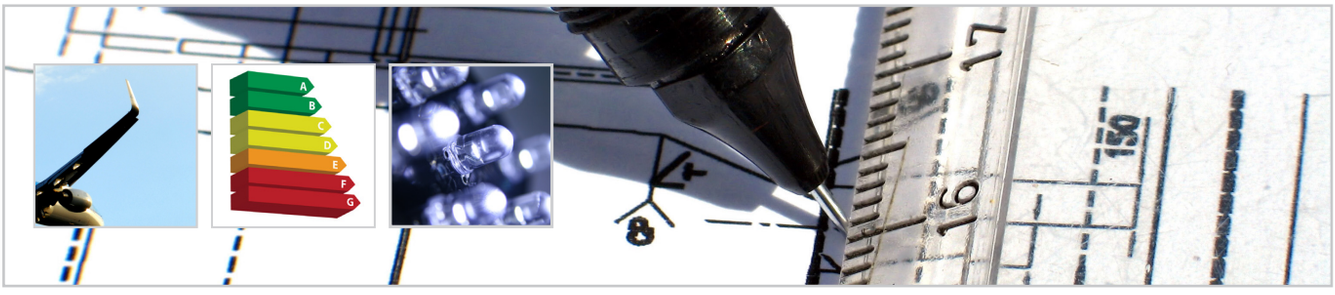
Arthur D Little

Engineering & Manufacturing Viewpoint

Energy Efficiency

Capture growth while managing the risk of over-engineering



There is a clear trend towards improved energy efficiency in industrial products and systems. The trend is driven more by market factors than by governmental intervention. Leading companies are setting energy efficiency targets and launch development programs to deliver more energy efficient products and systems. We see opportunities to capture growth in this area, but also a risk of over-engineering. In this viewpoint we share our thoughts on how to balance your product and service development program for growth and value.

Solid drivers underpin the trend towards more energy efficient products and solutions

Is the energy efficiency focus here to stay? Do I as a manager need to put priority on energy efficiency in my R&D work? Arthur D. Little would argue "yes" to these questions. Much has been written about the driving forces towards increased energy efficiency. To simplify, and put in the context of industrial products and systems in B2B markets, we highlight market pull, technology push and governmental intervention. See Figure 1.

In the markets for industrial products and systems, market pull plays the key role, and we include under this heading the monetary benefits of higher energy efficiency, typically linked to the reduced consumption of energy. The increasing cost of energy and the Total Cost of Ownership (TCO) perspective in procurement are the strongest factors. One must also add the reputational value customers place on being seen as taking responsibility for sustainability by its stakeholders, e.g. employees, customers and investors.

Availability of new and cost effective technologies and systems developed by sub-suppliers serves as a technology push that drive product development within OEM's. Technology that improves energy efficiency is in most cases readily available to be integrated into the final product or system.

Governmental intervention can be direct or indirect. In our discussions with legislative bodies we recognize that direct regulation in this area is quite complex. Finding fair and effective measures to base the regulation on, be it simulation based or through direct measurement, is a tough job. As a consequence, legislative bodies put their primary focus on large sectors that are not "self-balanced" through market-pull (e.g. fuel consumption of cars). Indirect intervention through energy tax and CO2 trading schemes has been in place for some time, and the expectation has been that this would increase further. However, in light of the slow-down of the economy there is a question to which extent there is general support for further increases.

Leading companies have set ambitious target for energy efficiency improvement

Although a strong direct energy efficiency regulation is not in place in most industries, leading companies have set ambitious targets to improve energy efficiency. A number of them have also already achieved significant energy efficiency gains.

We find that different companies' energy efficiency improvement targets can be categorized in three areas; internal energy efficiency improvements (energy efficiency of internal operations), product energy efficiency improvements and customer energy efficiency improvement, as depicted in Figure 2. Internal energy efficiency and product energy efficiency are intuitively easy to understand. By customer energy efficiency we mean the energy efficiency improvements that a company's products or services enable in the customer's overall process or system. Many companies set targets in more than one of these areas.

