Advancing Towards Net Zero

2023 Xiaomi Corporation White Paper on Climate Action

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Message from the Chairman

We are feeling the climate crisis like never before—heat waves, wildfires, flooding, and other extreame weather events are hitting every corner of our planet. The Sixth Assessment Report from the Intergovernmental Panel on Climate Change (IPCC) has made it clear that if the world needs to limit global temperature rise to well below 2℃ above pre-industrial levels and to pursue efforts to keep it even further to 1.5℃, more public funding, investment, and institutional resources must be directed towards accelerating the research and development of clean technologies. Technology companies, including Xiaomi, have a central role to play in bringing these transformative technologies to life.

Guided by our mission of "letting everyone in the world enjoy a better life through innovative technology", we recognize the critical role of corporations in the face of climate change due to the far-reaching nature of their influence. At Xiaomi, our commitment goes beyond providing quality and sustainable products and services to our users; we are embedding our respect for the environment and sustainable development at the core of our purpose and business strategy. In August 2023, we announced our commitment to achieving carbon neutrality and using 100% renewable energy in our own operations by 2040. We are also actively encouraging our key supplier partners to commit to climate goals regarding renewable energy adoption and greenhouse gas emission reduction that align with Xiaomi's ambition. Our impact is far greater when we collaborate to foster a green and high-quality transformation across the entire industry chain and ecosystem.

Xiaomi fully ascertains the significance of global net-zero targets, just as we know that technological innovation is what drives green transformation and helps battle the climate crisis. Xiaomi´s "Green Productivity" stems from our relentless pursuit of innovation and efficiency. We adhere to the principles of "choosing and investing in technologies that can create long-term value to better society and civilization". This philosophy is ingrained throughout our business lifecycle, guiding us to make our

products and services more efficient, economical, and with lower environmental footprints so that everyone can benefit from clean technology.

Not long ago, Xiaomi unveiled its brand new strategy-- the "Human x Car x Home" smart ecosystem, along with the powerful Xiaomi HyperOS. This system can integrate over 200 product categories, connect 820 million devices, and cover more than 95% of user scenarios. Xiaomi HyperOS is set to play a pivotal part in minimizing system redundancy, enhancing energy efficiency, reducing electronic waste, and promoting the global goals of sustainable consumption.

Building on this groundwork, we will continue our efforts to create a universal "connected system", enabling the interconnection of billions of devices in the future and delving into clean technology applications across multiple devices, scenarios, and the value chain to advance a greener lifestyle and low-carbon society for positive climate impacts.

It is our great honor to officially release the inaugural Xiaomi Corporation White Paper on Climate Action during the 28th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP28). For Xiaomi, this White Paper is a testament to our reflection, dedication, and endeavors in the era of global zero-carbon transition. We believe that technological

advancement is not a linear trajectory but a multi-dimensional, interconnected, and intricate ecosystem. Within this ecosystem, technological innovation and net-zero objectives complement each other, and business efficiency aligns with sustainable development.

Let us join hands and embark on this enduring journey of climate action, growing together, innovating together, witnessing and shaping together a more sustainable, eco-friendly, and harmonious future for generations to come.

Lei Jun

Harnessing the Power of Trends:

A Technology-driven Zero-carbon Transformation

The global zero-carbon transition will profoundly impact the technology and consumer electronics industry

With climate change now being considered one of the defining challenges of our times putting human existence and well-being at stake, member countries of the United Nations Framework Convention on Climate Change (UNFCCC) have each set forth national climate goals and transition pathways under the Paris Agreement.

In 2020, the Chinese government announced the monumental goals of peaking carbon emissions by 2030 and achieving carbon neutrality by 2060 (the "dual carbon goals"). These national objectives have since been integrated into the overarching framework of ecological civilization development and the broader spectrum of economic and social progress. As of 2023, China has achieved substantial progress in formulating the "1+N" policy system to enact the carbon peak and carbon neutrality goals. This endeavor rests on three foundations that aim to propel China's transition towards a zero-carbon future—an energy system that is clean and efficient, an economic system that is low-carbon, green and circular, and an ecosystem that is "carbon negative, symbiotic, and in harmony. Green and high-quality development has become China's rudimentary approach to addressing climate change.

Economic activity is the process of producing goods and services to meet public needs and create value. We see zero-carbon transformation as a paradigm shift in both production and lifestyle, where "green efficacy" will be the new norm supplanting conventional thinking. Technology will stand as the primary driver in this transition—through innovation and the integrated application of 'new energy, new materials, new intelligence, and new processes' (i.e. the Four New Elements)—in which green and zero-carbon productivity will reshape economic activities, profoundly altering the familiar aspects of our lives.

Reasoning from first principles, economic activity patterns are fundamentally shaped by how "information, energy and material" flows. From the trends of low-carbon technology development, we anticipate a step-by-step transition towards a zero-carbon economy beginning with the energy system, followed by basic industries, consumer goods circulation, and the end-of-life system. As each stage makes headway to the next, the tech-driven progression towards zero-carbon transformation can be likened to a "Three-stage Rocket" analogy.

"Carbon negative" refers to the condition where economic activities or ecosystems remove or sequester more CO_2 from the atmosphere than they emit.
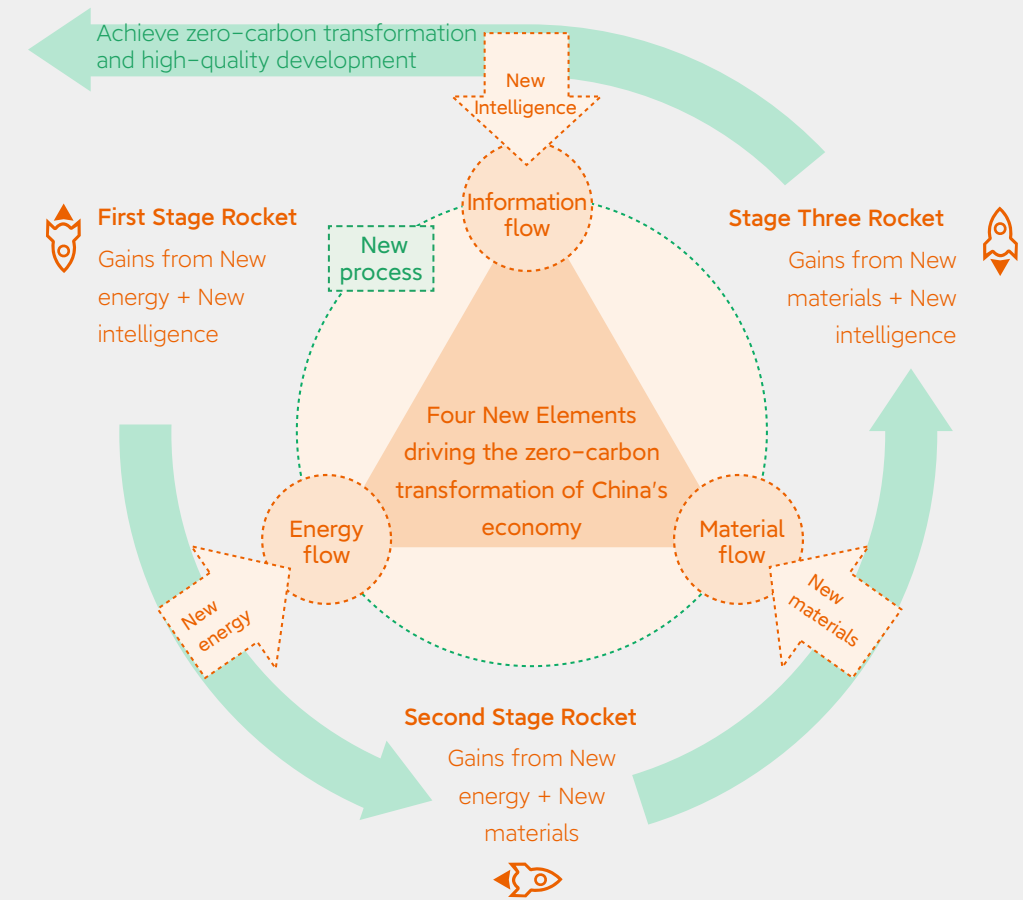

Figure 1. "Four New Elements" driving China's "Three-stage Rocket" Zero-carbon Transformation (2023 Report on the Low-carbon Transformation and High-quality Development of China Enterprises)

First Stage Rocket: New power system and data intelligence unleashing the potential of green electricity and computational power

When Xiaomi was founded, new energy technology was in its infancy, and replacing fossil fuels seemed distant.

In 2010, the costs of solar PV and wind energy were 710% and 95% higher than thermal power. Yet over the next decade, advancements in new materials, processes, and digital technology, coupled with increased efficiency and scale in power generation, led to an 88% and 68% reduction in power generation costs* for large-scale solar PV and wind power respectively. By 2022, global solar and wind power costs had achieved a spectacular 52% and 29% advantage over thermal power, showcasing their cost-competitiveness across most regions (IRENA, 2023) over the fossil-fired option.

In the midst of the zero-carbon transition, the ICT industry plays a pre-eminent role in the advancement of the new power system. Specifically, this allows for the integration of green computational power with the grid to upgrade traditional systems into an interconnected energy platform, empowering the power grid to handle renewable energy sources more efficiently and securely. Such transformation will benefit various industries including transportation, construction, and manufacturing, aligning with societal goals for green development and low-carbon transformation.

