at its Merthyr Tydfil factory since 1948 (see Note 1). This article discusses the creation of the Hoover New Wave range of 'green' washing machines, which were launched in 1993 after a four year programme of research, design and development and investment in new manufacturing plant costing £15 million. The New Wave range were the first products to be awarded an EU Ecolabel, having exceeded set criteria for energy, water and detergent consumption and wash performance.

The New Wave project originated in the late 1980s when Hoover found itself with a range of washing machines which were losing market share. Although the range had been updated a number of times, 'new' models relied on core designs which had not changed significantly since 1967. In 1989 Hoover felt that a completely new design was needed.

The company had already decided to buy in pre-coated steel for manufacture of washing machine cabinets, thus replacing the slow, labour-intensive and dirty process of welding and spray painting sheet steel. Developments in materials meant that the outer tub could now be moulded from reinforced plastics, rather than fabricated from steel. There was therefore an opportunity to develop a new product range and simultaneously introduce new manufacturing processes.

Hoover also recognised that a growing number of consumers were demanding 'greener' products, and that foreign competitors had already taken a lead in this market. Zanussi, for example, in 1986 launched its 'Jetsystem' range in which the water is pumped to the top of the machine and sprayed down on the clothes instead of wetting them in the drum, thus saving water and energy. Hoover was aware too of EU plans to label products, such as its new washing machines, for their environmental performance.

Environmental performance was of course only one aspect of the planned new machine's appeal. Hoover wished to move 'up-market' from its traditional position in the washing machine market with its new range, and detailed market research was commissioned to define the features wanted by purchasers in different European markets and countries.

THE PRODUCT DEVELOPMENT PROCESS

Although development of the New Wave involved serious consideration of environmental factors for the first time, apart from a move from the former linear product development process to a more 'concurrent' team-based project, no changes to the product development process were required. No environmental specialists were involved and the team 'learned as it went along'. Nevertheless, the environmental objectives added some difficult design problems, whose solution was aided by the establishment of a closely-knit product development team.

At the start of the New Wave project, senior managers from Engineering, Marketing, Manufacturing and Finance met to agree the business and market specification for the new range. This formed the basis of the technical specification.

Environmental impacts were a key factor in the specification. Hoover recognised – before this had been shown by formal life cycle analysis – that any reduction in the environmental impacts of the new

machine would depend mainly on minimising water and energy consumption in use. The aim was a significant improvement over the 44% reduction in water and 38% reduction in energy consumption/kg of wash load already achieved in Hoover designs since 1967.

The next step was to convert the technical specification into feasible design concepts. This involved three parallel tasks:

- Deciding how the machine was to be engineered and manufactured. For example, the best method of joining the pre-coated steel panels for the cabinet had to be decided. Replacement of the enamelled steel outer tub, previously fabricated from some 50 components, by a single-piece plastic tub contributed to a substantial reduction in the number of parts in the machine – as was required in the specification.
- Design of the visual aspects of the machine, including consideration of ergonomic principles. In particular, the Hoover industrial design team were concerned from the outset that the new machine should have a stunning visual appearance that would enable it to stand out from competing products in the market.
- Researching how to reduce water, energy and detergent consumption.

Research and Development

In order to reduce the amount of energy, water and detergent consumed by the machine Hoover asked its R&D group to conduct a feasibility study for a radically new wash process. This research produced several new concepts. These included: '*spin-wash*' (slow-speed spins during the wash to wet the load with a reduction in water level in the tub from 7.5 cm to just 2 cm in the original concept design); '*front-fill*' (the idea of filling the machine from the front and using the wash load as a filter to reduce the loss of detergent flushed into the sump); '*spray paddles*' (the idea of perforated agitator paddles in the drum to scoop up water from the base of the drum and shower it over the clothes – Figure 1a). The spray paddle concept would avoid infringing the patents on pumped systems used by Zanussi and other manufacturers (Figure 1b).

