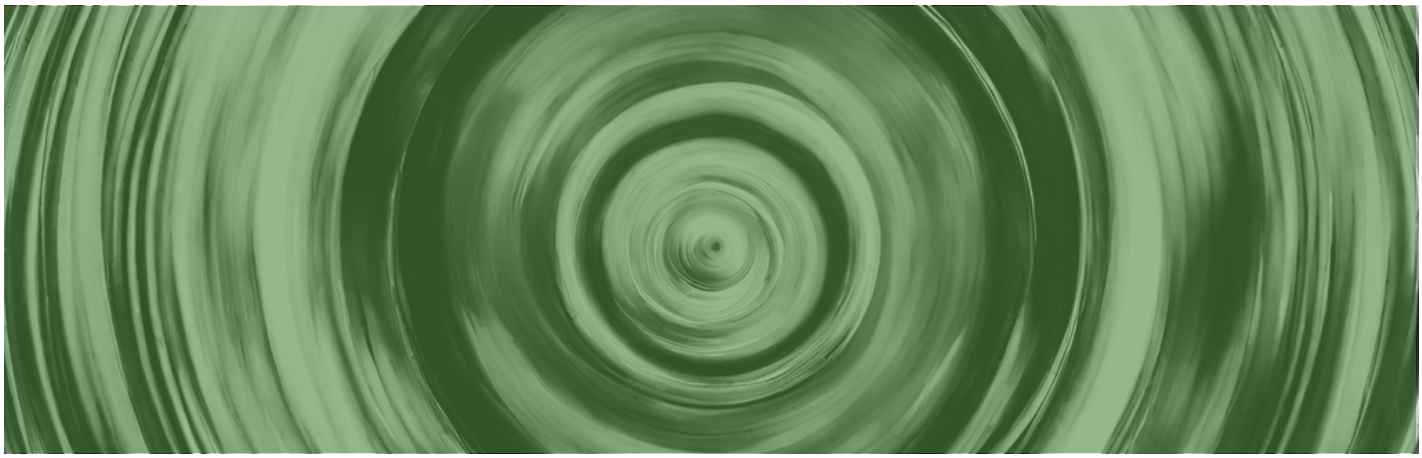
# Energizing Competitiveness: Strategies for Industrial Performance in a Cost-Conscious Era

**Executive Summary:** With mounting pressures to adopt green energy strategies, most manufacturers wonder how. Strife with concerns and already squeezed profit margins, decision-makers may be more keen to look for less risky and short-term energy-saving solutions. Particularly those solutions that promise little to no interference with production and manufacturing.

Decision-makers soon realise that while some strategies exist to reduce energy costs, only some take large enough steps to make a long-term impact.

Armed with the awareness facing manufacturing and production today, this insight report sheds light on the arguments for obtaining a stakeholders' position in the green supply chain.

To further complement the green-positioning strategy, the reader is introduced to emerging state-of-the-art technology concepts extending smart retrofitting to energy harvesting or recycling. Depending on the sector and application, some of these systems are in the proof-of-concept stages, and others are ready for deployment.



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I-R-POWER
recycling industry's electricity

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# Energy resilience in manufacturing

**Amidst future uncertainties in energy market prices and increasing global demand, resilience will hinge on selecting and implementing green and energy-saving alternatives.**

**Doing so is not merely a nod to global responsibility but a necessary one to seize a competitive edge.**

While governments and policymakers push the notion that high-energy-consuming manufacturers can benefit financially by integrating environmentally conscious measures, many wonder how.

Others are concerned that adopting energy-saving alternatives requires too much time.

As covered recently by the press "*Every minute that the machinery isn't working, every minute that paper isn't being produced is a damage to the profitability of the sector and a damage to the future investment potential and opportunities*, stated Andrew Large, director-general of the Confederation of Paper Industries." (The Guardian, 2022).

## *Are barriers too high?*

Given that many manufacturing processes run nearly continuously, integrating energy-saving technologies in industrial settings is akin to changing the wheels of a race car while it's whizzing around the track.

If the wheels stop spinning, how can one expect to maintain competitiveness, let alone win the race?

Interrupting manufacturing processes to replace legacy equipment with green or efficient alternatives is not without risk or uncertainty. Among them are concerns of unpredictable downtimes.