By 2050, in line with the 1.5°C scenario targets outlined by the International Energy Agency (IEA) and International Renewable Energy Agency (IRENA), **renewable electricity generation shall account for over 90% of total end-use electricity consumption and over 70% of total end-use energy consumption.** For green electricity to become a reliable power supply, overcoming its fluctuating and intermittent nature is the key challenge. A new generation of power systems, leveraging technologies such as the energy internet and coordinating distributed energy sources, alongside utilities with energy loading and storage capabilities, will be essential for coping with daily and seasonal fluctuations in energy demand.

The establishment of a modern power system necessitates not only grid upgrades but also substantial "flexibility resources" from society. These include active involvement in the power system interaction from various sources such as user demand response, diverse energy storage in batteries (including electric vehicles), and facilities to produce hydrogen with renewable energy. (National Energy Administration of China, 2023).

> As a technology company specializing in consumer electronics and hardware, Xiaomi is dedicated to reducing our own carbon footprint through the adoption of green electricity. We are also at the forefront of developing a cutting-edge architecture defined by "connected ecosystem, proactive intelligence", enabling universal connectivity across a wider array of smart, efficient, and interactive devices. This positions Xiaomi as an active contributor in shaping the new power system, allowing the benefits of green electricity and computational power to reach end-users apace.

Note: *Power generation cost refers to the "global weighted average levelized cost of electricity (IRENA, 2023).
On the one hand, digital technology has significantly boosted efficiency and galvanized cost reduction in manufacturing new energy equipment, site selection of power plants, electricity forecast, and power plant operation and maintenance. On the other hand, subsidy-free green electricity is also empowering the green development of the Information and Communication Technology (ICT) sector, meeting the surging societal demand for digitalization and intelligence with the provision of "Green Computational" power.

Second Stage Rocket: Green hydrogen economy setting the stage for "photosynthetic industry" and driving the raw material sector towards zero-carbon transformation

Once a decarbonization pathway is in place for the energy sector, basic industries heavily reliant on fossil fuels will have the preconditions to embark on their own zero-carbon journey.

With almost zero marginal costs, renewable energy sources are set to catalyze new industrial processes. The increasing availability and accessibility of "subsidy-free" green electricity will pave the way for the development of renewable energy-based hydrogen production (commonly known as "green hydrogen). This will help reduce its production cost, which is projected to reach parity with other energy sources by 2030.

Green hydrogen and carbon capture technologies serve as crucial links between zero-carbon energy systems and industrial raw materials. The coupling of these technologies, which essentially harnesses solar energy for production, signifies a paradigm shift from a "fossil-based" to a "photosynthetic" industry model. As green hydrogen becomes increasingly abundant, it not only enables the production of "green steel" through hydrogen-based iron reduction and electric arc furnace processes, but also allows for the reprocessing of captured CO_2 from industrial processes into chemical intermediates such as methanol, ammonia, and ethylene. The prospect of zero-carbon basic materials is expected to take shape after 2040.

In the consumer electronics industry, 77% of carbon emissions stem from the supply chain (World Economic Forum, 2021). While most emissions from the sector's value chain are indirect emissions from purchased electricity, which can be abated through the adoption of 100% renewable electricity, the remaining portions are largely associated with the extraction and processing of raw materials, and the decarbonization of which would require a fundamental transformation of the materials industry. Tracing back to the source, the main types of raw materials include **inorganic non-metallic materials** (such as glass, ceramics, and semiconductor materials), **metals** (aluminum, copper, iron, battery materials) as well as **polymeric materials** (plastics, resins, etc.). As the "photosynthetic industry" matures, we can anticipate a significant reduction in the carbon footprints linked to the production process of these materials.

> Xiaomi has been actively engaging with upstream material suppliers at the outset of product design to incorporate the use of high-performance green chemical materials. We support our supply chain and ecosystem partners, through strategic investments and empowerment activities, to explore and pioneer new and low-carbon materials of the future.

Third Stage Rocket: Data intelligence empowering a circular economy, achieving a net-zero closed loop between consumption and regeneration

An organic integration of the "photosynthetic industry" and "circular economy" is the most critical step, albeit challenging, towards decarbonizing economic activities. For every industry, the journey towards a net-zero closed loop demands unwavering efforts to improve the overall lifecycle efficiency of raw materials, as well as an uplift of their supply chain's capability to deliver a consistent supply of green and sustainable materials.
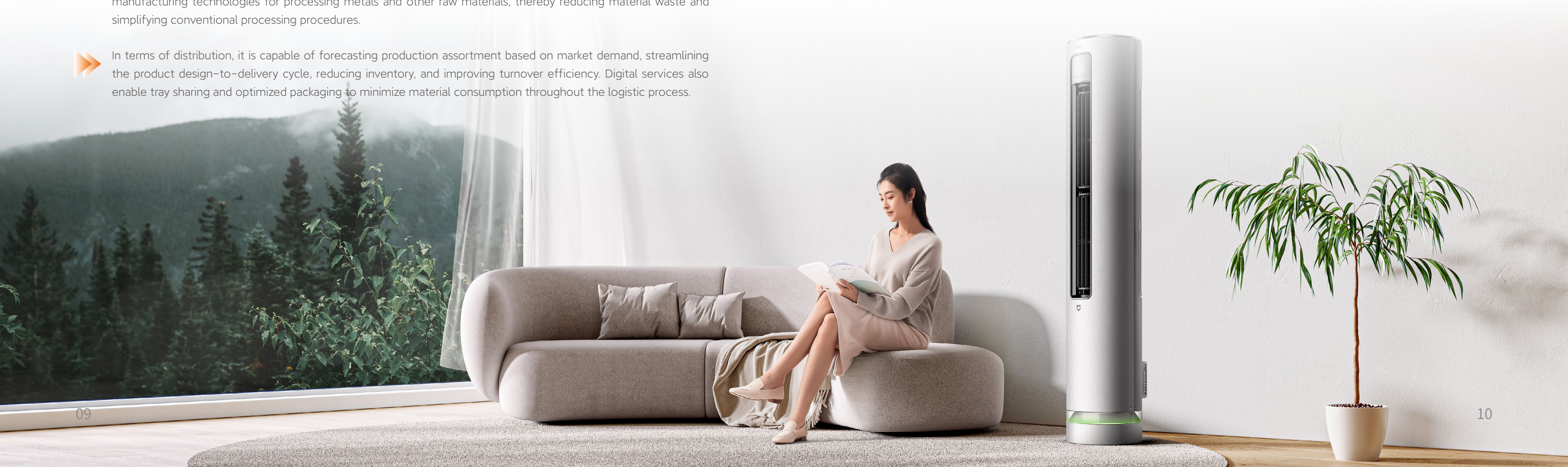
At present, data intelligence has already revamped how products and materials are developed, processed, distributed, and used across various industries, demonstrating notable improvements in using material more efficiently.
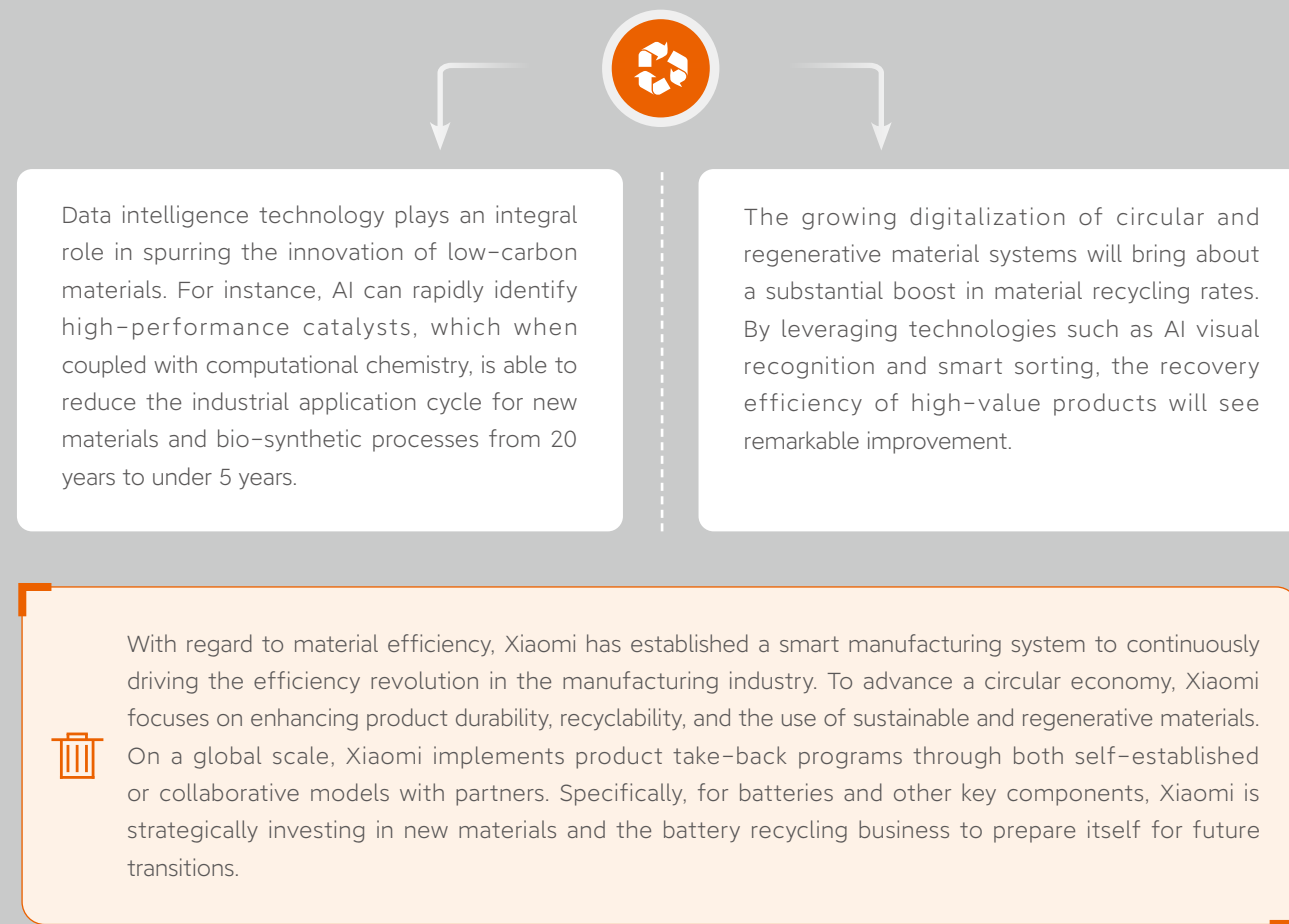
In product design, data intelligence technologies such as AI-supported self-optimization, user interaction, and experience design, **are speeding up the iteration cycle of product design approach and market validation.** For perspective, the integration of environmental simulation and AI-assisted solutions into product prototyping and mold design can further streamline structural formation, simplify complex structures into fabrications, and best-match suitable materials to improve material utilization rates and increase the use of new sustainable materials.

