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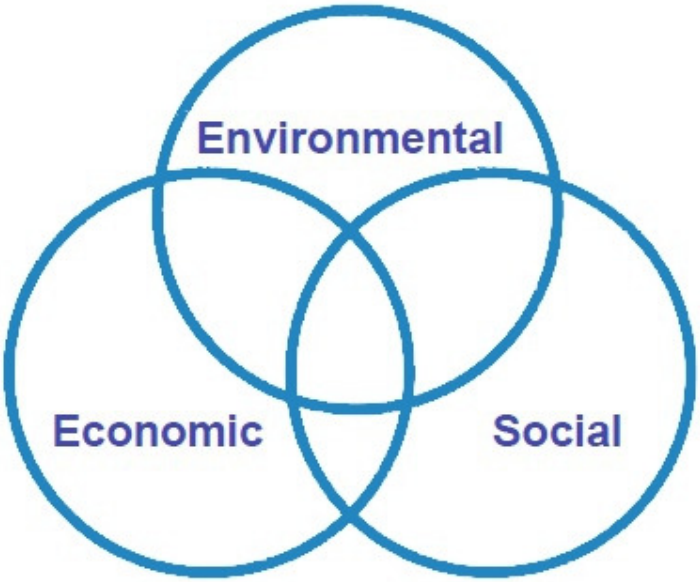
Industrial control systems and sustainable manufacturing



Sustainability indicators and issues

Sustainability, in simple terms, means using as few resources as possible, whether man-made, natural or indeed intellectual, to achieve one's objectives. Such a definition is highly pertinent in industries where a vast and wide variety of resources are utilised each day to achieve better production rates, higher availability and continued growth.

The three indicators of sustainability (pictured above) are environmental preservation, social responsibility and economic prosperity. Experts have found ways to quantify each of these dimensions to the extent that big multinational companies fully report their sustainability efforts year-on-year (e.g. see www.globalreporting.org).

Some key areas of environmental concern include[1]:

- Air quality
- De-forestation
- Bio-diversity
- Toxic chemicals
- Non-renewable materials
- Hazardous waste
- Waste volume
- Water

Social sustainability issues related to industries include:

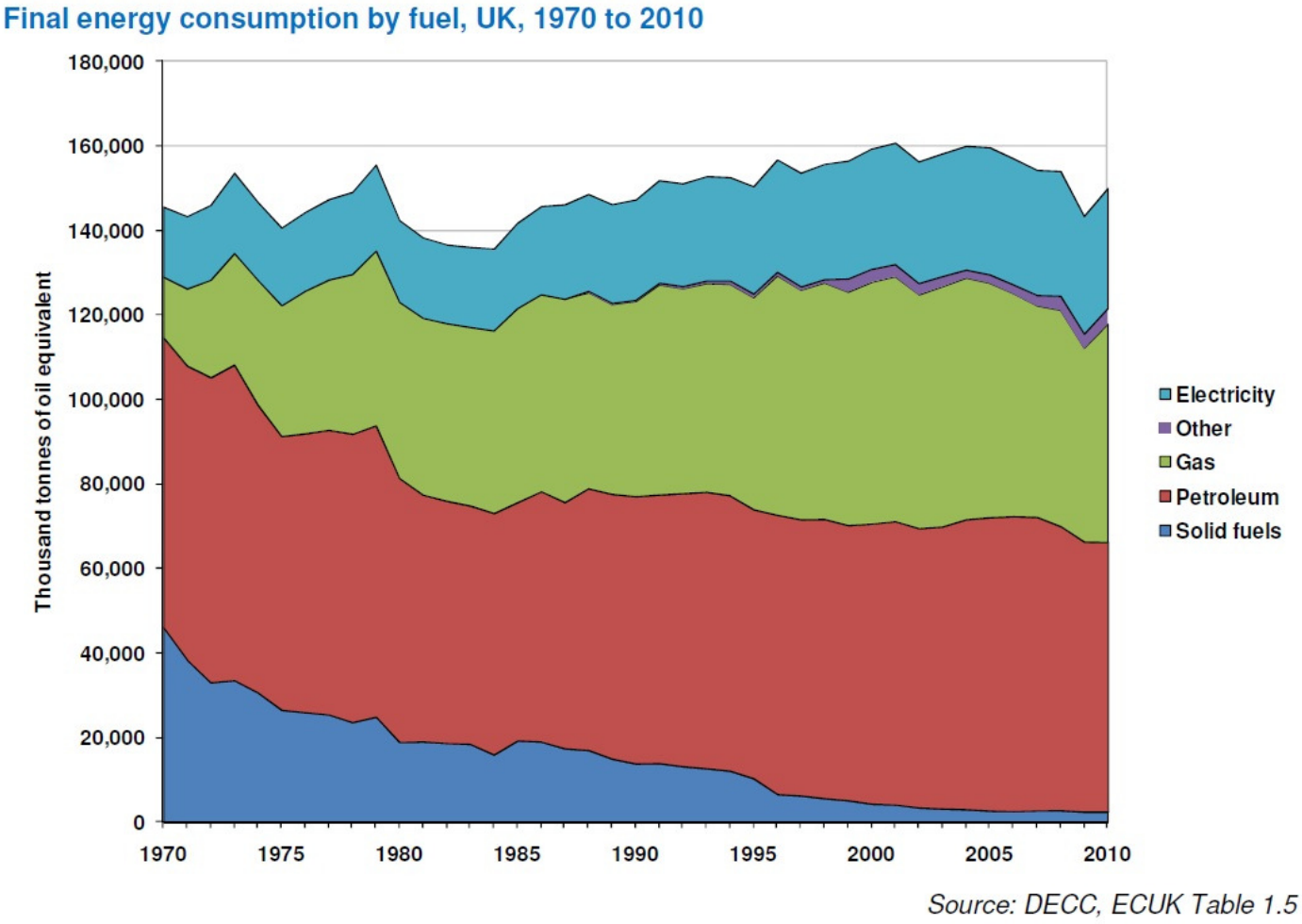
- Education
- Health and safety
- Employment

