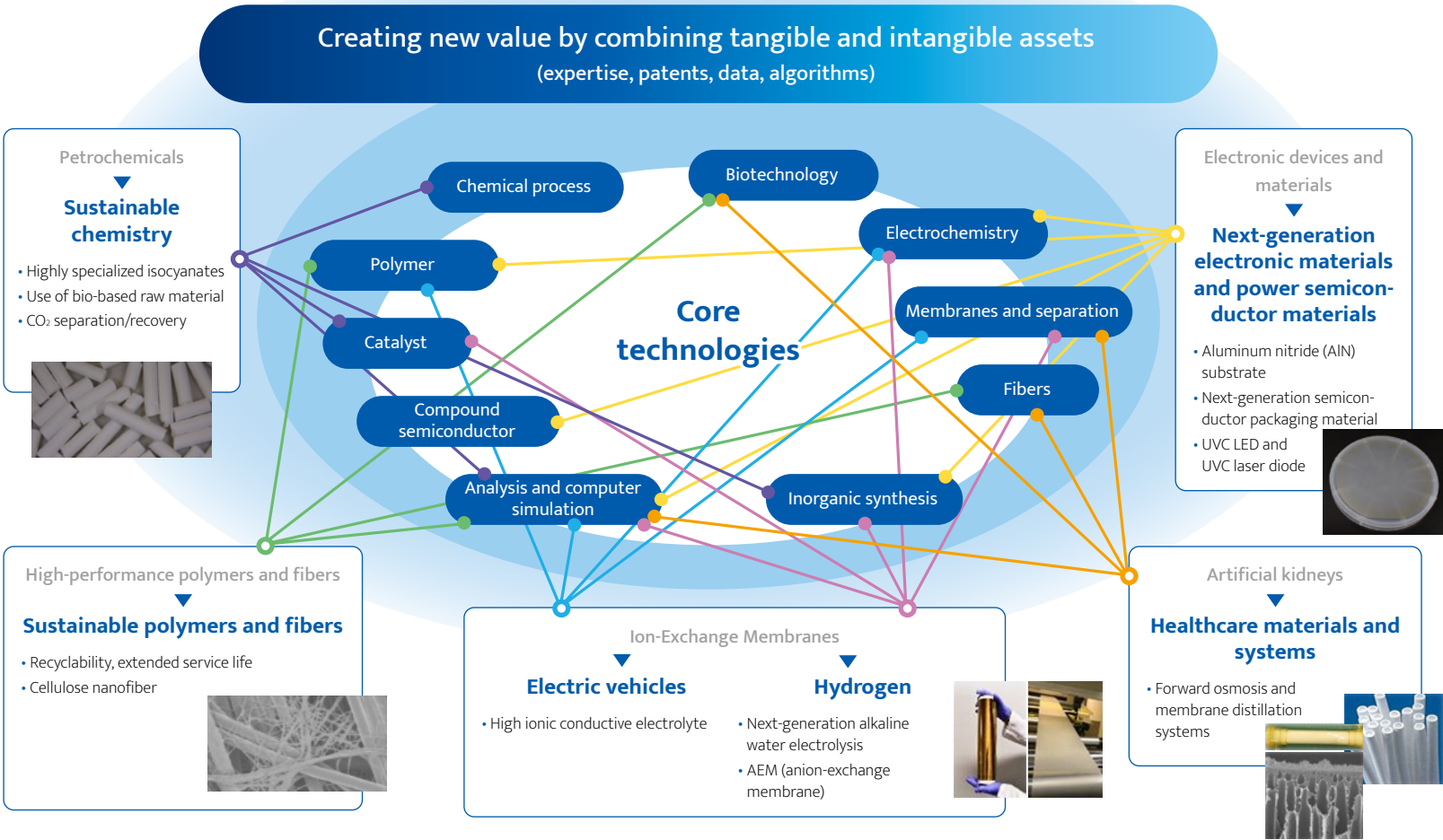


Research and Development

Driving business portfolio transformation by combining diverse core technologies

Asahi Kasei’s unique technology portfolio, centered on the diverse core technologies developed over long years of business, has supported manufacturing and the creation of many new businesses. We will continue to pursue this unique characteristic of Asahi Kasei while effecting major evolution in the manufacturing industry. The key is creating new value by combining tangible and intangible assets.