When it comes to production, **data intelligence can significantly enhance process precision and production efficiency, especially within the conventional manufacturing industry, thereby improving material efficiency.** Through digitalizing industrial processes, the power of algorithms is harnessed to better address production setbacks and bottlenecks, identify product defects, initiate proactive maintenance, and taper off material loss. The widespread application of Artificial Intelligence of Things (AIoT) in manufacturing will spur the adoption of additive manufacturing technologies for processing metals and other raw materials, thereby reducing material waste and simplifying conventional processing procedures.

In terms of distribution, it is capable of forecasting production assortment based on market demand, streamlining the product design-to-delivery cycle, reducing inventory, and improving turnover efficiency. Digital services also enable tray sharing and optimized packaging to minimize material consumption throughout the logistic process.

In the long run, achieving "net zero" at the material level demands a dual focus on "innovation at source" and "end-of-life closed loop". Innovation at source entails the development of more durable, lightweight, and efficient sustainable materials to enable zero-carbon transformation.** While significant breakthroughs in new material and scaling in production capacity will not be immediate, it is crucial to continue advancing innovations in areas such as synthetic bio-based materials, green processes, and efficient catalyst production.

Making end-of-life closed loop a reality requires establishing an efficient, extensive recycling system. Currently, **aluminum** is one of the most recycled materials, particularly in leading markets, where the use of recycled aluminum can make up to 40% of total aluminum consumption. With a per-unit carbon footprint of merely 5% of virgin aluminum, the consumer electronics industry is projected to use nearly 100% recycled aluminum in the future to fulfill its zero-carbon commitment. This shift poses grave challenges to end-of-life recycling systems. Similar to aluminum, the decarbonization of the smelting process with 100% renewable electricity makes recycled steel a proven solution for reducing the carbon footprint of stainless steel used in consumer electronic products. It is estimated that by 2050, recycled steel will account for 60% of China's total steel production. As for plastic, with effective sorting and separation processes, recycled plastic is expected to meet 40% of market demand by 2050 (RMI 2021, RMI 2022).

Along the zero-carbon journey, collaboration between consumer electronics and upstream raw material industries can unfold in two ways: enhancing product design and scaling up the use of sustainable materials, while accelerating breakthroughs in sustainable material science across product performance, production scale, circular system efficiency. These outcomes can be achieved through the integration of digital technologies such as the Internet of Things, edge computing, and artificial intelligence with the industry.

Data intelligence technology plays an integral role in spurring the innovation of low-carbon materials. For instance, AI can rapidly identify high-performance catalysts, which when coupled with computational chemistry, is able to reduce the industrial application cycle for new materials and bio-synthetic processes from 20 years to under 5 years.

The growing digitalization of circular and regenerative material systems will bring about a substantial boost in material recycling rates. By leveraging technologies such as AI visual recognition and smart sorting, the recovery efficiency of high-value products will see remarkable improvement.

With regard to material efficiency, Xiaomi has established a smart manufacturing system to continuously driving the efficiency revolution in the manufacturing industry. To advance a circular economy, Xiaomi focuses on enhancing product durability, recyclability, and the use of sustainable and regenerative materials. On a global scale, Xiaomi implements product take-back programs through both self-established or collaborative models with partners. Specifically, for batteries and other key components, Xiaomi is strategically investing in new materials and the battery recycling business to prepare itself for future transitions.

Staying in the course: the core of zero-carbon transition and its pathways

By taking a holistic consideration of the "Three-stage Rocket" model, national dual-carbon action plans outlined for various sectors, as well as key projections and insights from international and domestic research, we have pinpointed four key trends in relation to the development of the consumer electronics industry. These trends form the basis for crafting our strategic vision, goals, and actions to address climate change.

We are convinced that by integrating the construction of a new power system, accelerating the widespread adoption of green energy, embracing the trend of cost parity for green hydrogen, and increasing the share of green electricity, we can significantly reduce the greenhouse gas emissions from energy consumption across the value chain. In addition, we also strive to promote the "efficiency revolution" in manufacturing and distribution, expediting the transformation of upstream industries toward a "Photosynthetic Industry", and promoting a net-zero circular system in our society at large. All of these factors play a pivotal role in helping Xiaomi achieve our ambitious climate targets on time.

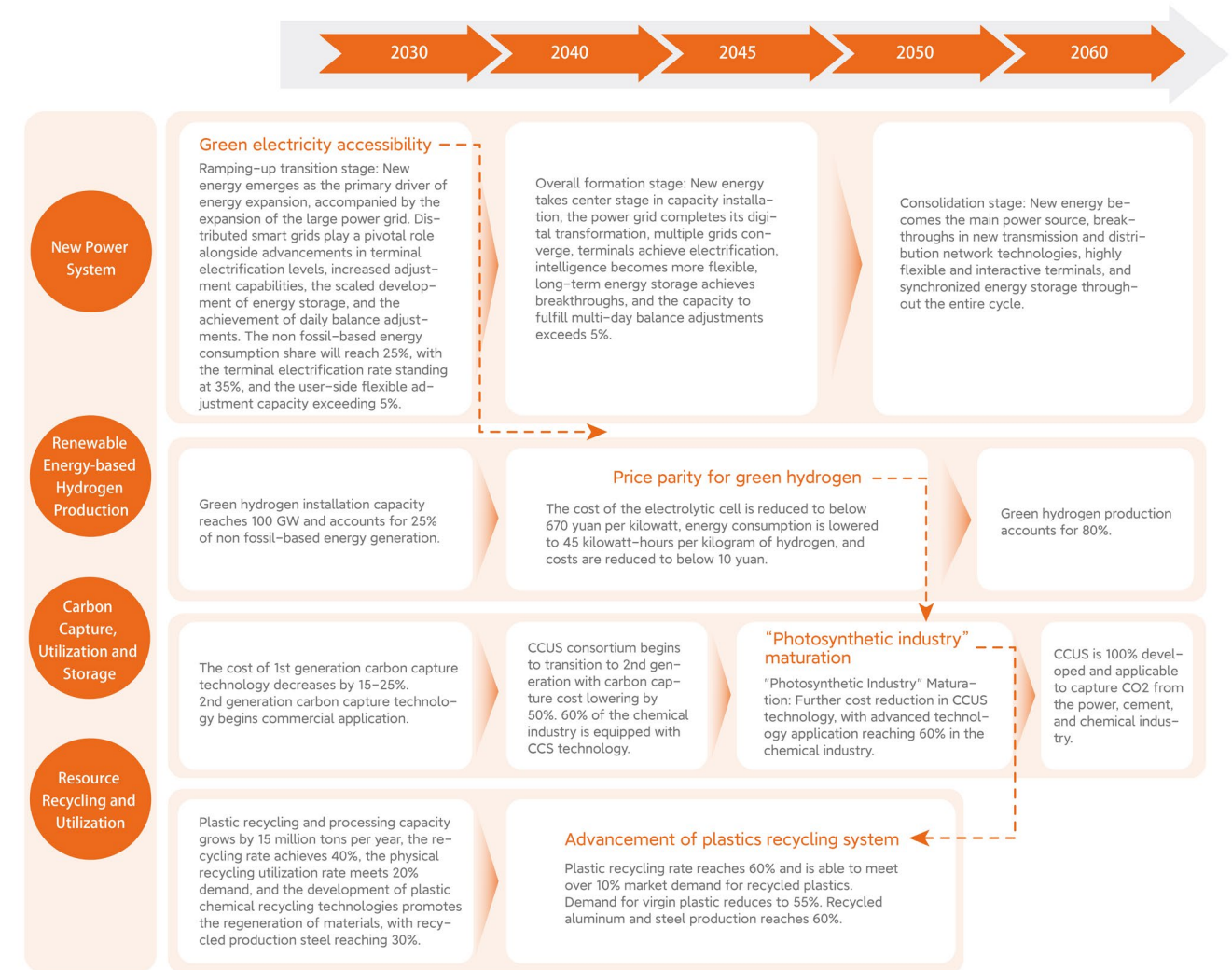### Zero-carbon Transition Pathways for Key Industrial Systems

2030 **2040** **2045** **2050** **2060**

New Power System

Green electricity accessibility
Ramping-up transition stage: New energy emerges as the primary driver of energy expansion, accompanied by the expansion of the large power grid. Distributed smart grids play a pivotal role alongside advancements in terminal electrification levels, increased adjustment capabilities, the scaled development of energy storage, and the achievement of daily balance adjustments. The non fossil-based energy consumption share will reach 25%, with the terminal electrification rate standing at 35%, and the user-side flexible adjustment capacity exceeding 5%.