The new wash process required parallel work to develop an electronic control system to allow more precise control of the wash cycle than was possible with the electro-mechanical timer traditionally used on Hoover machines. In addition the decision to use a plastic outer tub allowed a sump to be moulded in, thus allowing the drum and tub to fit more closely than previously and the machine to operate with less water (Figure 2b).

Figure 1 about here

Figure 2 about here

Design development

The research concepts then had to be developed into a practical design. This involved Hoover product engineers developing and testing key elements of the conceptual machine. They found that to get a consistently good wash performance required increasing tub water levels to 4.5 cm and reducing mechanical action, plus development of an effective spray paddle system. Subsequently a ball valve

was added to seal the base of the tub during filling, as the front fill system was insufficient to eliminate detergent lost to the sump.

In parallel component designs were being finalised for manufacture, in order to reduce costs, speed assembly and improve quality. In pursuit of these aims further parts reduction was achieved by substituting snap fits for screws and other fixings on components such as the door. As a result of applying this approach throughout the design, the new machine had one third fewer parts than the previous range.

ENVIRONMENTAL POLICY AND ECOLABELLING

The original impetus for the environmental aspects of the New Wave project was the growing European market for energy and water saving washing machines. However, soon after the project had begun, Hoover senior managers began to consider what the company should do to respond to environmental issues more generally. An environmental consultancy was commissioned to establish an environmental policy for Hoover. Their report resulted in the Board issuing an Environmental Mission Statement in April 1990, with an Environmental Affairs Committee responsible for implementation. The Hoover Environmental Mission stated that the company aimed: 'To adopt the best practical environmental methods in the design, production, packaging, use and disposal of its products, whilst continuing to improve their benefits to the consumer.' (Hoover, 1990).

Also in 1990 the European Union announced its Ecolabelling scheme, with washing machines among the initial categories of products to be labelled. Like the Hoover Environmental Mission, the Ecolabelling scheme is based on a 'cradle to grave' approach to product environmental impacts and, in 1991, a life cycle analysis (LCA) was commissioned to establish criteria for the washing machine ecolabel. The study showed that over 95% of the environmental impacts of washing machines occur during their use (Figure 3). Another LCA of washing machines, that included the impacts of detergent manufacture, concluded that some 80% environmental impacts occur during the use phase (Deni Greene Consulting, 1992).

The LCA for the ecolabel confirmed the focus at Hoover on reducing the water, energy and detergent consumption of New Wave, but also indicated other areas of environmental impact which may have had to be considered before the launch of the range; if it was to meet the ecolabel criteria.

Figure 3 about here

ECODESIGN

Hoover thus began to consider the environmental impacts arising from production, distribution and disposal of the New Wave.

Production

Use of pre-coated steel for the cabinet (Figure 4) gave Hoover major savings in energy consumption (previously required for welding and drying) and eliminated toxic emissions of volatile organic compounds (VOCs) from the factory. But the company was careful not to claim environmental improvements until the 'export' of emissions to the supplier of the pre-coated steel had been

evaluated. This subsequently showed that a real overall environmental benefit had been achieved – e.g. pre-coated steel is roll-coated involving less energy and VOC emissions than spray painting.

Environmental benefits also arise from the elimination of welding and enamelling from tub manufacture, and from the reduction in the number of parts in terms of the amount of materials and energy needed to make a machine.

Figure 4 about here

Distribution

Hoover examined the advantages and disadvantages of a cardboard pack versus a polystyrene pack shrink-wrapped with polythene. Both cost similar amounts and could be recycled, but the company came to the conclusion that – despite controversies about its use – polystyrene performed better and had the edge on environmental grounds, being lighter to transport and using much less water and energy to manufacture.

To reduce transport costs and fuel consumption, Hoover commissioned a new design of trailer for transporting its washing machines. This enabled more machines to be carried in each load, and significantly reduced the number of vehicle movements required in bulk distribution (Figure 5).

