dilapro

DIGITAL LASER PRODUCTION

Project n° 101138859

DIGITAL TWINS OF LASER PROCESSING FOR MULTI-CAPABILITY MANUFACTURING OF COMPLEX COMPONENTS AND DIGITAL CERTIFICATION

Newsletter #5

01. Managing Complexity: How DILAPRO Ensures Collaboration, Quality, and Engagement

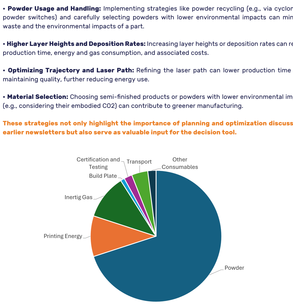
Project Management of an international consortium of 11 partners across industry, academia, and RTOs is no small feat—especially when most meetings happen online. The DILAPRO project has adopted innovative tools to ignite collaboration and keep the project thriving.

With so much expertise in the team, how do we ensure knowledge is shared across organisations? Often, participants don't fully understand each other's fields, leading to missed opportunities. In day-to-day meetings, focus is usually on the matter at hand, and not much time can be devoted to truly understanding each other's fields.

To tackle this, **DILAPRO** introduced knowledge-sharing sessions where partners covered the basics of their expertise, and others could ask all the "stupid questions" left unasked in regular meetings. Topics from machine learning and digital twins to eddy current sensors and the laser texturing technique have been presented in these voluntary sessions, that usually had an attendance of between 15 and 30 people.

Another innovative element in DILAPRO's management is the **Deliverable Quality Control Committee** (DQCC).
The **DQCC** consists of 1 member from each of the Universities, RTOs and organisations in **DILAPRO**, who assist the project manager in ensuring a high level across the 51 deliverables of the project. Each deliverable is reviewed by a DQCC member before submission, giving feedback on the content and scientific level of the deliverable.
The project coordinator also reads and comments on all deliverables, but can focus on ensuring consistency across the different partners. This collaborative approach not only ensures a high level of quality of the deliverables, but also that each DQCC member gets detailed insight into other parts of the project.

As mentioned, online meetings are a major part of an international project – and in the age of Teams and Zoom, they definitely improve communication and collaboration from the times of phone calls and e-mails only. However, online meetings are no substitute for physical meetings, so at least twice a year, the **DILAPRO** consortium gets together at a partner location to discuss the project, present results and get social. The last meeting was hosted by Dublin City University in January '25, and included 1 and a half days of workshops, presentations and discussions – along with sightseeing and wonderful Irish hospitality. We are already looking forward to the June '25 meeting at the European Welding Foundation in Lisbon, Portugal.



02. Environmental Impacts of Laser Manufacturing Technologies

In our previous newsletters, we introduced how **DILAPRO** aims to reduce the environmental impact of laser technologies. We shared our progress in process mapping, **Life Cycle Inventory** (LCI) data collection, and the evaluation of environmental impacts.

Now, we are moving towards the next step: integrating these findings into a comprehensive decision-making tool.
The goal of this task is to balance the quality of laser-manufactured parts with environmental and economic considerations.

High-quality parts should not come at an unreasonably high environmental or financial cost. To achieve this, we are developing a decision tool that will integrate both **Life Cycle Assessment** (LCA) and Life **Cycle Costing** (LCC) methodologies. This tool will empower users to compare different strategies for utilizing laser technologies, helping them make data-driven decisions about production processes.

The decision tool will rely on the results of our LCA and LCC analyses. Below is a brief overview of some key findings and strategies identified so far:

• Utilizing Build Space Efficiently: Maximizing the use of the build plate reduces material waste and time. This aligns closely with the sustainability principles discussed in Newsletter #1.

• Sealing and Gas Usage: Optimizing gas consumption during the process can significantly reduce environmental impacts, particularly with inert gases like argon or nitrogen.

• Powder Usage and Handling: Implementing strategies like powder recycling (e.g., via cyclones or powder switches) and carefully selecting powders with lower environmental impacts can minimize waste and the environmental impacts of a part.

• Higher Layer Heights and Deposition Rates: Increasing layer heights or deposition rates can reduce production time, energy and gas consumption, and associated costs.

• Optimizing Trajectory and Laser Path: Refining the laser path can lower production time while maintaining quality, further reducing energy use.

• Material Selection: Choosing semi-finished products or powders with lower environmental impacts (e.g., considering their embodied CO2) can contribute to greener manufacturing.

These strategies not only highlight the importance of planning and optimization discussed in earlier newsletters but also serve as valuable input for the decision tool.



***Figure 1:** Stylized results of the contributions of different consumables in LPBF to global warming*

The decision tool we are developing will be designed to provide clear, actionable insights for users of the **DILAFACT** software.

It will allow for comparisons between processing steps, costs, and environmental impacts based on defined parameters such as material usage, energy consumption, and part quality.

For example, the tool could feature visual outputs like pie charts to display the environmental impact of each process step (e.g., in terms of CO2 equivalents). This would help identify the most significant contributors to environmental impacts, such as powder, gas or energy usage, enabling users to focus their efforts on areas with the highest expected pay-off.

To ensure the tool addresses real-world needs, we are currently brainstorming with users and equipment providers within the **DILAPRO** consortium to identify additional requirements or "nice-to-have" features beyond the initial scope of the task. These discussions will help us refine the tool, so it delivers both practical and strategic value, even if performing a complete **LCA** and **LCC** will be out of the scope of **DILAFACT** software.

By integrating environmental considerations into an accessible decision-making framework, we are taking another important step toward sustainable laser manufacturing.

Events

New Addition to ILAS 2025: DILAPRO Project Workshop!

We're thrilled to announce a new and exciting workshop at ILAS 2025! Join us on Wednesday, March 26th for the DILAPRO Project Workshop, where we will dive into the transformative role of data-based technologies in revolutionizing the certification processes for laser-based additive manufacturing.

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DILAPRO Project presented EWF at the Specialization in Laser Welding

We had the pleasure of presenting the DILAPRO Project during the European Federation for Welding, Joining and Cutting (EWF) Specialization in Laser Welding, sharing the latest advancements and innovations being developed.

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DILAPRO's 3rd Physical Meeting: Advancing Innovation at Dublin City University

The DILAPRO consortium recently gathered for its third physical meeting, hosted by Dublin City University (DCU). This two-day event brought together project partners from across Europe, fostering collaboration, innovation, and knowledge-sharing as we continue to push the boundaries of digital transformation in lifelong learning.

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Strengthening Collaboration and Innovation: IMDEA Materials Hosts Visit from DTU for DILAPRO Project

On January 8-9, IMDEA Materials Institute had the pleasure of hosting colleagues from the Technical University of Denmark (DTU) as part of the DILAPRO Project.

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