Overall formation stage: New energy takes center stage in capacity installation, the power grid completes its digital transformation, multiple grids converge, terminals achieve electrification, intelligence becomes more flexible, long-term energy storage achieves breakthroughs, and the capacity to fulfill multi-day balance adjustments exceeds 5%.

Consolidation stage: New energy becomes the main power source, breakthroughs in new transmission and distribution network technologies, highly flexible and interactive terminals, and synchronized energy storage throughout the entire cycle.

Renewable Energy-based Hydrogen Production

Green hydrogen installation capacity reaches 100 GW and accounts for 25% of non fossil-based energy generation.

Price parity for green hydrogen
The cost of the electrolytic cell is reduced to below 670 yuan per kilowatt, energy consumption is lowered to 45 kilowatt-hours per kilogram of hydrogen, and costs are reduced to below 10 yuan.

Green hydrogen production accounts for 80%.

Carbon Capture, Utilization and Storage

The cost of 1st generation carbon capture technology decreases by 15-25%. 2nd generation carbon capture technology begins commercial application.

CCUS consortium begins to transition to 2nd generation with carbon capture cost lowering by 50%. 60% of the chemical industry is equipped with CCS technology.

"Photosynthetic industry" maturation
"Photosynthetic Industry" Maturation: Further cost reduction in CCUS technology, with advanced technology application reaching 60% in the chemical industry.

CCUS is 100% developed and applicable to capture CO2 from the power, cement, and chemical industry.

Resource Recycling and Utilization

Plastic recycling and processing capacity grows by 15 million tons per year, the recycling rate achieves 40%, the physical recycling utilization rate meets 20% demand, and the development of plastic chemical recycling technologies promotes the regeneration of materials, with recycled production steel reaching 30%.

Advancement of plastics recycling system
Plastic recycling rate reaches 60% and is able to meet over 10% market demand for recycled plastics. Demand for virgin plastic reduces to 55%. Recycled aluminum and steel production reaches 60%.

Figure 2: Zero-carbon Transition Pathways for Key Industrial Systems in China

The Force Awakens:

From Zero-carbon Philosophy to Methodology

Xiaomi Corporation was founded in April 2010 and listed on the Main Board of the Hong Kong Stock Exchange on July 9, 2018 (1810.HK). Xiaomi is a consumer electronics and smart manufacturing company with smartphones and smart hardware connected by an IoT platform at its core. Embracing our vision of "Make friends with users and be the coolest company in the users' hearts", Xiaomi continuously pursues innovations, high-quality user experience, and operational efficiency. The company relentlessly builds amazing products with honest prices to let everyone in the world enjoy a better life through innovative technology.

In 13 years, Xiaomi has revoluntionized conventional manufacturing with internet thinking and approaches, pioneering the fusion of "Internet + Manufacturing" to drive an efficiency revolution in the business world that maximizes user benefits and socio-economic effectiveness. The "Xiaomi Model" has evolved into an innovative business model with underlying principles that represent a healthier and sensible consumption mindset and values. In a broader sense, it is a development paradigm that emphasizes innovation and efficiency.

Xiaomi's Zero-carbon Philosophy

Xiaomi's Zero-carbon Philosophy

Innovative Technology

High Price-to-performance Ratio

Extreme/Outstanding Efficiency

Environmental efficiency   Circulation efficiency   Product efficiency

Better Experience

$$\text{Satisfaction} = \frac{\text{Efficacy}}{\text{Expectation}} \quad \times \quad \text{Low-carbon} = \frac{\text{Efficacy}}{\text{Carbon Footprint}}$$

$$\text{Low-carbon satisfaction} = \frac{\text{Efficacy}^2 \uparrow}{\text{Expectation} \times \text{Carbon Footprint} \downarrow}$$

"Human x Car x Home" Connected Ecosystem

Zero-carbon Solution

Let Everyone Enjoy a Better Life through Technology
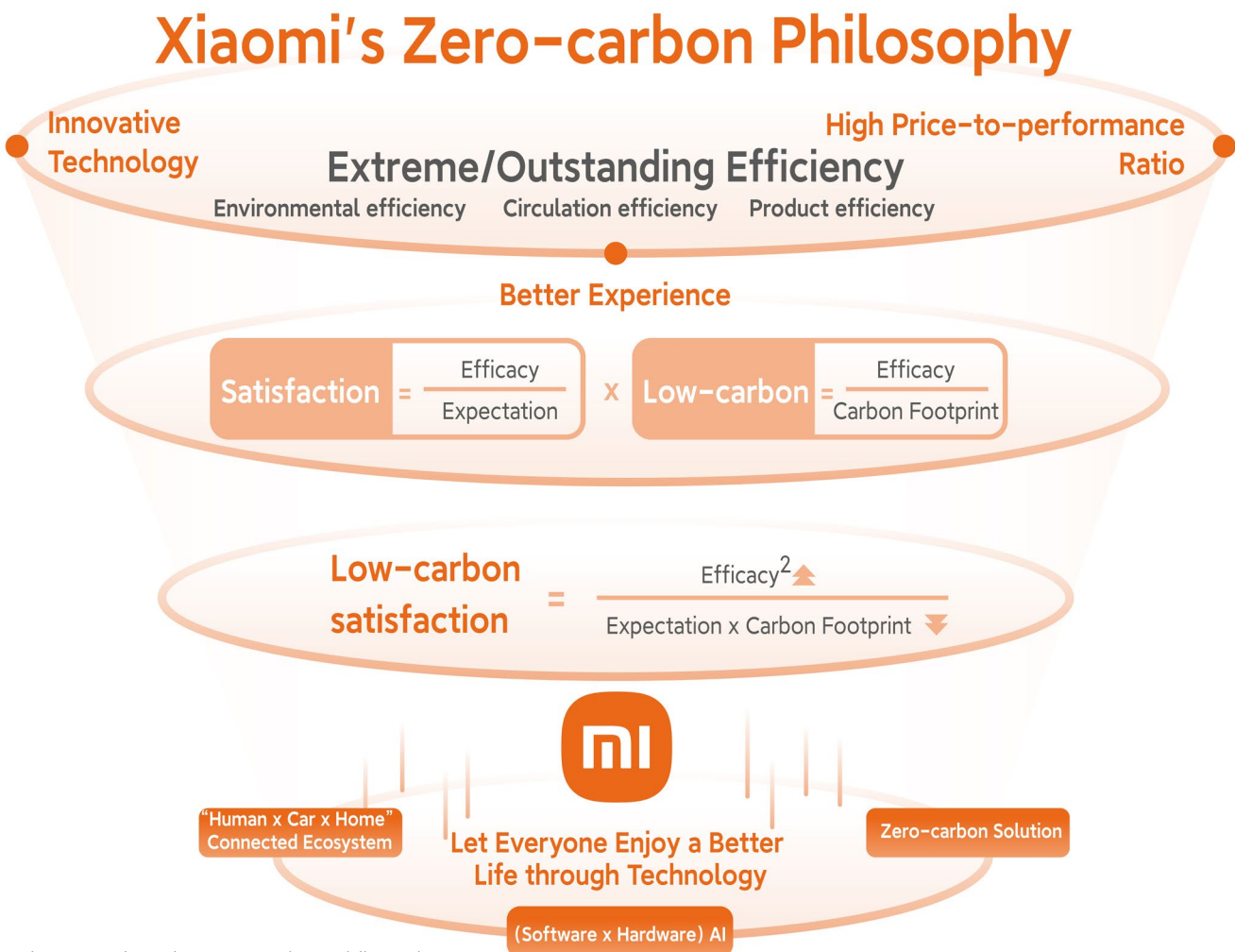
(Software x Hardware) AI

Figure 3. Xiaomi's Zero-carbon Philosophy

Each year, the challenges presented by climate change are increasingly evident and detrimental across the world. To uphold our mission of letting everyone in the world enjoy a better life through innovative technology, we believe it is our responsibility as global tech innovators to help avert the rapidly changing climate with solutions built upon our strength in innovations and efficiency. We have infused climate-conscious elements into the design-to-delivery process of our coolest product, exploring every possible integration of low-carbon with Xiaomi's business strategy and brand features, and translating these principles into environmentally-friendly technologies and products that help accelerate the global transition to a net-zero economy.