However, adopting a growth mindset may ease the transition to going green while seizing promised benefits.

Start small, build, and then scale.

An overall strategy may be to reinvest green energy savings or simply let them compound with time, effectively increasing profit margins.

### *Clean-cut strategies to energise competitiveness*

One of the simplest and most clean-cut strategies to energise competitiveness is to reduce energy consumption.

The competitive edge from reducing energy consumption manifests as a consequence of implementing solutions designed to improve energy efficiency by:

1. Promoting cost savings.
2. Attracting new clients.
3. Maintaining existing clientele.

For example, switching to energy-efficient lighting or changing lighting settings according to the production plan are simple solutions. Combining the two can cut energy costs even more; capital investments are minimal, and there is no need for external expertise.

Other options include replacing windows or reducing the indoor temperatures. Despite their ease, these energy saving options make minor dents in energy costs, are realised over a long period and may receive a lacklustre applause from stakeholders.

Simply, more considerable savings may require larger steps.

For example, energy-recycling systems are emerging state-of-the-art concepts for building upon the existing basis of equipment.

A most innovative approach uses vibration energy from heavy-duty freight railroad traffic (Zhang et al., 2023).

The invention consists of a track vibration energy harvester that is retrofitted under the rail track through a fixed fixture.

Each time a train travels at a certain speed, the vibrations generated between the wheels and rails are transformed into electricity.

Surely, if we can come up with smart energy retrofitting solutions to transport our goods, then there must be equivalent solutions for making them.

### *An opportunity to be in the green supply chain*

Fortunately, manufacturers may soon find themselves in an opportune moment. As the global appetite and political pressures mount for a greener supply chain (Haleem et al., 2023) manufacturers may do well by shining the spotlight on the production methods.

The seeking behaviour of sourcing and procurement officers from major companies foreshadows a marketing advantage businesses can expect should they choose to showcase their green and sustainable practices.

The need for businesses offering sustainable products or services that can also document their sustainability commitment, such as tonnes of CO2 saved per year, will emerge as top-choice supplier.

This is why technologies enabling manufacturers to operate with marked improvements in energy efficiency on a more immediate time scale can seize the promise of a competitive advantage.

### **Flywheel energy storage technology translates to energy efficiency**

Energy storage systems use various technologies. Many can contribute to energy-efficient solutions in manufacturing and production settings.

Among them are hydroelectricity, batteries, supercapacitors, thermal storage, and energy storage flywheels.

To date, Li-ion batteries, supercapacitors, and flywheels can be deployed more rapidly and as scalable solutions (Li et al., 2022).

Notably, flywheels have the least environmental impact among the three technologies since they contain little to no chemicals.

Simply, a flywheel is a mass rotating about an axis, which can store energy mechanically through kinetic energy.

While low-speed flywheels have been used for years for uninterrupted power systems, modern high-speed flywheels (HSF) can deliver energy-efficient solutions for manufacturing and production settings.

According to the latest scientific developments (Choudhury et al., 2021), flywheel energy storage systems offer a range of advantages:

- Low maintenance
- Longer life cycle
- Highest depth of discharge
- No environmental hazard
- Fast power response
- Potentially high specific density
- Short discharge time
- Efficient energy storage capability
- Short-term response
- Efficiency is 90%

Unknown to most, the advancements of flywheel technology and the popularity of the uses began decades ago within motorsport consortia.

Now flywheel technology is diffusing to the factory floor.

### *How the race track catalyzed clean energy flywheel technology.*

Known as a 'little brother' of the HSF, a micro-HSF is used as a kinetic recovery system (KERS). The micro-HSF was first developed to recover the braking energy of race cars and then for buses. The resulting light and compact designs could deliver high power output for rapid acceleration.

The development, diffusion, and much of our knowledge today about flywheel technology was accelerated when the use was allowed in Formula One races nearly 15 years ago (Sorniotti et al., 2008).

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### *Flywheels explained simply*

Whenever a vehicle brakes, the flywheel system spins up, and the kinetic energy, which would otherwise be wasted as heat, is transferred to the flywheel, causing it to spin. This spinning flywheel stores the energy as rotational energy.