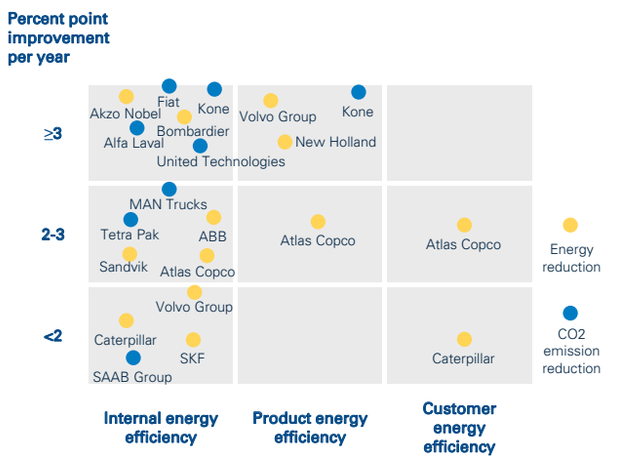
Figure 1: Drivers for increased energy efficient products and solutions

Source: Arthur D. Little

For example, the heavy vehicle OEM AB Volvo has set targets of both improving production energy efficiency (internal) as well as its product energy efficiency. Between 2008 and 2014, AB Volvo wants to reduce its CO2 emissions from production plants by 12%. In 2014, the company plans to demonstrate a prototype truck with 20% lower fuel consumption compared to the 2008 truck model.

Another example is Tetra Pak, which set its first energy efficiency improvement target in 2005. The target was to reduce CO2 emissions in its operations by 10% by 2010. With strong internal energy efficiency focus Tetra Pak managed to overshoot its target and reach a 13% reduction in carbon emissions despite a business growth of 23% during those 5 years.

Figure 2: Example of energy efficiency improvement targets in different target areas



Source: Arthur D. Little, WWF

Going forward, Tetra Pak will continue to set ambitious energy efficiency targets.

The industrial group Atlas Copco has set the ambitious target to reduce its customer energy efficiency by 20% by 2020, meaning that it does not only focus on energy efficiency of its products, but also looks for other ways of improving the energy efficiency of its customers' processes.

As the energy efficiency area matures, we predict more and more companies to include customer energy efficiency targets.

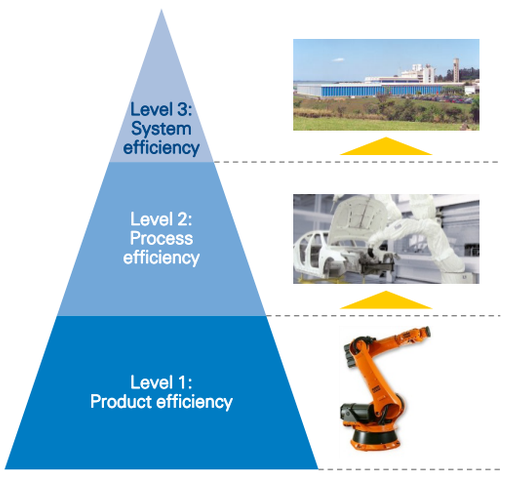
Careful consideration of system boundaries is needed in the design of an energy efficiency program

When a target area and overall ambition level (as described in the previous section) has been set, managers must operationalize this into an efficient and effective energy efficiency program. In doing so many aspects need careful consideration. One example is how to set the system boundaries of the energy efficiency improvement scope. This is especially important if customer energy efficiency is the target area.

The boundaries may span from single products to a complete system as shown in Figure 3. For a manufacturer of industrial products and systems it is therefore important to understand the complete "customer energy efficiency pyramid" and how its products will be used in an overall process and the complete system. Improving the energy efficiency of the individual product is not always the most cost effective way to improve the energy efficiency for the customer in the context of its complete production system.

A good example of this can be found in underground mining where one of the most energy consuming processes is the ventilation process. The process of ventilating toxic gases from explosives and exhaust gases from diesel powered mining equipment covers approximately 50% of the total energy consumption in an underground (hard-rock) mine.

Figure 3: The "customer energy efficiency pyramid"



Source: Arthur D. Little

Instead of putting all focus on improving energy efficiency of the individual mining equipment, suppliers can look at alternative ways to improve energy efficiency of the process. Electrification of equipment is one way to eliminate exhaust gases (not necessarily the same as improving energy efficiency). Equipment electrification has the secondary effect of reducing the need for ventilation, and thereby improves the energy efficiency of the whole system.

These types of secondary effects are critical to understand when creating business cases for an energy efficiency program. There is a risk of over-engineering individual products, adding expensive energy saving features that have limited marginal return. The customers' purchasing professionals motivate vendor selection by looking primarily at factors that can be monetized and included in a total cost of ownership calculation.

Suppliers must be ready to support with facts and figures of the overall benefits.