Based on our understanding of the global pathway towards net zero emission, Xiaomi has introduced the concept of Low-carbon Satisfaction as a novel indicator that encompasses three dimensions—product efficacy, price, and environmental footprint, to measure our products and services from a whole new perspective. The concept has eventually evolved into Xiaomi's Zero-carbon Philosophy. With the goal of raising the Low-carbon Satisfaction Score for our users, we work to improve both our product efficacy and affordability whilst making strides to reduce the environmental footprints of our products and services. In doing so, we believe we can make clean technology accessible to everyone. This concept is deeply embedded in the entire lifecycle of Xiaomi's products and services, and serves as a key element that shapes our technology strategy (i.e. deep exploration into foundational technologies, sustained long-term investment, seamless hardware-software integration, and comprehensive AI empowerment).

In October 2023, Xiaomi unveiled its brand new strategy "Human x Car x Home" smart ecosystem, featuring Xiaomi HyperOS—a human-centric operating system at its core—designed to connect personal devices, cars, and smart home products into a single, integrated system framework. This innovation lays the groundwork for creating a universal "connected system", enabling the interconnection of billions of devices in the future. This opens the door for us to delve into clean technology applications across multiple devices, scenarios, and value chains to advance a greener lifestyle and low-carbon society for positive climate impacts.

Entering this new decade, Xiaomi is rejuvenated with a deep sense of earnestness and passion and has embarked on a whole new journey toward our dreams and visions.

The Force, originates from technological innovation

In its 13 years of entrepreneurship, Xiaomi has placed research and development in technology front and center throughout its growth journey. Years of dedicated efforts and build-up in its technological mastery are now witnessing a remarkable leap from quantity to quality. Xiaomi's technology strategy underscores our steadfast commitment to being "technology-centric" and investing in the future. At present, Xiaomi's technology R&D spans 12 domains, ranging from 5G telecommunication technology, big data to cloud computing and artificial intelligence. Leveraging its smart manufacturing system, the reach has extended into 99 sub-sectors, including robotics, unmanned factories, and intelligent electric vehicles. Over the next five years, Xiaomi plans to invest over 100 billion RMB in research and development, maintaining an annual compound growth rate of over 30% in R&D expenses. This investment is set to expand Xiaomi's presence across four technological domains: chips, robotics, operating systems, and artificial intelligence. All the while, Xiaomi stands at the nexus of "technology—industry—users", delving deep into the technological landscape to identify and overcome efficiency bottlenecks, continuously broadening its radius of influence and impact. **In essence, Xiaomi's "Force" emanates from its technology-centric spirit.**

Optical Technology System – Acoustic Recognition —Millimeter Wave Radar Technology – Various SensorTechnologies.

5G/6G communication technology, Wi-Fi 7.Bluetooth Mesh, NFC, etc, and interconnection communication protocols based on the foregoing communication technologies.

Screen display technology and automatic control technology such as mechanical arms.

To form a unified Al capability framework that provides support for Al algorithm and computing power requirements for variousbusinesses in different scenarios.

Chip cluster, including the technical capabilitiesof the chips provided by our partners and ourself-developed chips.

Smartphone – loT devices – System integrationof smart cockpits and smart homes and close integration thereof with cloud.

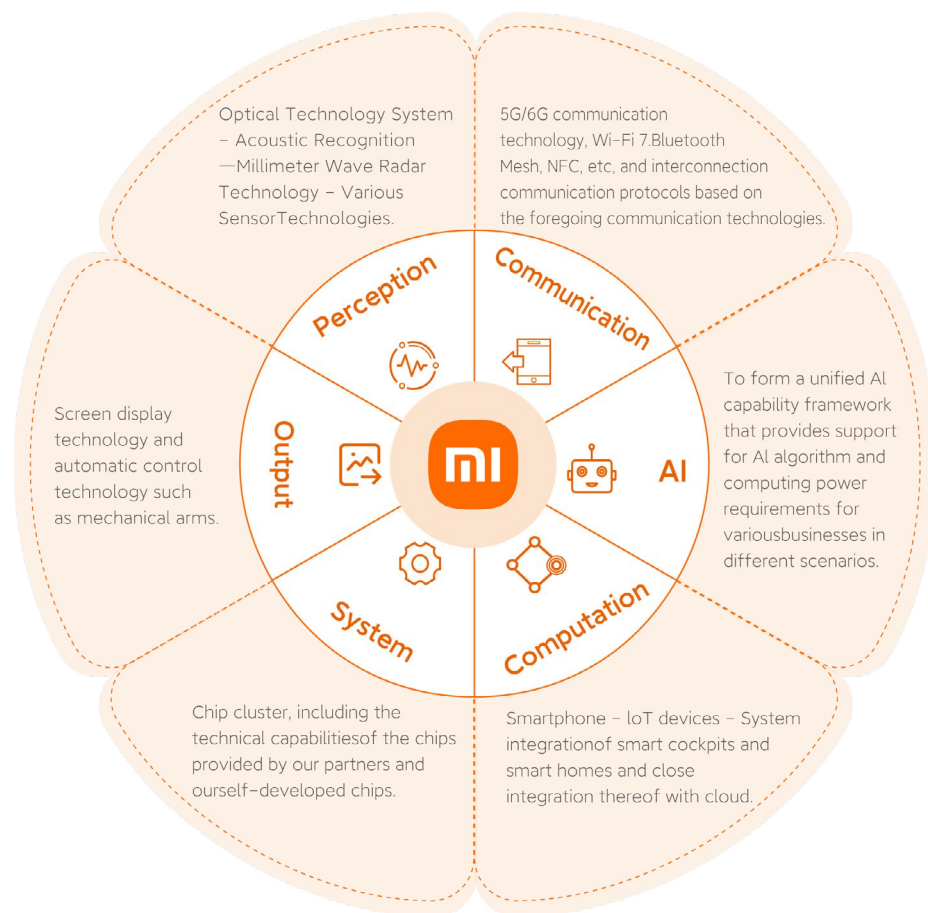Perception / Communication / AI / Computation / System / Output

Figure.4 Xiaomi's Technical Structure (Xiaomi corporation 2022 environmental, social and governance report)

Xiaomi believes that the key to achieving optimal results and fulfilling its business purpose is through an efficiency model that focuses on bringing happiness to as many people as possible, by leveraging network effects for users and scale effects for the industry. This model bridges the gap between technology accessibility and innovation motive, expediting both the innovation cycle and efficiency. This, in turn, establishes Xiaomi as an incubator for the consumer market and an accelerator for the industrial manufacturing sector.

The purpose of Xiaomi Model

"In manufacturing and distribution, it (Xiaomi model) is an innovative business model; In socio-economic and cultural contexts, it represents a healthier and sensible consumption mindset and value orientation; from a macro-economic standpoint, it is a development paradigm that emphasizes innovation and efficiency."

On our journey from smartphones to "Human x Car x Home", Xiaomi's products always aim for excellence at the product and application scenario levels and strive to break through efficiency bottlenecks in a broader context through pioneering new technologies.

With Xiaomi's established technology innovation system, we have outlined three new directions in the progression toward global net-zero targets:
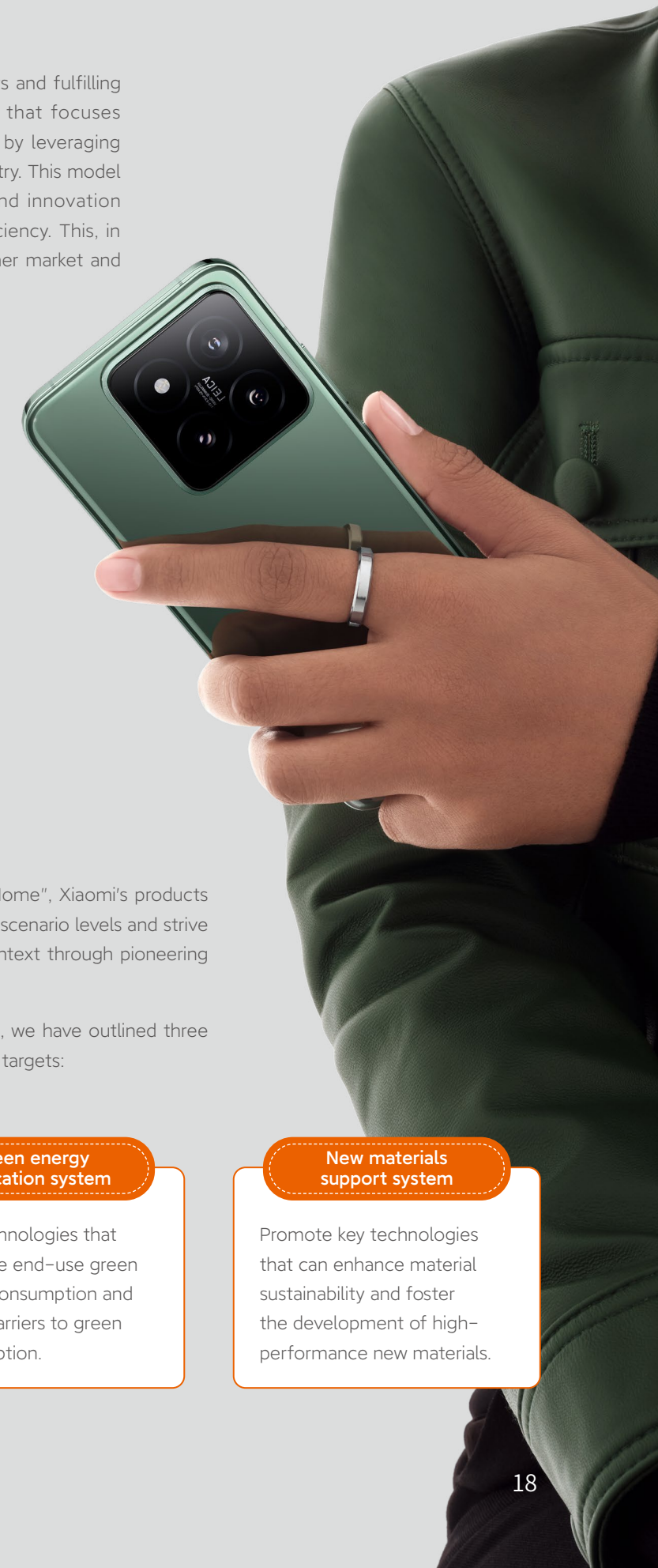
Smart manufacturing technology system

