

# Case Study: A Mechanical Engineer's Personal Sustainability Roadmap and European Regulatory Alignment

Throughout this module, we provided you foundational knowledge, practical examples and tools that you can apply to understand the environmental SDGs, and this case study can assist you broaden your understanding and apply knowledge from module 4 into practical solution through problem-based solving. For that purpose, follow the case below.

## Case scenario

Alex, a recently graduated mechanical engineer, has started working at a small engineering firm that specializes in designing and maintaining industrial machinery. Although the firm is making slow progress toward sustainability, it lacks formal policies in this area. Passionate about environmental issues, Alex is eager to integrate sustainable practices into their work and influence the firm's direction. To achieve this, Alex creates a personal sustainability roadmap, aiming to align both individual and firm-wide practices with European regulations and policies that promote sustainability in engineering. Following steps below resolve this case:

### ➤ Step 1: Understanding Sustainability in Mechanical Engineering

Alex quickly realizes that mechanical engineering plays a crucial role in environmental sustainability. The firm's projects, whether designing machines or improving industrial processes, significantly impact energy consumption, material use, and waste generation. Alex identifies key areas where sustainability can be applied:

- *Energy efficiency* in machinery design
- *Sustainable material selection* and waste reduction
- *Design for the circular economy*, promoting reusability and recyclability
- *Reducing carbon footprints* in manufacturing and operations

These goals become central to Alex's sustainability roadmap, which focuses on transforming how engineering is approached at the firm.

### ➤ Step 2: Creating a Personal Sustainability Roadmap

To bring sustainable thinking into his career, Alex creates a personal sustainability roadmap that outlines specific steps to integrate sustainability into daily engineering work.

#### I. Education and Continuous Learning:

- *Courses and Certifications:* Alex enrolls in courses focused on sustainable engineering practices, such as lifecycle analysis and energy-efficient systems.
- *Industry Engagement:* Alex attends conferences and webinars to stay updated on the latest sustainability trends in mechanical engineering.

#### II. Setting Professional Sustainability Goals:

- *Short-Term Goals:* Begin incorporating sustainability into current projects, suggesting design improvements to reduce energy consumption and using more environmentally friendly materials.

- **Mid-Term Goals:** Propose a firm-wide sustainability strategy, starting with practical changes such as improving recycling efforts and reducing waste in the design and manufacturing processes.
- **Long-Term Goals:** Lead a project that significantly reduces the carbon footprint of the firm's products, positioning the firm as a sustainability leader in the industry.

### III. **Engaging with the Firm:**

- **Advocacy:** In team meetings, Alex introduces discussions on sustainability and suggests evaluating the environmental impact of designs.
- **Collaboration:** Alex forms a working group with like-minded colleagues to brainstorm and propose sustainable practices for the company.

### IV. **Tracking and Evaluation:**

Alex creates a system to track progress toward sustainability goals, documenting achievements such as energy savings in designs and the use of recycled materials.

## ➤ **Step 3: Researching European Policies and Regulations Impacting Engineering**

Realizing the importance of aligning the firm's practices with European regulations, Alex conducts research to identify relevant policies that promote sustainability in engineering. These regulations provide both a framework for guiding sustainable practices and a roadmap for compliance and innovation.

