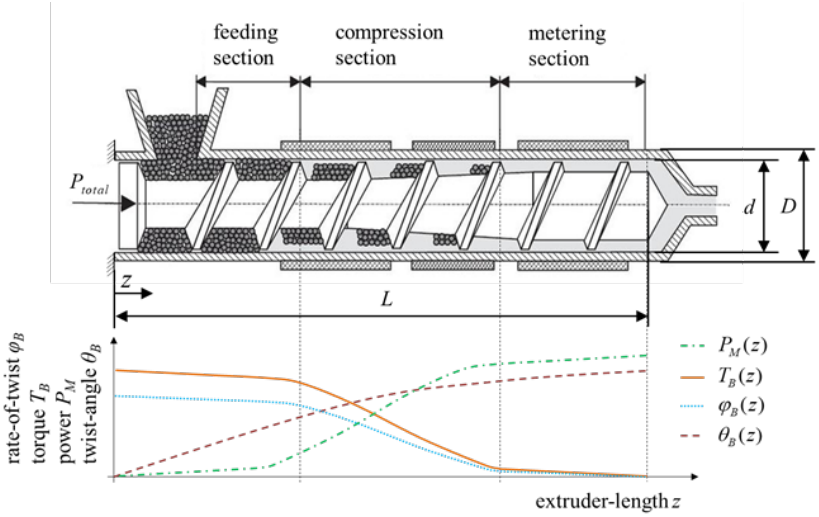
SUCCESS STORY

Pro²Future
Products and Production Systems of the Future

Programme: COMET – Competence Centres for Excellent Technologies

Programme line: COMET-Centre K1

Type of project: E-Manager 1.2, 2 years, strategic



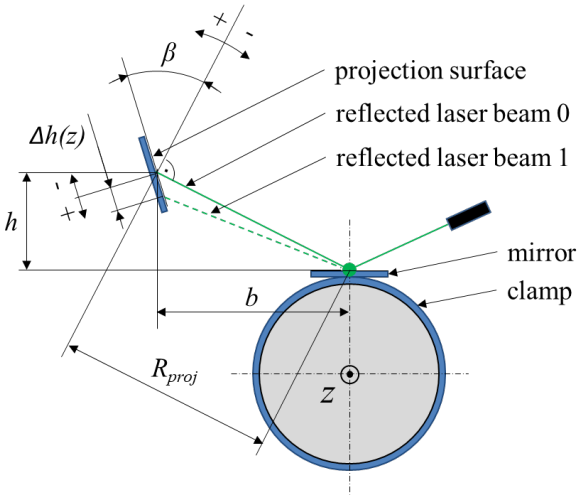
IMPROVED ENERGY EFFICIENCY IN EXTRUSION

NOVEL MEASURING METHOD ENABLES TO DETECT AXIAL DISTRIBUTION OF MECHANICAL ENERGY INPUT ALONG A SINGLE-SCREW EXTRUDER

Global annual plastic production reached approximately 370 million tons for 2020 (statista.com) – more than a third of which is processed by using **extrusion machines**.

Depending on the processing, between **37%** and **48%** of the energy demand is **provided** by the **extruder**. Approximately **80%** of this energy is introduced in the form of mechanical energy due to the **rotating screw**. This mechanical energy input is mainly dependent on screw geometry and design of the extruder and strongly influences the **total energy consumption** as well as the **quality** of the **extruded plastic**.

Researchers at Pro²Future have succeeded in developing a **novel measurement approach** to identify how much mechanical energy is introduced at which **axial extruder position**. The measuring principle is based on the **deformation** of the extruder **cylinder** due to the energy input, which is detected by **laser beam** deflection using a **mirror system**.



Schematic representation of the measurement method

The physical principle is based on the mechanical power being **proportional** to the **screw** respectively **cylinder torque**.

Federal Ministry
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Climate Action, Environment, Energy, Mobility, Innovation and Technology

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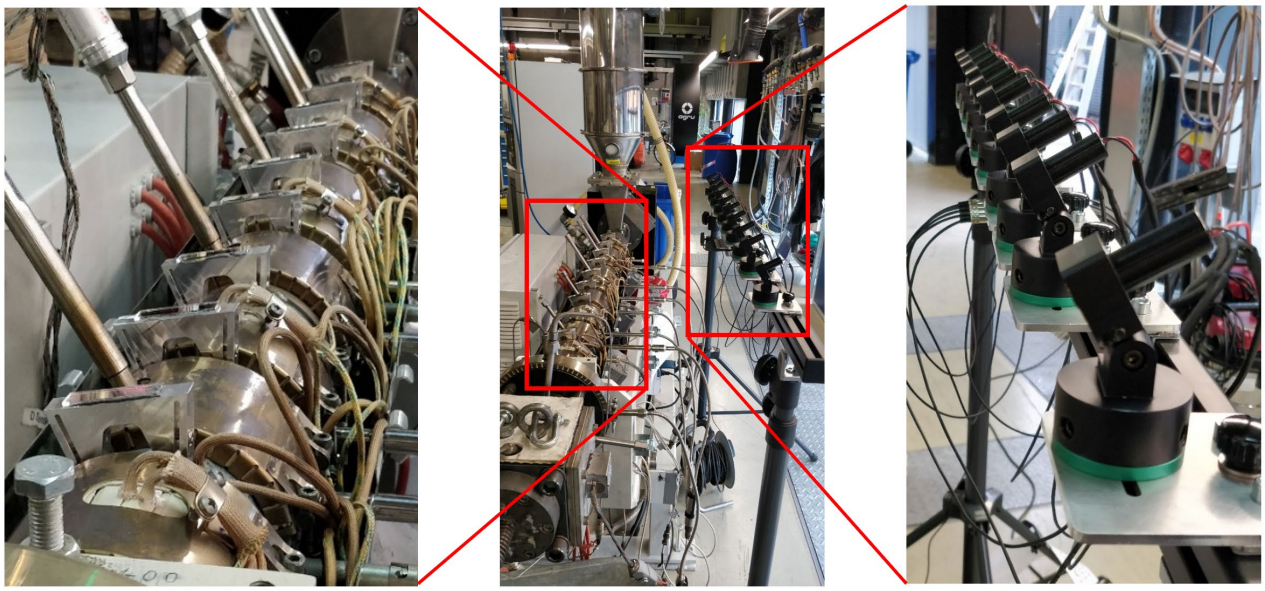

Prototype test setup with 10 measuring points on a single-screw extruder.

Impact and effects

The development of the measurement method is already well advanced, and several **prototypes** have been designed and tested. The prototypes consist of flexible measuring units, with each individual unit consisting of a mirror mount and a laser, which can be placed at any position on the extruder barrel. Recent measurements carried out have shown very promising results. Subsequently, the measuring method and measurement devices will be improved, and it is planned to develop a measuring system for **commercial use**.

The measurement method can be used for **process monitoring**, **design improvement** (characterization of the energy input along the processing unit), and **optimization** and **validation** of simulation models, which means that more **energy-efficient** extrusion screws can be produced. This leads to a more **sustainable screw design** and overall, to an **improved energy efficiency** in **polymer processing**.

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