Develop key equipment, processes, and technology that can further elevate manufacturing efficiency, quality, and effectiveness.

Green energy application system

Explore technologies that can enhance end-use green electricity consumption and lower the barriers to green energy adoption.

New materials support system

Promote key technologies that can enhance material sustainability and foster the development of high-performance new materials.

Adam Smith Efficiency: Division of labor creates efficiency

- Utilizing digital technologies to optimize the value chain's operations, fostering collaboration within the value chain to achieve win-win outcome, and enhancing industry-wide efficiency.

- Investing in and empowering industries to co-create green intelligent solutions, enhancing production efficiency across the value chain, and introducing "hot-selling products" consistently through collaboration and division of labor.

Keynesian efficiency: Aggregating demand creates efficiency

- Adhering to the product strategy of "Amazing products, honest price", precisely identifies user needs for accessible technology while advancing supply-side efficiency to meet users' needs for good cost-effectiveness and achieves a balanced state of production and consumption.

Schumpeterian efficiency: Disruptive innovation creates efficiency

- Addressing efficiency bottlenecks within various environments and application scenarios. Discovering, cultivating, and integrating technology and products faster and more efficiently to create optimal solutions.

Growth, driven by the quest for "efficiency" and "efficacy"

Xiaomi never ceases to pursue extreme efficiency and technological innovation. This progress, in return, propels Xiaom to achieve higher efficiency, creating a virtuous cycle of growth model that allows Xiaomi to prosper continuously beyond its periphery.

Fundamental tenets of efficiency

From an economic standpoint, **the driving force behind Xiaomi's continuous innovation stems from its efforts to integrate "three types of efficiency"—Adam Smith efficiency, Keynesian efficiency, and Schumpeterian efficiency*.**

Footnote: In his book "Everything for Sale: the Virtues and Limits of Markets", economics author Rubert Kuttner categorizes efficiency into three types, drawing from the perspectives of three influential economists, the Adam Smith-type, Keynes-type, and Schumpeter-type.

Adam Smith efficiency posits that social division of labor can enhance production efficiency. Specialization and the division of tasks lead to more effective production, thereby increasing overall productivity.

Keynesian efficiency asserts that the level of national income determines purchasing power, and consumers' limited buying capacity hinders effective demand. This can be improved by lowering prices, aggregating total demand to consume more productivity, and reducing unproductive and surplus productivity.

Schumpeterain efficiency holds that innovation is reconfiguring production factors to drive higher efficiency in the production system. The transformation of production technologies and methods plays a paramount role in economic development.
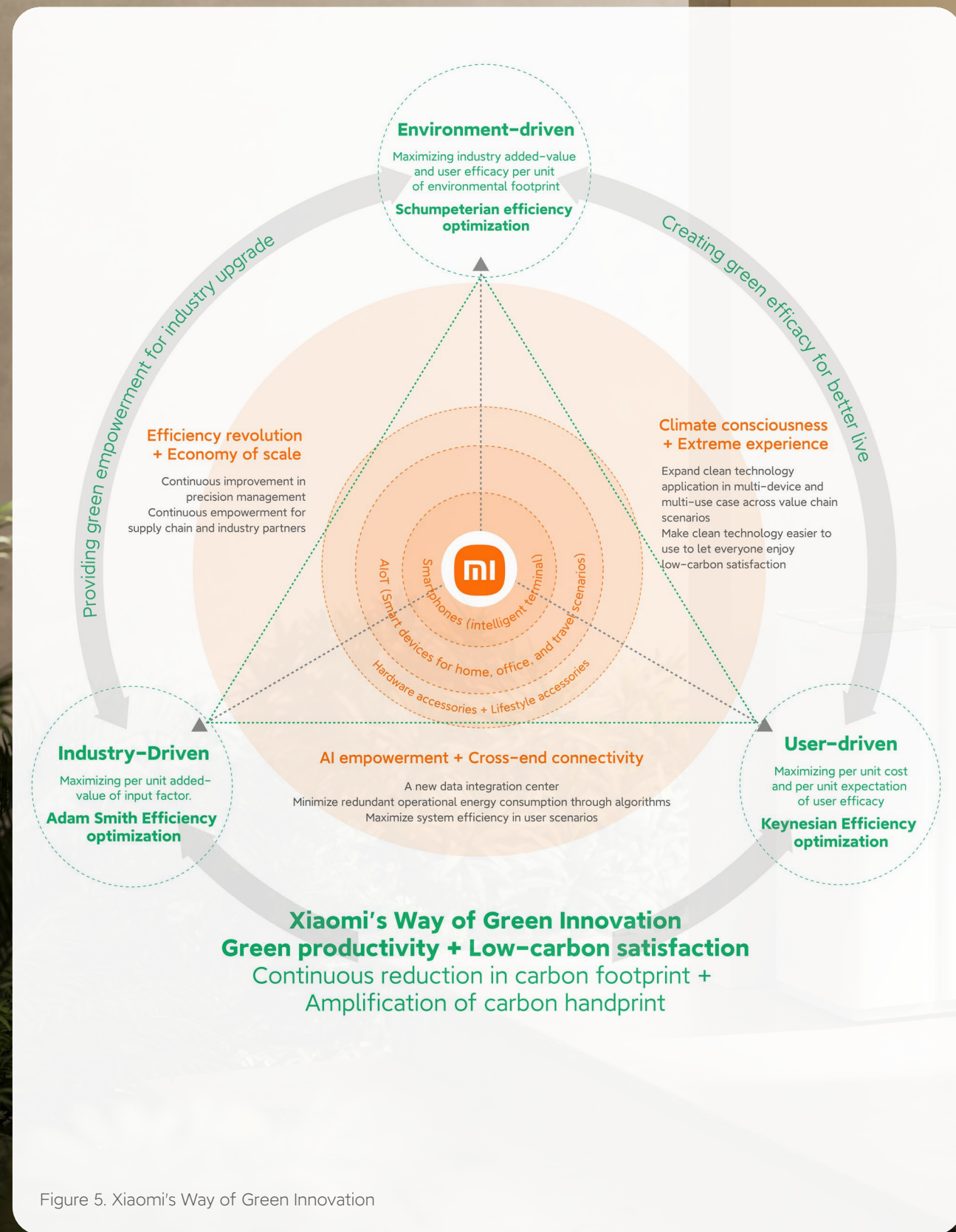
Environment-driven
Maximizing industry added-value
and user efficacy per unit
of environmental footprint
**Schumpeterian efficiency
optimization**

Creating green efficacy for better live

Providing green empowerment for industry upgrade

**Efficiency revolution
+ Economy of scale**
Continuous improvement in
precision management
Continuous empowerment for
supply chain and industry partners

**Climate consciousness
+ Extreme experience**
Expand clean technology
application in multi-device and
multi-use case across value chain
scenarios
Make clean technology easier to
use to let everyone enjoy
Low-carbon satisfaction

Smartphones (intelligent terminal)
AIoT (Smart devices for home, office, and travel scenarios)
Hardware accessories + Lifestyle accessories

Industry-Driven
Maximizing per unit added-
value of input factor.
**Adam Smith Efficiency
optimization**

AI empowerment + Cross-end connectivity
A new data integration center
Minimize redundant operational energy consumption through algorithms
Maximize system efficiency in user scenarios

User-driven
Maximizing per unit cost
and per unit expectation
of user efficacy
**Keynesian Efficiency
optimization**

Xiaomi's Way of Green Innovation
Green productivity + Low-carbon satisfaction
Continuous reduction in carbon footprint +
Amplification of carbon handprint

Figure 5. Xiaomi's Way of Green Innovation

The Green Efficiency Philosophy

With the upgrade of the "Smartphone x AIoT" strategy, Xiaomi has gradually composed its Green Efficiency Philosophy: **As a technology company, Xiaomi constantly integrates and optimizes industry efficiency, product efficacy, and environmental efficiency through green technologies and innovations.**

From an environmental perspective, the "Efficiency Triangle" framework guides Xiaomi's efforts to consistently enhance industry and product efficiency through technological innovation. Not only will it generate higher user efficacy, but also deliver robust improvement in material efficiency, energy efficiency, and green efficacy across the entire product lifecycles.