Later, when the vehicle needs a burst of power, instead of relying on gas, the flywheel releases this stored energy into the system. The process simply repeats.

Now, imagine scaling that system to harness the braking energy of electric motors on the factory floor.

Energy that would otherwise be dumped as heat can be stored, released and used to slash energy consumption costs. The benefits are immediate, and the stored energy can be redistributed across production.

Sounds complicated? It's not.

***Retrofit legacy equipment with flywheel technology for immediate savings***

A challenge most manufacturing companies have in common is that the installed base of legacy machines and equipment is not yet equipped to be energy efficient (Jaspert et al., 2021).

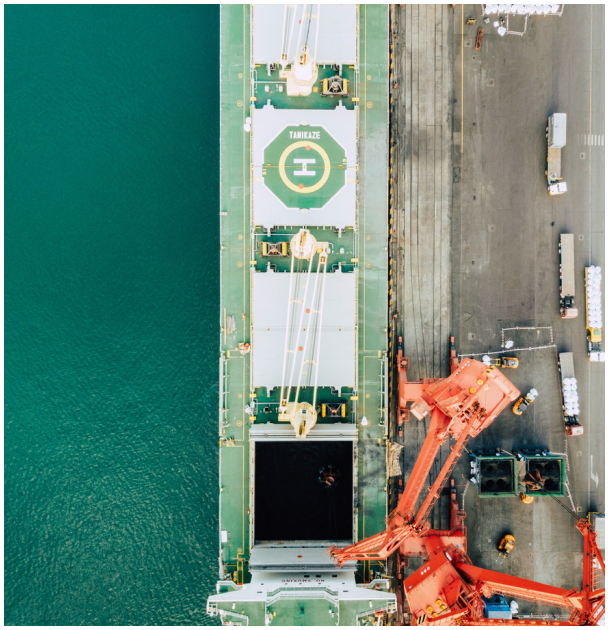
Although the need and benefits of reducing energy consumption within production lines are clear, the decision to replace or retrofit the existing assets must first be made.

While updating machinery can yield positive short-term effects on the production plant's digitization and energy efficiency level, replacing functional machines also requires high investments and contradicts the idea of sustainable production (Khan et al., 2018)

Retrofitting legacy equipment, however, can reduce energy consumption and carbon footprints with little to no interruption to manufacturing and production. Thus, retrofitting may be more suitable options for getting started.

In other words, there is no need to replace wheels on the race car while they spin.

During many types of manufacturing and production processes, for example, electric motors are known to consume the most incredible power.



Much of that power is lost to heat. And few industry floors are immune to incredible power consumption, including but not limited to:

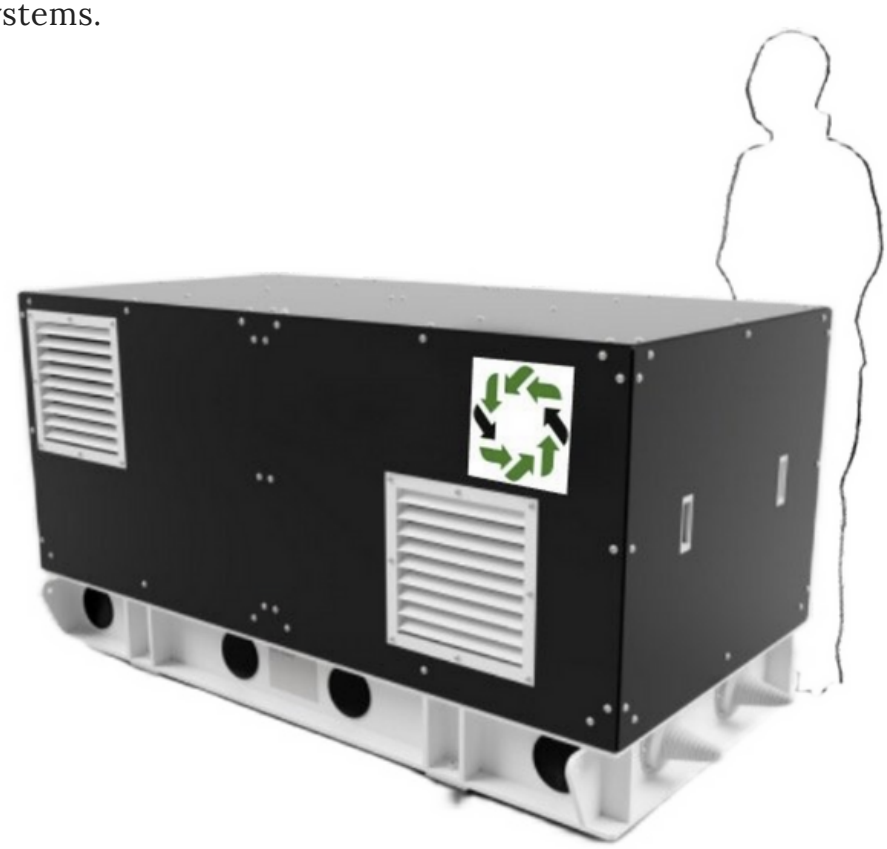
- Glass, Paper and Packaging
- Apparel and Textiles
- Oil, Chemicals, and Plastics
- Gadgets and Computers
- Automotive
- Transportation and Distribution
- Food Production
- Metal Manufacturing