Figure 5 about here

Disposal

A reduction in the number of fixings in the machine – adopted mainly for production reasons – would make the New Wave easier to take apart for recycling. Recycling would also be facilitated by reducing the variety of plastics used and identifying them by type.

MARKETING THE NEW WAVE

The New Wave range was first launched in February 1993, but due to a delay in introducing the Ecolabelling scheme, the award of an EU Ecolabel to the range did not occur until November 1993.

By early 1997 the Hoover New Wave and its successor range were still the only appliances to have been awarded an Ecolabel. Use of the Ecolabel is voluntary and involves payment of registration and licensing fees. Although other washing machine manufacturers have models that qualify, they have not applied for an Ecolabel because they apparently do not consider the marketing advantage is worth the cost (ENDS, 1996a). Another factor was the introduction of mandatory EU energy labelling in April 1996. This label gives a ranking for energy efficiency, thus rewarding manufacturers of the most efficient machines, unlike the simple pass/fail criterion of the Ecolabel.

Since launch the New Wave range has sold well. Hoover believes that its environmental approach, supported by the Ecolabel, has been an important factor in the range's success, especially in the environmentally-aware German market in which the company doubled its share in 1994, and in

enabling the company to enter other environmentally-conscious markets such as Denmark and Austria.

Environmental factors are less important in the UK market. In the absence of any other independent endorsement, the New Wave was initially promoted mainly on its money-saving aspects. However, in later sales material the 'environmental friendliness' of the range and the independent backing offered by the award of the Ecolabel were strongly featured, targeting environmentally-conscious consumers in the upper-middle segment of the UK washing machine market.

In 1996 the New Wave range was replaced by an incrementally improved range, called New Wave Plus 5, with increased capacity and lower water consumption. This range also gained an Ecolabel, plus the top energy label rating for energy efficiency (Figure 6).

Figure 6 about here

Extending the product family

The £15m investment in the development and manufacture of the New Wave has also been employed to produce lower-priced models aimed at the volume UK and Southern European markets. By modifying the New Wave design, mainly by substituting electro-mechanical for electronic controls, Hoover developed the 'Soft Wave' and later 'Eco-Wave 5' ranges. These also save energy, water and detergent compared to previous models, but do not quite satisfy the Ecolabel criteria because they lack features, such as spinwash, that require electronic controls. These lower-cost ranges have the same mechanical components as New Wave and are assembled on the same lines.

LESSONS

What lessons about designing for the environment can be learned from the New Wave project?

Balancing design attributes

Any successful 'greener' product must balance environmental performance against the many other design attributes – performance, reliability, appearance, etc. – wanted by the market at which the product is aimed, and do so at a competitive price. This point was highlighted in a broader study of sixteen greener products (including the New Wave) which showed that to be commercially successful, the products had to be competitive in terms of performance, quality and value for money before environmental factors entered the list of customer requirements (Smith, Roy and Potter, 1996; ENDS, 1996b). These various elements were included in the specification for the New Wave range from the start of its development.

Integrated product development

Incorporating environmental objectives into the product development process does not require a fundamental change to that process. What seems vital is that the green product development process is carried out in a concurrent, integrated manner. Adopting a concurrent, team-based approach, such as that introduced by Hoover for the New Wave project, means that the marketing,

engineering/industrial design, production, financial and environmental aspects of the product, can be considered by team members from the planning and specification stage onwards.

From 'green' to ecodesign

Designing for the environment is new activity, and for most companies, will involve a learning process. Hoover began the New Wave project with the aim of producing a design that would meet the growing market demand for washing machines that required less water, energy and detergent in use. The choice of materials and production processes was mainly determined by performance, cost and efficiency considerations. Following the introduction of the Hoover Environmental Mission, and the company's involvement in formulating the washing machine criteria for the EU Ecolabelling scheme, environmental impacts from the production, distribution and disposal phases of the life cycle were considered. Fortunately, analysis showed that the new materials and production processes used less energy and generated fewer emissions than the previous processes. However, it is possible that had the system been designed from the start with the environment more directly in mind greater improvements might have been achieved.