Sustainability from an economic perspective impacts the social and ecological consequences of economic activity.

[1] Source: University of Cambridge, England.

Paradoxically, the more intelligence we acquire on sustainability, the more unsustainable resource seems to be required for the world to keep functioning. One recent illustration shows that energy consumption in the UK has not decreased significantly since the 1970s (***figure 1***). In fact, this tendency is negative – an average of 3 % increase in energy consumption is not only unsustainable but also has a detrimental effect on natural resources.

Figure 1.



Sustainability – a problem for manufacturing?

It will be no surprise to learn that an increased demand for manufactured products directly correlates with increased volumes of consequential waste, significant air pollution and depletion of non-renewable materials. Even though manufacturing output growth boosts economic performance and creates social opportunities (such as higher employment rates) it does not enhance environmental preservation.

The industries at the centre of sustainability concerns are those consuming the most energy (***figure 2***), with the sectors generating high volumes of toxic pollution being:

- Petrochemicals
- Pulp and Paper
- Primary Metals

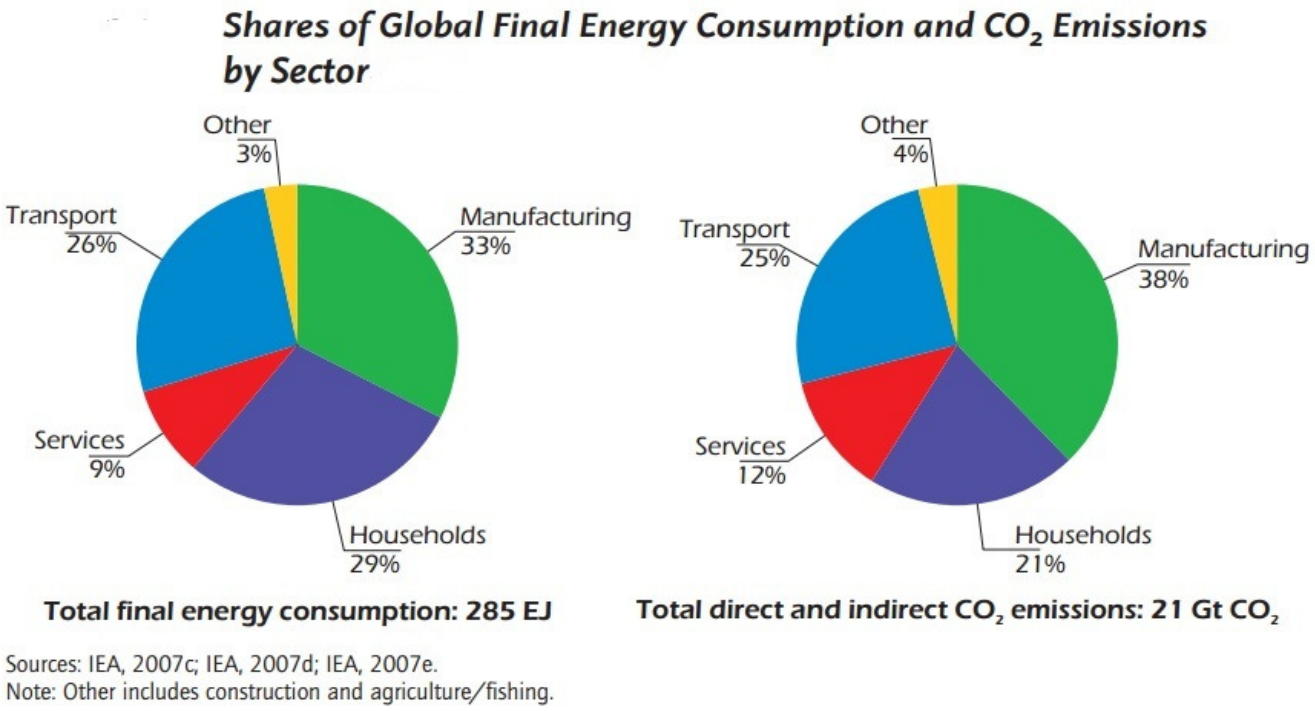


Figure 2.

Industrial control systems and sustainability

Global competition and rapidly changing customer requirements demand increasing sophistication in manufacturing environments. Enterprises are required to constantly redesign their products and continuously reconfigure their manufacturing systems[2]. The control systems industry has a part to play in the sustainability obligation.

Five ways in which the industrial automation sector can contribute to more sustainable manufacturing processes include:

1. **Using less energy –** AC and DC servo control ensures that motors employed in manufacturing work very efficiently thus reducing emissions and saving energy.
2. **Reducing unwanted outputs** – control systems ensure leaner production. By reducing end-of-line waste, automated systems contribute to reduced waste volumes.
3. **Recycling –** advanced automation methods allow for quick re-use of materials such as plastics and paper.
4. **Health and Safety assurance –** several industrial control techniques have been developed to minimize exposure to and impact of toxic chemicals.
5. **Prolonged machinery utility –** Most types of machinery have many years of useful life remaining but often electronic obsolescence renders the machine inefficient and difficult to support early before its mechanical lifetime has passed.

[2] As in Intelligent Systems in Manufacturing: Current Developments and Future Prospects, Meziane, F.

Optima Forum

How control systems are contributing to more sustainable manufacturing?

We at Optima initiated a discussion related to industrial automation and how it could be used in achieving more sustainable production. We asked several plastics and packaging industry professionals one simple question using social media networks:

Do you think that it is more sustainable to keep maintaining your old machinery or do you see brand new machines being more environmentally friendly and more efficient?

This is what some industry professionals had to say:

