A world designed to last

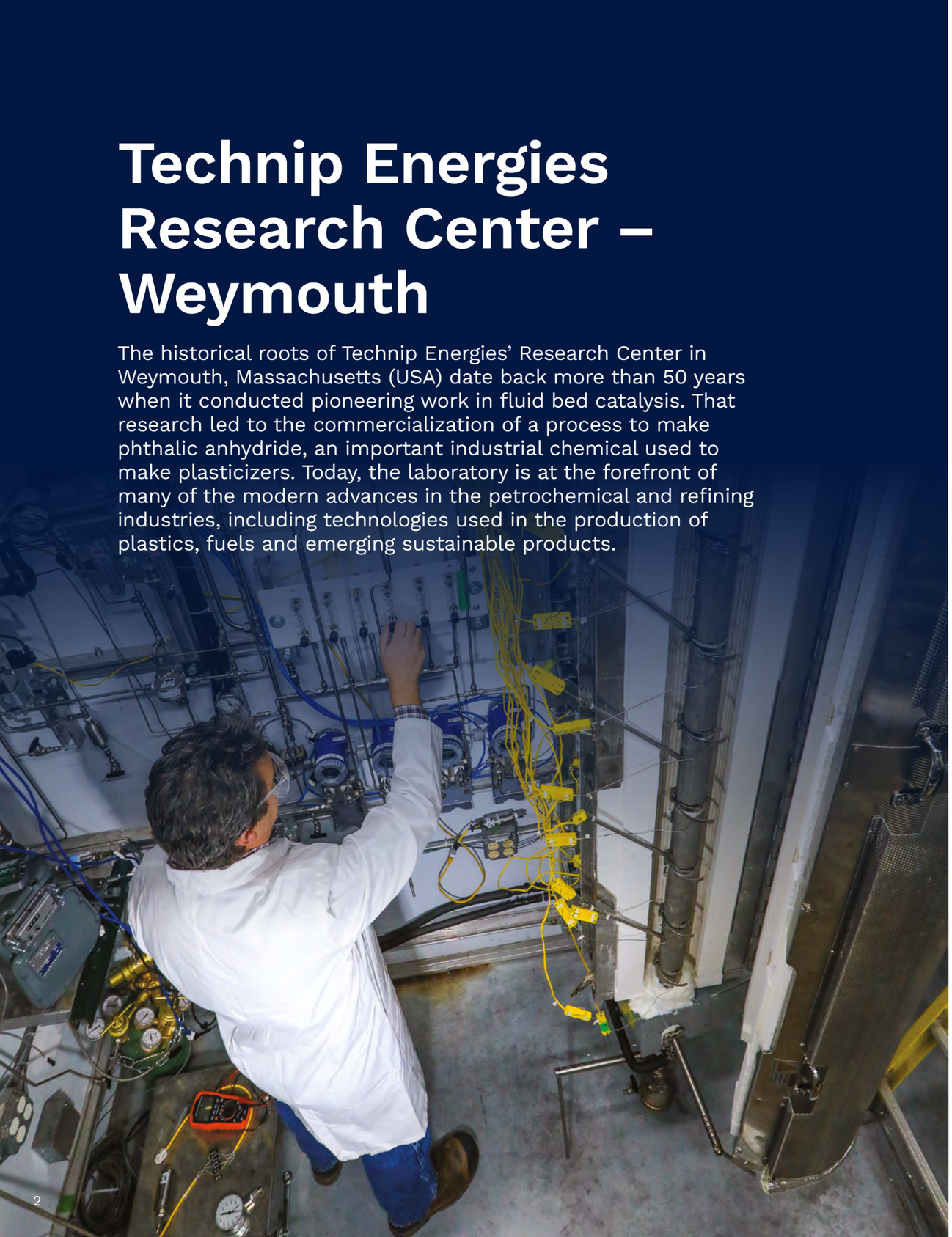
Weymouth research center



TECHNIP ENERGIES

Technip Energies Research Center – Weymouth

The historical roots of Technip Energies' Research Center in Weymouth, Massachusetts (USA) date back more than 50 years when it conducted pioneering work in fluid bed catalysis. That research led to the commercialization of a process to make phthalic anhydride, an important industrial chemical used to make plasticizers. Today, the laboratory is at the forefront of many of the modern advances in the petrochemical and refining industries, including technologies used in the production of plastics, fuels and emerging sustainable products.



Process Commercialization

Technip Energies has a track record of successfully commercializing one technology per year, many of which had their start at the lab. Through cooperative effort with partners and clients, Technip Energies' lab and engineering teams have worked together to generate highly accurate data that allows clients to cost-effectively extend their research and development capabilities. Most importantly, our clients gain access to an experienced research team dedicated to the development of novel process technologies.

SERVICES

- Conceptual process design
- Design of experiments
- Technical and economic evaluation
- Catalyst evaluation
- Technical support to licensees
- Kinetics study and reactor design
- Unit operations
- Process modeling
- Bench-scale and pilot-plant programs





Operating Principles and Equipment

Working on a small scale, Technip Energies designs, builds, and operates bench and pilot-scale plants. Experiments are designed and run over many months to generate the critical design data needed to cost-effectively scale-up a process to commercial conditions. Scale-up factors more than one- million-to-one have been achieved in a variety of process applications.

Facilities include fixed bed, fluid bed and stirred reactors as well as separation equipment. Programs range from preliminary catalyst screening to complete process demonstration.

Pilot plants are designed and operated to optimize performance. The reaction and separation systems are integrated to function as a complete plant. Process streams are fully recycled to steady state to determine the material balance and yield and produce a sample representative of the eventual commercial product. Most pilot plants are automated for unattended operation, enabling the study of long-term behavior of catalysts at low cost.