	Efficiency			**Efficacy**
	Material efficiency	**Energy efficiency**	**Green efficacy**	**User efficacy**
Industry efficiency — Industry end, mainly relies on technological upgrade to improve efficiency and efficacy	Material consumption per unit value in the production process	Energy consumption per unit value in the production process	Incremental consumption or the creation of green energy and green material in the production process	User value-based industry efficiency
Product efficiency — User end, mainly depends on design optimization to improve efficiency and efficacy	Product material efficiency: material consumption by users to obtain per unit of efficacy	Product efficacy: energy consumption by users to obtain per unit of efficacy	Incremental consumption or creation of green energy and green material in user consumption process	User value-based product efficiency

Achieve extreme efficiency   **Create more green efficacy**

Xiaomi's Green Efficiency Philosophy

Figure 6. Xiaomi's Green Efficiency Philosophy

Through its endeavor to maximize industry efficiency, product efficacy, and environmental efficiency, Xiaomi continues to reduce its own carbon footprint while expanding its green impacts to unleash the dual benefits of green innovation.

Environmental benefits

Create sustained green efficacy through technology and product innovation. Xiaomi strives to improve energy and material efficiency across the product lifecycle, and also lowers barriers to the application of green technology, making sustainable materials and renewable energy more accessible and user-friendly.

Economic benefits

The widespread adoption of new technologies will facilitate industrial upgrades and enhance the quality of life for everyone. In the era of "Everything Interconnected", Xiaomi toils to pursue extreme efficiency in product-service experiences and operational efficiency, contributing to overall corporate and societal efficiency and, ultimately, bringing benefits to consumers.

Xiaomi's way of green innovation: unleashing green productivity x creating low-carbon satisfaction

Embracing its philosophy of green efficiency, Xiaomi continually unleashes the dual environmental and economic benefits for industries and users. On the industrial front, our "Internet + Manufacturing" model empowers ecosystem partners and supply chains, uplifting the quality and efficiency of "Made in China". On the user side, we lead the way in building a human-centric experience and creating an interconnected tech ecosystem and service scenarios that revolve around users to foster a more sustainable lifestyle.

Unleashing green productivity

In production and distribution, Xiaomi is dedicated to an innovative and efficient model. From the stringent performance requirements of smartphones to the extensive AIoT product lines, Xiaomi has garnered rich experience in technological innovation as well as practical implementation. Its well-polished smart manufacturing system and production equipment are helping supply chain partners improve production processes and efficiency, opening up new possibilities to reconfigure technology applications with supply chain resources, and paving the way for industry-wide efficiency revolution and high-quality green development.

Creating low-carbon satisfaction

Under the circumstances that user expectations remain unchanged, Xiaomi's products can become more energy-efficient and generate more green efficacy. This translates into an exceptional experience beyond user expectations when they can access green energy and materials more conveniently. From applied technologies to foundational elements, hardware to software, content to services, and user to the business ecosystem, Xiaomi offers a set of all-round and open solutions spanning across smart consumer hardware products including smart home, wearables, and mobility devices, along with an open-sourced development model. Ultimately, Xiaomi strives to deliver a high-quality, intelligent, and low-carbon lifestyle experience for users.
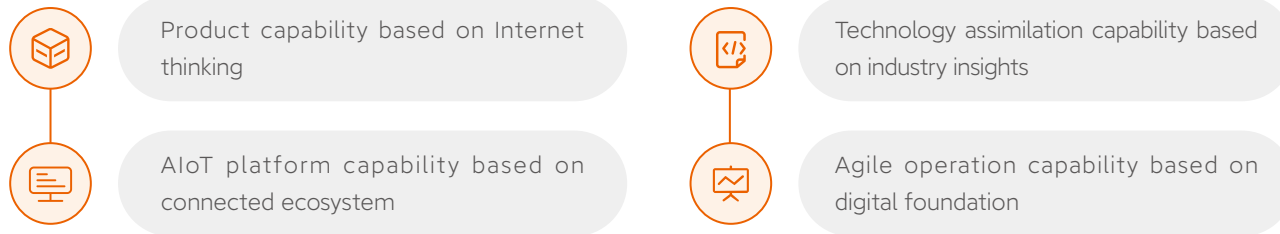
Redefining happiness and well-being under the zero-carbon aspiration:

- According to the renowned economist Paul Samuelson's Happiness Equation: Happiness = consumption divided by desire

- Insights from scholars like Miura Atsushi in works such as "The Fourth Consumer Era" reveal a societal shift toward thrifty consumption by eliminating excess, extravagance, and non-essential elements, and prioritizing simple, practical, and minimal consumption needs. This shift amplifies the overall sense of happiness by simplifying and refining the denominator "desire" in the happiness equation.

Xiaomi's way of zero-carbon transition can be summed up in one statement——"The pursuit of extreme efficiency, the creation of green efficacy".

Built on Xiaomi's efficiency philosophy and efficacy concept, we have concluded four fundamental capabilities to drive the zero-carbon transformation and five pathways to achieve the net-zero targets:
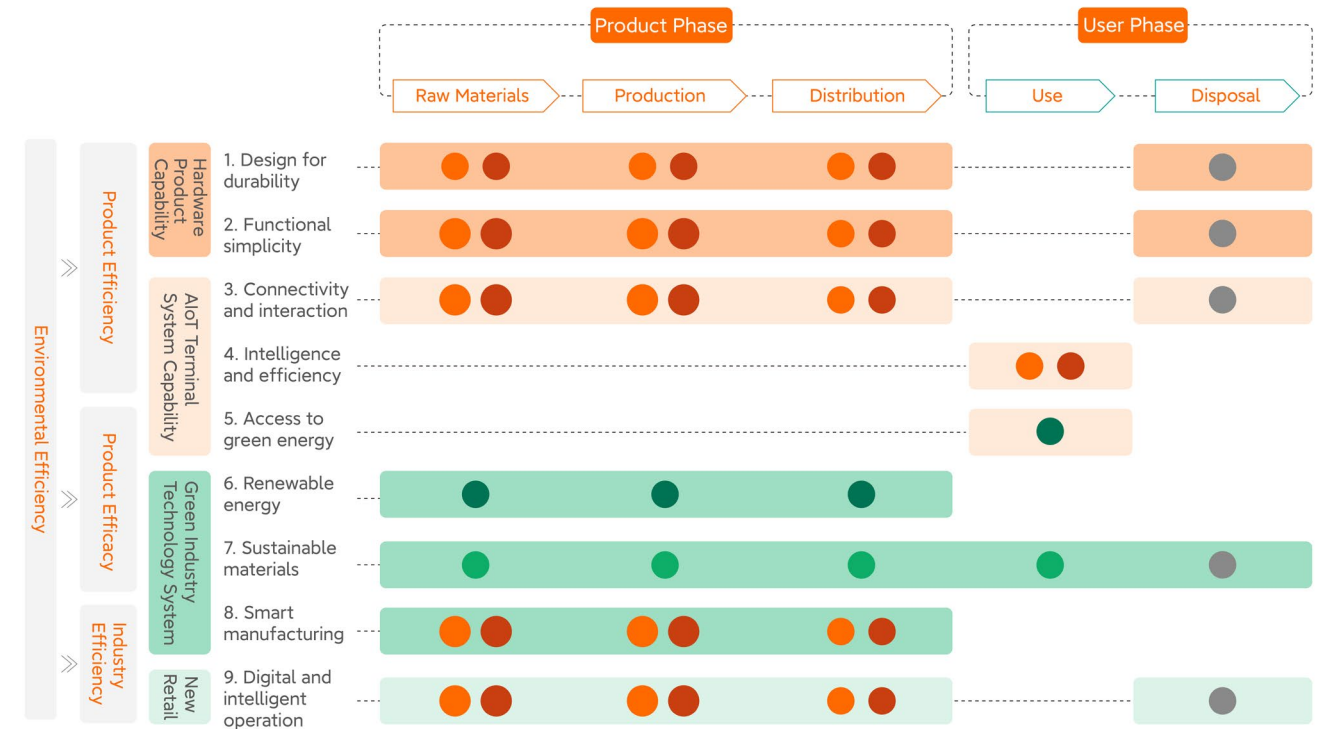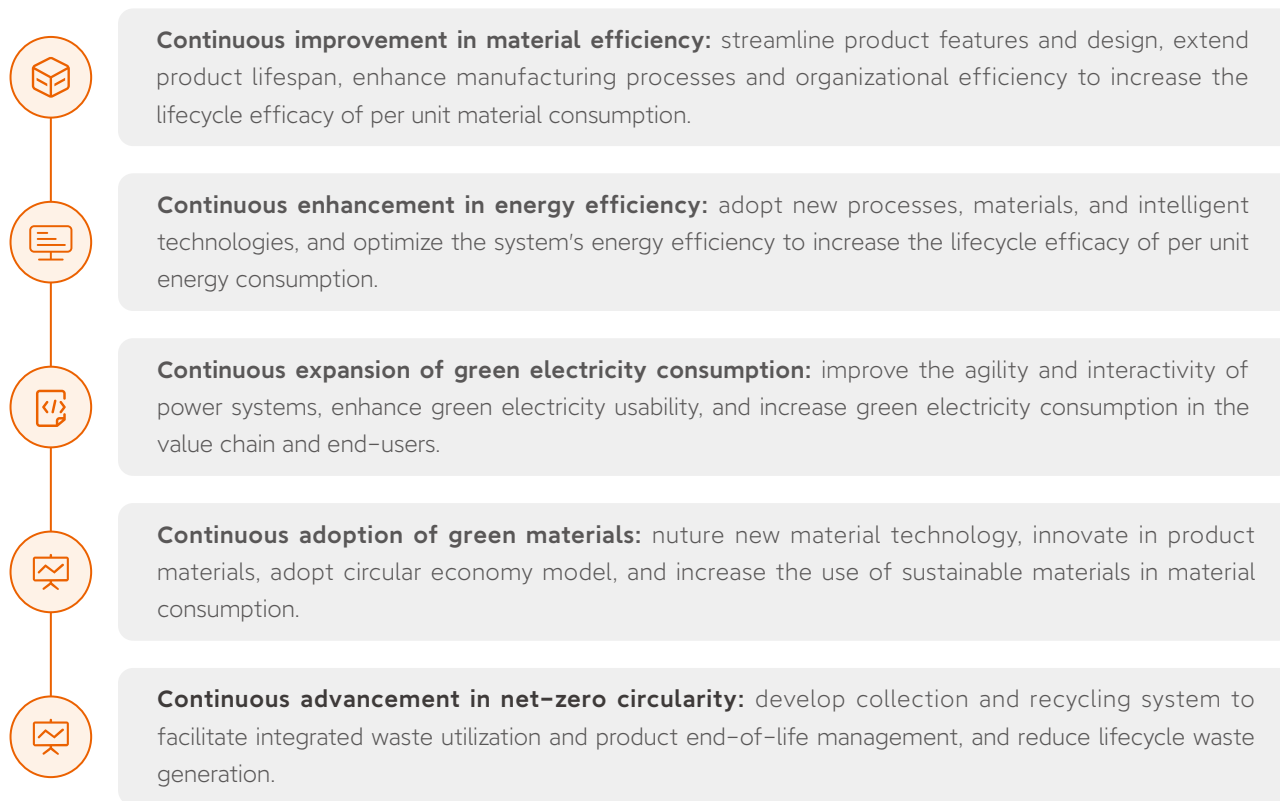
Four fundamental capabilities