Examples of new business creation in the Material sector driven by core technologies



Business portfolio transformation driven by combinations of diverse core technologies

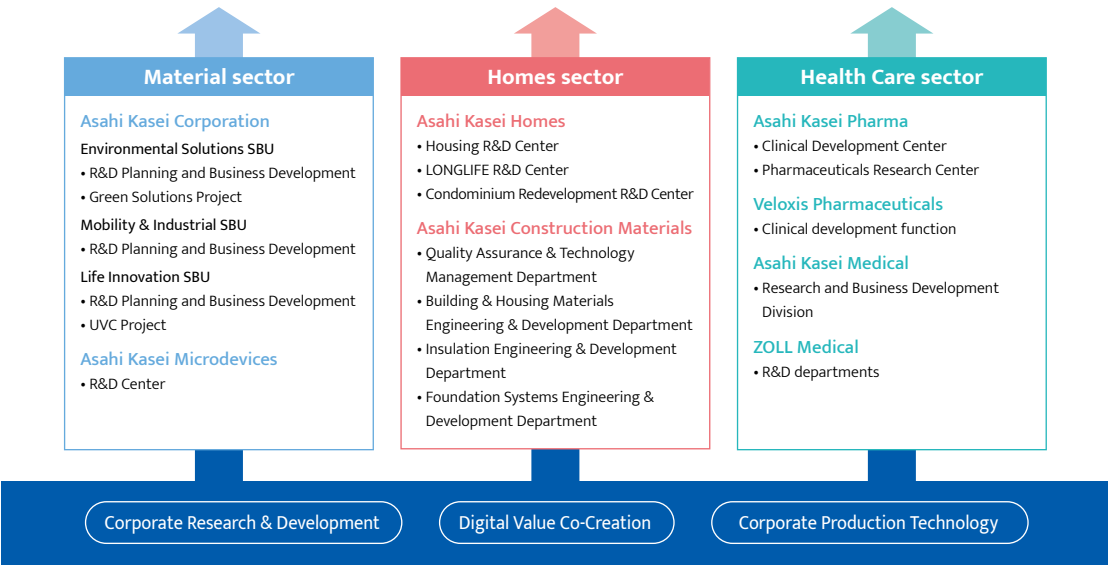
Over the course of more than 100 years of business activities, Asahi Kasei has flexibly transformed its business portfolio in response to changes in society’s needs and the market environment. This is supported by its unique technology portfolio, cultivated through continuous business operations, by which combinations of diverse core technologies has led to the creation of businesses unique to Asahi Kasei. As society moves forward at an ever-increasing rate of change, the value that Asahi Kasei should provide through its business will also change. One engine that will enable us to quickly deliver higher added value is the high-level combinations of technologies from different fields based on Asahi Kasei’s unique technology portfolio.

In addition, Asahi Kasei will effect major evolution in the way of manufacturing in the future. Our vision for the manufacturing industry is to proactively utilize intangible assets such as the expertise, patents, data, and algorithms used to create products in unprecedented ways, and to provide new value by combining tangible and intangible assets. In order to continue to be a company that remains essential to society, we will continue to take on the challenge of transforming our business portfolio by creating businesses that are unique to Asahi Kasei.

Research and Development

Strengthening existing businesses and creating new businesses for the future of society

At Asahi Kasei, R&D is conducted seamlessly between corporate R&D (cross-sectional functions), which explores medium-to-long-term projects group-wide with the aim of creating new businesses, and the research and technology development functions of each individual business (deep delving function), which delve deeper into subjects necessary to enhance business competitiveness.