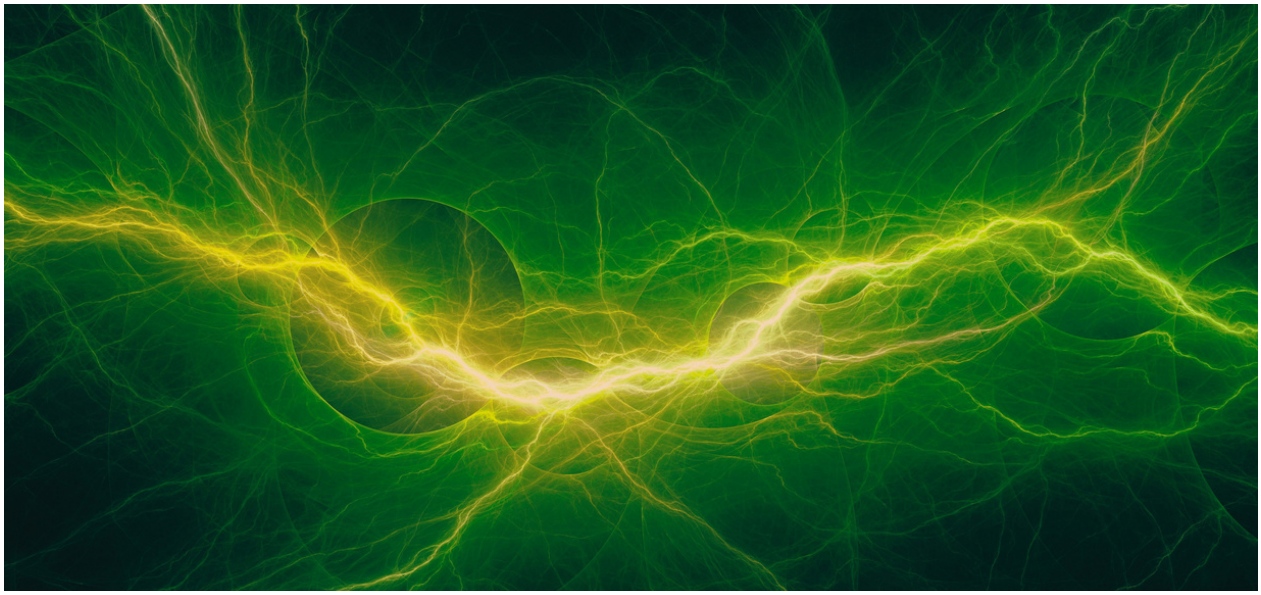
**I-R-Power,** for instance, is ready to retrofit legacy equipment with its electricity recycling system. One core feature is the state-of-the-art flywheel technology. The system is non-intrusive and designed to be compatible with existing electrical systems.

With every industrial press, mould, cast or assembly process where electric motors undergo repeated or cyclic braking, IR-Power can capture and store wasted braking energy and release it back into the grid.

One of many benefits of the **I-R-Powers**' recycling electricity system is that the flywheel technology can cut energy costs associated with peak loads by supplying boosts of high-power output.

In this way, you can embrace the competitive mentality and technology we've come to admire in Formula One racing.





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