To design an effective and successful energy efficiency development program, manufacturers of industrial products and systems must balance the potentially added cost against customer value and willingness to pay.

Balance customer value of energy efficiency against added product and system cost

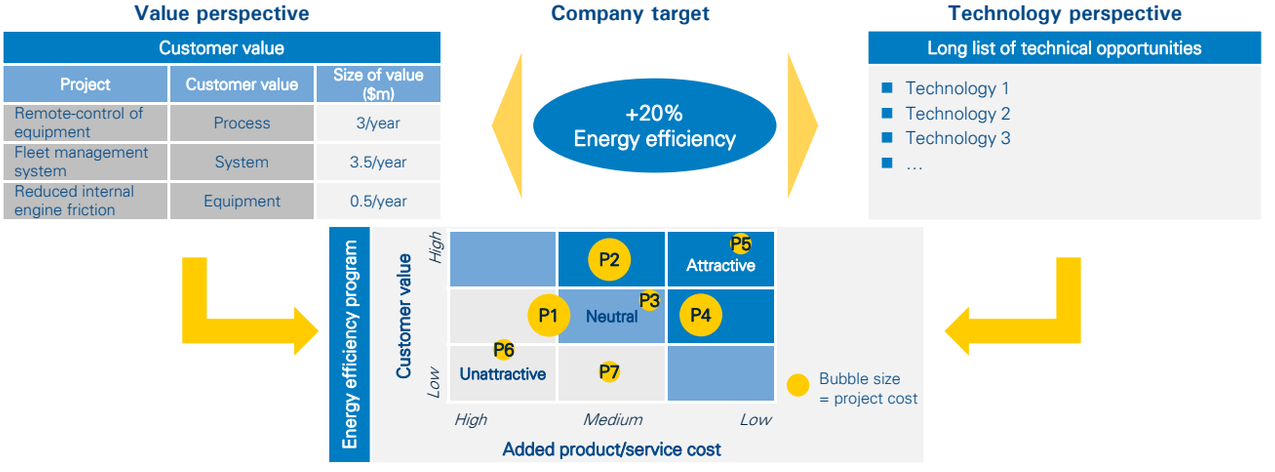
We suggest that an innovation matrix (as depicted in Figure 4), combining the value and technology perspectives, is used as the basis for prioritization and detailing of your energy efficiency program. This approach manages the risk of over-engineering and ensures maximum customer value.

The use of the innovation matrix is a process whereby a long list of technical opportunities, are combined into potential improvement projects. The added cost, if any, to the product or service that these improvements would generate, is mapped against the customer value that the improvements would bring. The process can also start by generation of customer value enhancing ideas that drive a need for development projects.

The cost of the development projects can be illustrated by e.g. "bubble size". Alternatively, the "bubble size" can depict engineering hours required, as in many cases the capacity of the R&D organization will be the limiting factor.

The improvements projects, in order of priority, and in enough quantity to reach the overall target, provided these projects are attractive, will form the energy efficiency program.

Figure 4: Innovation matrix using a value based approach to prioritize energy efficiency improvement projects



Source: Arthur D. Little

Capture growth opportunities enabled by energy efficiency focus

The understanding of the customer gained by the broad perspective of the energy efficiency will serve as a powerful vehicle for innovation. In practice this often means that the company leverages its know-how to expand into adjacent business areas. Consequently, when an equipment manufacturer wants to maximize added customer energy efficiency value, it does not always mean developing new technologies or product features but might equally well result in new services or business models.

A good example where an energy efficiency focus has enabled growth in adjacent areas is the BeyondZero portfolio by company SKF. The BeyondZero portfolio consists of products and solutions that help customers save energy and reduce carbon emissions. By combining its superior knowledge of how to improve energy efficiency by reducing friction, with a customer solutions perspective, SKF generated a revenue of SEK 2.5 billion from its BeyondZero portfolio in 2011 and plan to quadruple this number by 2016.

Summary and conclusions

We see opportunities to capture value and growth from the trend towards improved energy efficiency in industrial products and systems. The trend is solid and driven more by market factors than by regulation. To stay ahead, an efficient and effective energy efficiency program is required. The risk of over-engineering of individual products must be managed by carefully balancing the potentially added product cost against customer value (and willingness to pay). This balance requires a broad perspective and deep insight into the customer's process and system. Insight into systems and processes will also serve as a powerful vehicle for innovation of new features, services and business models.

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Arthur D. Little

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