Reactor Technologies

Fixed bed reactor systems range from single tube reactors to integrated pilot plants. Through successful development of processes, the lab has acquired extensive experience in tubular reactors, packed bed reactors, multi-stage adiabatic reactors and trickle bed reactors. Reactions studied include:

- Alkylation, transalkylation
- Dehydrogenation
- Etherification
- Hydrogenation
- Isomerization



Separation Technologies

Unit operations experience includes:

- Absorption
- Adsorption
- Crystallization
- Distillation
- Extraction
- Filtration

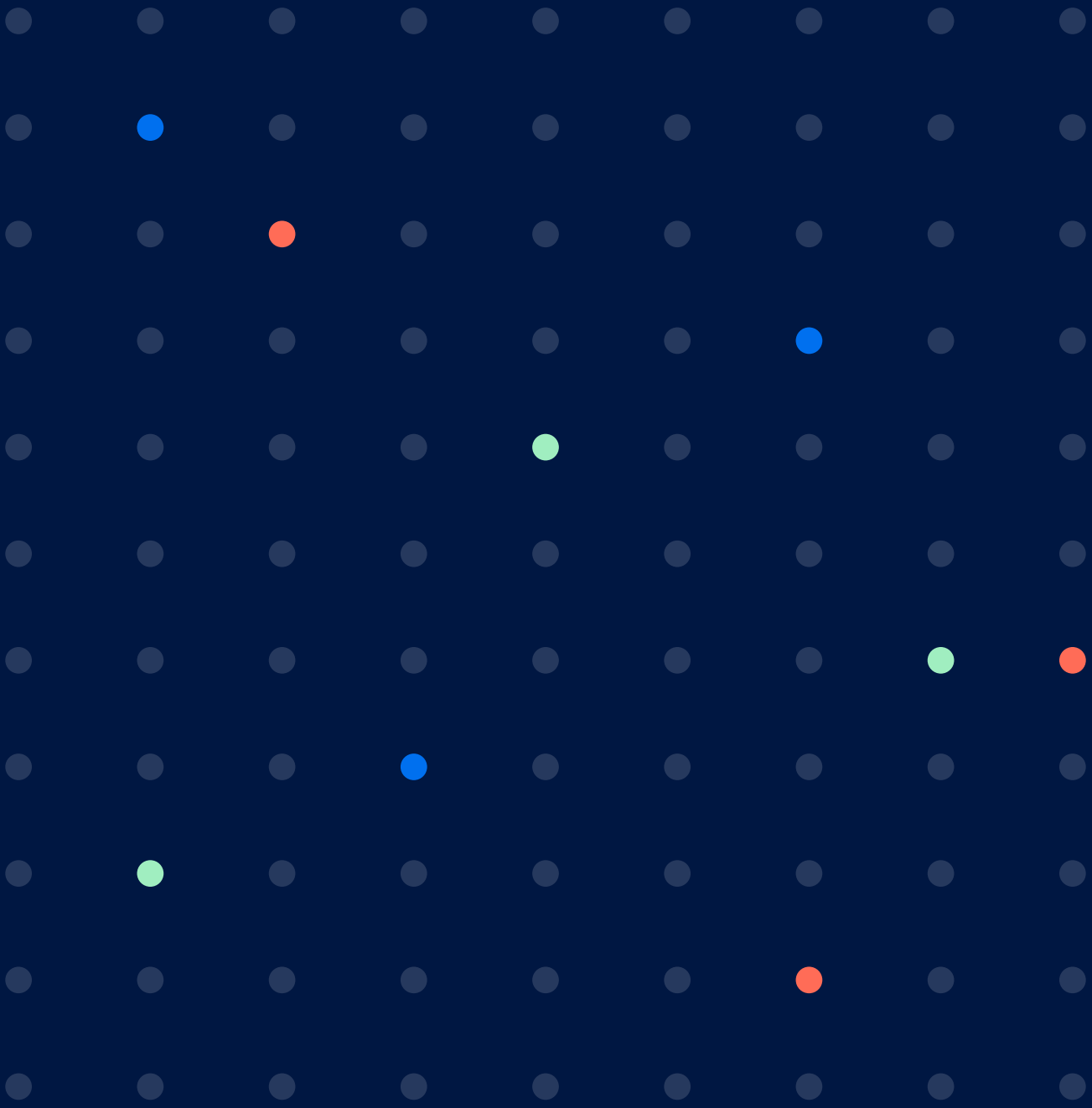
These operations are carried out either batch wise or continuously. Complex problems, including azeotropic and extractive distillation, are resolved using these processes. In addition, we identify and solve problems such as foaming, fouling, and product odor and color that are not amenable to computation.

Some separation operations for product recovery and purification can be designed by computation from physical data using scientific and engineering principles. The measurement of phase equilibria and critical properties for design purposes requires establishment of true phase equilibria, accurate determination of pressure and temperature, and use of reliable sampling and analytical techniques.

Analytical Capability

- Chemical analysis and physical measurements are integral parts of the research and development process.
- For continuous process units, streams are fed directly to chromatographs for online analysis and the results are transmitted to computers for process calculations.
- Technip Energies has a wide range of advanced analytical resources available.
  - Gas Chromatography - TCD/FID/MS/NPD/SCD
  - Ion Chromatography
  - TGA
  - LECO Total Carbon
- Technip Energies has established relationships with local universities and third-party laboratories for spectroscopy, Nuclear Magnetic Resonance (NMR) and other analyses.





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