In other words during the New Wave project Hoover learned the benefits of moving from a 'green' design approach focused on selected environmental issues to an 'ecodesign' approach aimed at balancing environmental impacts throughout the life cycle.

Continuous improvement

Designing for the environment is a dynamic process involving continuous technical change. Data published in *Which?* magazine (Consumers Association, 1995, 1996) and elsewhere (e.g. GEA, 1995) indicates that the New Wave was one of the best European machines available in the mid-1990s in terms of energy consumption, and among the better machines in terms of water consumption. Nevertheless, Hoover is having to continue to improve its designs to keep up with the evolving standards of environmental performance set by competitors and regulators. Further reductions in the energy, water and detergent consumption of washing machines are possible, for example by improved insulation, increased motor efficiency and controls to match water and detergent input to suit the type, amount and dirtiness of the wash load. Although some manufacturers are introducing such systems, their general use depends on cost and market advantage.

Organisational change

The environmental improvement of products cannot be fully achieved by individual companies working alone. Energy consumption, for example, depends on wash temperatures, which in turn depend on detergent formulation and consumer behaviour, given that in some countries cold water washing is common. Likewise, while the variety of plastics used in the New Wave was reduced and plastic components are marked to facilitate recycling, at present plastic components tend to be buried in land-fills rather than recycled. Similarly only a small proportion of washing machine packaging is

recovered for recycling. Individual manufacturers could set up their own recycling schemes, but in practice an effective and efficient system requires the involvement of other organisations such as local authorities and recycling firms and the stimulus of appropriate legislation.

Apart from recycling, measures that may help conserve resources and reduce waste include increasing product life, and reusing components from repaired or discarded machines. Although it may be argued that there are environmental advantages in designing products to last longer, the issues are complex. Hoover therefore kept to its standard design life of 10 years for the New Wave, arguing that due to improvements in technology, designing for a longer life was unlikely to be environmentally beneficial. In common with the rest of the domestic appliance industry, Hoover did not plan to take back and reuse components believing that such components would be outdated and unacceptable to consumers. In any case, the UK Trade Descriptions Act requires that new products contain new components. One way by which this problem could be approached is by designing a long-life basic chassis, which could be 'upgraded' with the latest control and motor technology at the end of its initial life (Goggin, 1994). However, the adoption of such radical ecodesign approaches depends on market acceptability, legislative change, and perhaps on the introduction of new patterns of production and ownership, such as leasing.

Footnote

1. In May 1995 the Hoover European Appliance Group was sold by its US owners, Maytag, to the Italian white goods manufacturer, Candy. The policies and approaches outlined in this article may of course change under this new ownership.

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Figure Captions

Figure 1 Diagrammatic comparison of
(a) passive spray paddle system (similar to that used on Hoover machines)
(b) pumped spray system (similar to that used on Zanussi ‘Jetsystem’ and other washers).
(Open University)

Figure 2 (a) Traditional offset steel outer tub and inner drum arrangement.
(b) Plastic tub with moulded in sump, shows the reduced amount of water required to cover the heating element. (Open University)

Figure 3 Life Cycle Analysis of washing machines, showing the percentage contribution to total environmental impacts at the product life stages from ‘cradle’ to ‘grave’
(After PA Consulting Group, 1991)

Figure 4 Pressing pre-coated steel panels for washing machine cabinets. (Hoover European Appliance Group)

Figure 5 Shrink-wrapped Hoover washing machines being loaded onto specially-designed trailer. Both packaging and trailer were developed to reduce environmental impacts from distribution. (Hoover European Appliance Group)

Figure 6 Part of a 1996 Hoover brochure for the New Wave Plus 5 range, showing the top-of-the-range model and the EU Ecolabel symbol. (Hoover European Appliance Group)

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