Corporate R&D Mission

Asahi Kasei defines the mission of corporate R&D as follows, and our ideal vision is to transform various societal issues into opportunities that we can leverage to drive our sustainable growth.

| | |
|---|---|
| Nurturing, acquiring, and cultivating core technologies | Deeping core technologies, and acquiring and cultivating external technologies to develop highly differentiated and superior products and services |
| Creating new businesses through innovation | Accelerating collaboration with external parties, including by corporate venture capital (CVC) and open innovation, in addition to strengthening our own R&D management |
| Platform technology functions | Further strengthening the platform technology functions that support the company |

Strategic priority areas and key R&D activities of corporate R&D

We have established four key strategic areas for corporate R&D: 1) **Carbon neutrality (decarbonization and hydrogen)**, 2) **Circular economy**, 3) **Healthcare**, and 4) **Digital solutions**, and are focusing resource allocation on related subjects. The main subjects in each field are as follows:

1) Carbon neutrality (decarbonization and hydrogen)

Verification of basic chemical production from bioethanol

We are currently developing and designing a process for producing basic chemicals from bioethanol, and are studying a 40,000–50,000 ton/year plant targeting start-up in 2027.

Development of alkaline water electrolysis system

We are currently developing an alkaline water electrolysis system that uses renewable energy to produce hydrogen (see [page 49](#)). In addition, we are also working on the development of membranes for anion-exchange water electrolysis equipment. This should yield next-generation membranes with the potential to bring about significant improvements in both performance and cost.

Development of CO₂ chemistry technology and CO₂ separation/recovery system

Asahi Kasei was the first in the world to establish a polycarbonate manufacturing process using CO₂ as raw material. We are applying the basic technology to develop a diphenyl carbonate manufacturing process using CO₂ as raw material and an isocyanate manufacturing process that uses CO₂ derivatives. We are also conducting verification trials on a CO₂ separation/recovery system using a zeolite adsorbent.

2) Circular economy

Development of cellulose nanofiber (CNF) composite materials

We aim to make highly functional biomass materials a reality by creating nanocomposites of bio-derived CNF and engineering resins. Leveraging our strengths in having an integrated manufacturing process from CNF to composites, we are working to develop and commercialize products that are low-cost, have low environmental impact, and are highly functional.

3) Healthcare

Forward osmosis (FO) membrane and membrane distillation (MD) for pharmaceutical manufacturing

We are working with multiple potential customers on demonstration trials on an innovative process to concentrate pharmaceutical ingredients using a hybrid system of FO membranes and MD. By achieving concentration without heating or pressurization, the system prevents denaturation of the ingredients, while allowing shorter freeze-drying time which further reduces the energy requirement.

Research and Development

4) Digital solutions

UVC LED and UVC laser diode

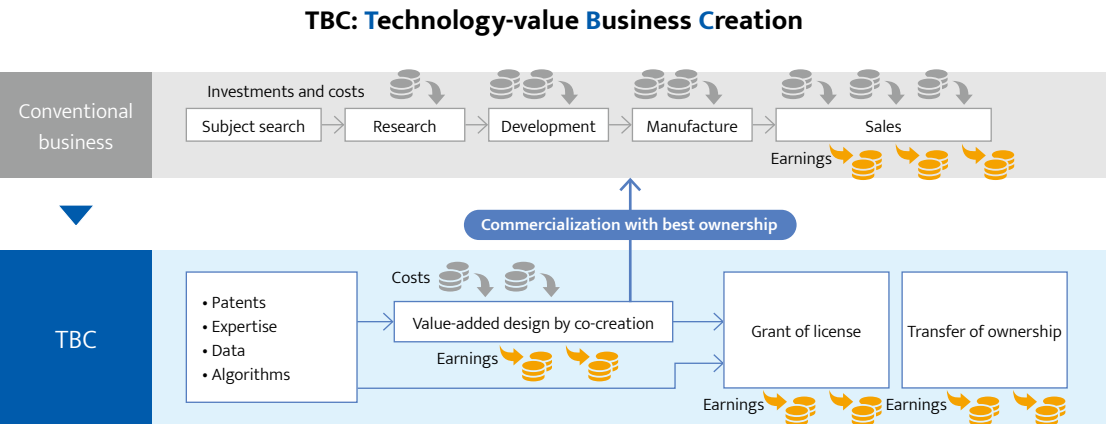
In addition to developing deep-ultraviolet (UVC) LEDs that can produce high-output UVC light with a wavelength of 265 nm, which is highly effective for sterilization and virus inactivation, we are also working on research to further increase output and to increase the diameter and quality of substrates. We are also developing UVC laser diodes in collaboration with Nagoya University, and in November 2022 the project achieved the world's first continuous room-temperature operation of a UVC semiconductor laser diode.