H.G: In terms of carbon footprint it is worse to buy a new machine than to maintain an old one. The carbon footprint of making the new machine is usually so big that it will take years to justify their purchase in "green" terms.
Of course, this is not what machinery producers will tell you, but then again- they care more about their sales than the planet. The situation is the same in the vehicles industry. Changing to Electric Vehicles makes sense for a future where natural resources will become scarcer, but it has nothing to do with eco-friendliness, at least not in the short term.

C.L: . It depends on what kind of product you are producing. You need to be competitive, so do not waste your money on buying expensive machineries with expensive spare parts if the profile has a poor added value. Of course, if you have big profiles to do, with high-speed process, your equipment MUST be at the top.

R.M: Let us say you are not selling the company anytime soon. Then if your business model or financial reporting has a column for sustainability, you can take the extra expenditure of new equipment to save mother earth and grandpa planet and let your amortization schedule do its thing and put some money in your gross for the duration of the schedule. Otherwise, if the equipment is not ancient, then retrofit/refurbish, for example, change drives, barrel temperature controllers (e.g. extruders), chill rolls and downstream heat transfer and drives as well. You get performance for a fraction of the cost and depending on what you run there are things to do to increase throughput per rpm. On the other hand if you need to change everything to get there...do the math and pick your course - retrofit versus new.

M.B: Before taking any decision on investment, either refurbishing or new machine buying, an energy audit is a must.

D.S: I agree with the upgrade option, I have seen specialty compounders that use single and twin-screw machines over 50 years old with retrofitted screws, motors, etc. and these are just as efficient as new machinery.

M.B: Before upgrading the machine, the following questions should be addressed:
1. Whether you want to upgrade your product quality?
2. Whether you want only to address energy saving for reduced production cost?
If so, the approach should be different.

I feel that only changing the screw and motor does not fix the problem. It is required to observe the capacity of existing thrust bearing.

K.A: There is a simple graph applying depreciation against maintenance costs used by most maintenance teams. When the two graphs cross it is time to consider the purchase of new equipment. The graphs can be modified to take into account efficiencies of new technology and weighted if the company desires against environment issues. I agree with many of the comments foregoing that the footprint of a new machine is high any way, so the machines need to be at least five years old before even considering replacement.

P.P: It depends largely on your use. If you have very high production rates, new fast efficient machines can pay for themselves in a short time, however if slow production rates due to orders or design of product, a fast efficient machine may be a waste of the resources used to make it as it might do no better, or as they say, horses for courses.

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