TRANSPORT AND SUPPLY CHAIN OPTIMISATION
Transport technologies for industrial processes
Within the scope of the EPOS project, extensive literature and market research reviews were performed in order to identify different technological, organisational, service and management solutions that could be applied to different industrial sites and clusters. The collected information will aid in establishing on-site and/or cross-sectorial industrial symbiosis opportunities; additionally, to enhance overall sustainability, performance and resource efficiency of different process industry sectors. Through the cooperation of project partners, a longlist of different technological options was created. Resource material for this list included: scientific articles, project reports, manufacturer’s documentation and datasheets.

About the EPOS Technology Focus

TRANSPORT AND SUPPLY CHAIN OPTIMISATION

The transport and supply chain is one of the core processes in each industry sector. The optimisation of existing transport and supply systems can be done through the introduction of new technological, organisational or operational measures. Improvements can be made on many levels, namely plant, site, warehouse and transport to or from other industrial sites or plants. In addition to the improvement of the existing transport and supply processes, there are also opportunities for collaboration or the sharing of resources and assets related to the transport and supply chain. These opportunities can be identified in order to establish symbiosis between different sectors (e.g. shared warehouse facilities, consolidation of freight shipments, etc.). Options for the optimisation of plant or warehouse transport and logistics systems are identified. Though some of these technologies are already widely used across different industrial sectors, there is often a potential for improvement, upgrading or replacement of old systems with new ones, which are more efficient and practical. In addition to the technological options, possibilities for transport optimisation from an organisational perspective is provided; allowing for a better understanding in how to utilise available transport capacities. Measures for improved operation of storage facilities are also indicated.

TRANSPORT TECHNOLOGIES FOR INDUSTRIAL PROCESSES

The technologies identified here are for transport within industrial processes.

- Belt conveyor
- Vertical conveyor
- Spiral conveyor
- Pneumatic conveying system
- Air-slide conveyor
- Linear motor
- Pneumatic tube system
- Compressed air engine
A common mechanism used for the transportation of goods and materials in industrial processes. The use of belts with a low coefficient of friction, such as cog belts/timing belts, instead of screw conveyors, can contribute to the overall improvement of energy efficiency on an industrial site. Additional types of belts that can be used are polyurethane belts with polyamide fabric tooth facing, which were developed to reduce friction during belt and pulley tooth meshing.

**Technology 1: Belt conveyor**

**Applicability**
For the transportation of goods and materials in various industry sectors.

**Maturity**
Commercial.

**Cog-Veyor’s solution**
Vertical conveyors (freight lifts, material lifts) are used to raise material. They are often combined with horizontal conveyors to ensure continuous movement; they can also be equipped with forks in order to increase the throughput and ensure continuous material flow.

**Applicability**
For the transportation of goods in different industrial processes where transport between different height levels is required. They are especially practical in the assembly processes.

**Maturity**
Commercial.

**Project/product reference**
Qimarox vertical conveyors.
Spiral conveyors serve a similar function to vertical conveyors; it is used to transport materials to different height levels. Unlike vertical conveyors, spiral conveyors allow for the continuous movement of materials, which results in a higher throughput. To prevent sliding there is only a slight decline or incline (usually of approximately 9° to 11°).

**Applicability**
For use in different industrial processes, where transport between different height levels is required. Spiral conveyors are especially practical in the assembly processes.

**Maturity**
Commercial.

**Project/product reference**
Ryson spiral conveyors.

![Figure 3 Spiral conveyor](image)
Pneumatic conveying systems work by using air flow and a pressure differential; creating either a pressure conveyer or a vacuum conveyer. Together, the flow and pressure are used to carry airborne solid particles from one point to another. These particles can be up to approximately 50 mm in size. The powder or solid must be dry, not sticking and with a moisture content of no more than 20%. In a pneumatic conveying system, most of the energy is used for the transport of the air itself. The energy efficiency of a pneumatic conveying plant is relatively low, but this is often outweighed by easy handling and, in well-designed systems, dust free solutions.

Applicability
For the transportation of common solids such as flour, sugar, cement and many more (see also the basic description).

Maturity
Commercial.

Project/product reference
Hecht’s solution.
Technology 5: Air-slide conveyor

Developed as a replacement for screw conveyors and belt conveyors, where noise, maintenance, and dusting to the environment were issues. The energy requirements are minimal because only a small volume of air at low pressure is required to move the material.

Applicability
For the point-to-point movement of any bulk dry free flowing powder that can fluidise (see also the basic description).

Maturity
Commercial.

Project/product reference
FLSmidth’ solution.
Technology 6: Linear motor

Linear motors work on the same principle as the basic electric motor, but with the stator and rotor unrolled in order to enable linear instead of circular movement. There are different types of linear motors: induction, synchronous, homopolar and piezoelectric.

Applicability
Can be used in many areas such as railway transport (high-speed trains, transport shuttles); for the linear movement of materials in horizontal or vertical directions.

Maturity
Commercial.

Project/product reference
Maglev high-speed train.
Technology 7: Pneumatic tube system

Cylindrical containers are transported through a network of tubes, using compressed air (vacuum). A cylindrical container enters at a sending station, where it is sucked to a receiving station by a vacuum, initiated by a compressed air pump.

Applicability
These are used in many sectors where small goods are transported, especially in the banking, medical and pharmaceutical industries. There are some experiments for public transport utilisation of this technology.

Maturity
Commercial.

Project/product reference
Eagle pneumatic tube delivery systems.
Compressed air engines use compressed air to produce mechanical work. This is done with either linear or rotational movement.

**Applicability**
This engine was widely used in the past for railway transport in critical environments (mines); presently there is a lot of development in the automotive industry. Pneumatic motors are widely used in various industry sectors.

**Maturity**
Emergent.

**Project/product reference**
Deprag air motors.
REFERENCES