### **Key European Policies Impacting Engineering:**

- I. **European Green Deal:** Aimed at making Europe climate-neutral by 2050, this policy requires firms to reduce greenhouse gas emissions and adopt low-carbon technologies. Alex sees this as an opportunity to integrate energy-efficient and carbon-reducing designs into the firm's projects.
- II. **Circular Economy Action Plan (CEAP):** Focused on sustainable product design, reducing waste, and encouraging recyclability, this plan prompts Alex to rethink how the firm designs machinery. Alex advocates for designs that use recycled materials, extend product lifecycles, and facilitate disassembly for future reuse.
- III. **Eco-design for Sustainable Products Regulation (ESPR):** This regulation mandates that energy-related products meet specific environmental performance standards. Alex ensures that the firm's designs focus on energy efficiency and minimising environmental impact throughout the product's lifecycle.
- IV. **REACH Regulation (Registration, Evaluation, Authorisation, and Restriction of Chemicals):** REACH limits the use of hazardous chemicals. Alex pushes for material selection that avoids harmful substances, ensuring both safety and environmental responsibility in designs.
- V. **European Climate Law:** This law commits the EU to climate neutrality by 2050, which means projects must contribute to significant carbon reductions. Alex incorporates this into the design process by selecting low-carbon technologies and materials that reduce the environmental footprint.
- VI. **EU Emissions Trading System (EU ETS):** The EU ETS regulates greenhouse gas emissions for industries. Alex evaluates the firm's operational emissions and begins exploring ways to reduce them through energy-efficient processes and technologies.

#### ➤ Step 4: Incorporating European Policies into the Sustainability Roadmap

Armed with a deeper understanding of European regulations, Alex adjusts the personal sustainability roadmap to ensure both individual efforts and the firm's projects comply with these regulations.

##### I. Policy Compliance Review:

- *Short-Term:* Alex conducts a compliance review of the firm's projects, ensuring adherence to the new (2024) Ecodesign for Sustainable Products Regulation (ESPR) and REACH regulations. This includes auditing existing designs to improve energy efficiency and eliminate harmful materials.
- *Mid-Term:* Alex proposes an internal sustainability audit, identifying areas where the firm can improve in terms of waste reduction and energy use, aligning with the EU's Circular Economy Action Plan (CEAP).

##### II. Aligning Projects with Circular Economy Goals:

- Alex works with the design team to implement principles from the Circular Economy Action Plan (CEAP), promoting durable, repairable, and recyclable designs in the firm's machinery.

##### III. Energy Efficiency and Carbon Reduction: EDUCATION MISSION FOR SUSTAINABILITY

- Alex introduces *energy-efficient technologies* and *low-carbon materials* in machine design projects, ensuring that new developments support the European Green Deal and Climate Law objectives.

##### IV. Developing a Firm-Wide Sustainability Policy:

- Alex uses the knowledge of European policies to advocate for a firm-wide sustainability strategy. This strategy includes designing products that meet Eco-Design standards, reducing the firm's carbon footprint in line with the European Climate Law, and prioritising sustainability in every project.

#### ➤ Step 5: Early Wins and Challenges

##### ○ Successes:

- Alex successfully influences a design change that reduces the power consumption of a key product by 15%, positioning the firm as more energy-efficient and environmentally conscious.
- Through advocacy and leadership, Alex forms a working group within the firm that drafts a preliminary sustainability policy. The firm's leadership agrees to explore sustainability initiatives more seriously, thanks to Alex's efforts.

##### ○ Challenges:

- Some colleagues resist the changes, particularly those concerned about the costs of adopting more sustainable materials or processes. Alex learns to frame sustainability as not only an ethical choice but also a long-term cost-saving measure, aligning with future regulatory compliance.

#### ➤ Step 6: Impact and Future Goals

By integrating European policies and regulations into both his personal sustainability roadmap and the firm's projects, Alex has successfully influenced the firm's trajectory toward sustainability. Through a combination of education, advocacy, and regulatory alignment, Alex has:

- ✓ Developed key sustainability-focused skills in mechanical engineering.

- ✓ Led the firm to adopt more sustainable design practices in line with the European Green Deal and Circular Economy Action Plan.
- ✓ Positioned the firm to comply with future EU regulations, securing a competitive advantage.

Moving forward, Alex aims to continue driving sustainability at the firm, with an eye on leading projects that have a measurable positive impact on the environment. Alex plans to expand the firm's sustainability policy and further align the firm's operations with Europe's ambitious climate and sustainability goals.

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***This case study highlights how a mechanical engineer can combine personal career goals with regulatory compliance, demonstrating the importance of understanding both sustainable engineering practices and the broader regulatory environment. By doing so, Alex is not only building a more sustainable career but also positioning the firm as a leader in environmentally responsible engineering.***

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