Aluminum nitride (AlN) substrate

AlN-based devices combine low power loss with high voltage resistance and have the potential to achieve higher energy efficiency than silicon carbide (SiC) and gallium nitride (GaN) devices. As such, they are expected to be used in next-generation power devices and radio frequency (RF) applications. In August 2023, our subsidiary Crystal IS, Inc. successfully manufactured a 4-inch diameter AlN single crystal substrate.

Creating new earnings models utilizing intangible assets

Asahi Kasei views intangible assets as important management resources and aims to increase corporate value through the organic combination of intangible assets. We are already seeing an increasing number of cases of successful monetization using intangible assets such as licenses and data, and in order to further accelerate our efforts, we established the Technology-value Business Creation (TBC) Project. This is a pioneering initiative that aims to add value to the vast amount of intangible technology assets (patents, expertise, data, algorithms, etc.) accumulated within the Asahi Kasei Group and generate revenue by providing them in various forms that are not limited to ordinary licenses.



Through the company-wide promotion of digital transformation, we are digitizing the vast amount of information and expertise that we have accumulated across a wide range of businesses, while also developing digital talent and fostering a culture of co-creation. Expertise that has been formalized in the form of data, AI, and other formats enables speedy, high value-added co-creation. By offering licenses and services that take advantage of these features, the TBC Project aims to enable early monetization through co-creation with minimal capital investment, and to respond quickly and accurately to increasingly complex and diverse needs and an uncertain business environment.

We are currently pursuing licensing activities for a variety of technologies, including lithium-ion capacitors, which combine a long service life with low cost, and high ionic conductive electrolytes, which enable low-cost, high-capacity lithium-ion batteries.

We are also advancing activities to make broad use of our patents in our three business sectors. We are taking our expertise in the Health Care sector, where we are a leader in the licensing business, and in the Homes sector, where our strength lies in our business model for intangible assets, and applying it to the Material sector. We are also accelerating our activities by appointing Dr. William R. LaFontaine, Jr., a pioneer in the IP business, as a Senior Advisor.



Dr. William R. LaFontaine, Jr.
Senior Advisor,
TBC Project

Co-creation to add value to diverse intangible assets

After serving as General Manager of Intellectual Property and Vice President of Research Business Development at IBM, and I began working for Asahi Kasei in 2024. At IBM Research Business Development brought in US\$1 billion in annual revenues by contributing to our partners' businesses through joint development, technology transfer, and licensing, as well as by continually enhancing IBM's own technologies. At Asahi Kasei I am leveraging this experience to propel business transformation using intangible assets in asset-light ways.

When I came to Asahi Kasei, I was surprised by the wide range of technologies and patents it has. These intangible assets not only strengthen the company's own competitiveness, but also have the potential to create new value for its partners. Currently, together with members of Asahi Kasei, I am thoroughly evaluating such value from the customer's perspective, and designing value from new perspectives.

It can be difficult for Asahi Kasei to quickly realize value using its own technology alone, so it is important for us to join with partners at an early stage to co-create value. Working with business units to spread the culture of co-creation, we are helping to integrate management strategy and technology strategy, which is essential for such efforts, as we develop next-generation businesses and foster specialists in the area of licensing.

Intellectual Property

Enhancing corporate value with intellectual property

Corporate IP and the Intellectual Property Intelligence Department work together as intellectual property (IP) experts who provide ongoing support to increasingly sophisticated businesses, protecting the interests of our businesses and working to maximize corporate value.

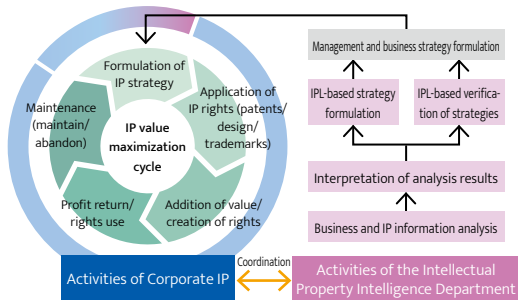
Asahi Kasei’s IP organization

Our IP organization comprises two bodies: Corporate IP, which is part of Corporate Research & Development, and the Intellectual Property Intelligence Department, which reports to the Executive Officer for Corporate Strategy. The mission of these organizations is as follows.

| | |
|--|---|
| <p>Mission of Corporate IP</p> <p>Corporate IP aims to strengthen the following five key activities that have been performed conventionally:</p> <ol style="list-style-type: none">1) Construction of an IP network that contributes to businesses based on a scenario for IP rights utilization2) IP clearance to assure business execution3) Implementation of IP activities to support globalization of businesses4) Contribution to business innovation, from the perspective of IP, by digital transformation5) Implementation of systematic human resource development plans over the medium-to-long term | <p>Mission of the Intellectual Property Intelligence Department</p> <p>The Intellectual Property Intelligence Department focuses on contributing to management and business strategy formulation through activities related to IP and intangible assets (IP activities), under the theme of “achieving further increases in corporate value through intangible assets.” Using IP landscaping (IPL) as a tool, the department focuses on 1) contributing to management and business strategy formulation from an intellectual property perspective by proposing strategies for utilizing intangible assets, and 2) strengthening relationships with stakeholders through the disclosure of intellectual property information.</p> |
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Maximizing the value of intellectual property

The Intellectual Property Intelligence Department uses IPL to analyze the business environment from a technical perspective, and thereby contribute to management and business strategy formulation, and by providing new perspectives to management, it further contributes to more elaborate decision-making. Furthermore, by providing strategies for utilizing intellectual property and intangible assets, the department supports the formulation of business strategies that are predicated on such utilization.



Corporate IP formulates IP strategies necessary to contribute to the accomplishment of business strategies and to the maximization of the value of IP and intangible assets by implementing an “IP value maximization cycle” together with the business divisions to steadily implement these IP strategies.

Process of corporate value enhancement through IP activities

To clarify how our mission-based IP activities lead to and contribute to enhanced corporate value through various business activities, we depicted the process of corporate value enhancement. Through examination of this depiction, it became clear that our IP activities have a structure that contributes to corporate value enhancement through management decisions and business activities. The content and effects of IP activities in this process also vary depending on the project. Our Intellectual Property Report 2024 presents the process of corporate value enhancement in our three business sectors.

Validating the process of corporate value enhancement through case studies

To deepen understanding of the corporate value enhancement process, we examined actual business case studies and specifically the contribution of our IP activities.

Asahi Kasei enhances the value it provides to its customers by formulating and executing business strategies, which creates a virtuous cycle that increases customer satisfaction and trust in our company, leading to the acquisition of further business opportunities. IP activities contribute to maintaining and expanding this virtuous cycle by protecting and utilizing intellectual property and intangible assets.