Product capability based on Internet thinking

Technology assimilation capability based on industry insights

AIoT platform capability based on connected ecosystem

Agile operation capability based on digital foundation

Five transformative pathways

Continuous improvement in material efficiency: streamline product features and design, extend product lifespan, enhance manufacturing processes and organizational efficiency to increase the lifecycle efficacy of per unit material consumption.

Continuous enhancement in energy efficiency: adopt new processes, materials, and intelligent technologies, and optimize the system's energy efficiency to increase the lifecycle efficacy of per unit energy consumption.

Continuous expansion of green electricity consumption: improve the agility and interactivity of power systems, enhance green electricity usability, and increase green electricity consumption in the value chain and end-users.

Continuous adoption of green materials: nurture new material technology, innovate in product materials, adopt circular economy model, and increase the use of sustainable materials in material consumption.

Continuous advancement in net-zero circularity: develop collection and recycling system to facilitate integrated waste utilization and product end-of-life management, and reduce lifecycle waste generation.

Figure 7. Xiaomi's Zero-carbon Approach

Xiaomi's Way:

Nine Approaches to Reach Climate Goals

—— From Xiaomi's experience, we believe there are nine approaches to achieve carbon reduction targets in the consumer electronics industry.

Two approaches to building product capability based on Internet Thinking

Design for durability

In an era where the world embraces designs that harmonize with nature, the shift towards sustainable design is imperative. Xiaomi's design philosophy centers on **practical hardware, intuitive products, and sleek and minimalistic industrial design,** the combination of which reflects Xiaomi's design ethos to avoid superfluous features but concentrate on delivering high-performance, value-driven products, from control portals to smart home devices. This will enhance Xiaomi's product longevity, technical adaptability, and aesthetic appeal, while minimizing environmental impacts associated with frequent replacement of products and components.

Excellence in durability: As a testament to sustainable design, Xiaomi products are crafted to withstand daily wear and tear, which means they will have a longer lifespan. This, in turn, reduces the need for new materials and generates less electronic waste as a result. Early in the product design phase, our engineers prioritize durability during material selection. Wear-resistant ceramic materials, and organic silicone resin materials that are durable, mildew-resistant, and acid-alkali-resistant, are all examples of durable materials that are used across our smartphone products. Our engineering standards go beyond international norms in regard to dust resistance, water-proofing, and shock resistance, to make our products robust and reliable for everyday use. Xiaomi also ensures compatibility across product models for software updates and hardware maintenance, which enhances product longevity and prevents premature disposal due to functional issues or software obsolescence.

Case study: Crafting the ultimate protective glass screen

Xiaomi and its partners co-developed a new glass material, the "Xiaomi Ceramic Glass", which is used in Xiaomi 14 Pro. This display panel adopts a special powder formula that is heated at over 800 ℃ , and through crystal formation, microcrystals are produced, which form an interlocking structure and become evenly dispersed in the glass. This design allows Xiaomi Ceramic Glass to far exceed the strength of typical glass, boosting 10 times higher drop resistance and 1.25 times higher scratch resistance while maintaining high transparency.

Minimalistic design language: Xiaomi's innovation transcends the boundaries of minimalism. With an exceptional industrial design philosophy, Xiaomi is able to blend aesthetics and function seamlessly in consumer electronics. The essence of "Mi LooK" is evident in their range of products, demonstrating a uniform and cohesive allure underlying a minimalistic and sleek design language that is timeless, classic, and works well in any setting. Consumers are less likely to replace them because of superficial novelty. For this reason, Xiaomi stands as a beacon for sustainable and responsible consumption in today's ever-changing consumer electronics market.

Mi Home Desk Lamp

The Mi Home Desk Lamp showcases the iconic "Mi LooK" aesthetic, combining a sleek and minimalist design with an innovative laptop hinge solution that connects the lamp arm and pole. Beyond its lightweight and versatile design, this structure exemplifies durability, with a hinge lifespan of over 10,000 times that exceeds industry standards by a wide margin.

In the field of product design, Xiaomi has received numerous industrial design awards from various organizations:

Xiaomi products such as fresh air-conditioners, wireless vacuum cleaners, electric screwdrivers, rice cookers, microwaves, smart door locks, and Mi Home smart rearview mirror, have garnered top honors at the world's three major design competitions—the "iF Design Award," "International Design Excellence Awards," and "Red Dot Design Award*."

Exploring the products of the future: As a tech company, Xiaomi is focused on making products with "future-oriented" features that can stand the test of time. Our commitment to investing substantially in emerging technologies gives our users access to experience new developments in the industry. Taking batteries as an example, Xiaomi has been researching solid-state batteries since March 2023, a technology that would allow us to achieve a higher energy density of 1,000 Wh/L, while also mitigating issues such as reduced battery life, poorer performance under low temperatures, and safety concerns which are common in batteries. All this combined will revolutionize the future of smartphone batteries.

*Note: The iF Design Award in Germany, the International Design Excellence Awards (IDEA) in the United States, and the Red Dot Design Award in Germany collectively represent the world's top three design honors in the global design community.

Functional simplicity

Precision and excellence in simplicity

Xiaomi maintains a mindful approach to creating products with streamlined features and avoiding over-complications. For instance, Xiaomi's self-developed HyperConnect technology embedded in Xiaomi HyperOS and the cognitive center of Xiaomi's device ecosystem—HyperMind, enables real-time and seamless communication between devices while using less energy and generating less electronic waste, hence a lower environmental footprint without sacrificing performance. Furthermore, HyperMind can utilize the four perceptual capabilities of devices—environment, vision, sound, and behavior, to learn user requirements and automatically adapt devices to their needs, eliminating unnecessary energy consumption. All of this allows Xiaomi to create a user-centric product and interactive experience that responds to each unique user's demand, ushing in a new era of user-centric, clean technology and sustainable living.

Focus on essential features to optimize product efficacy

Xiaomi focuses on the most pressing needs of the majority, identifies the essence of products, and is dedicated to addressing the pain points of the largest user group. By merging innovative technologies with industrial design, Xiaomi creates efficient and streamlined products tailored to users' needs.

Case study:

- **Xiaomi TV control:** In the past, TV remote controls had a vast array of buttons with over 80% of them being confusing to ordinary users. Xiaomi changed all that with their first remote released in 2012, featuring only 11 buttons, making it simple enough for anyone to operate without needing to learn how.

- **Xiaomi power strip:** The first generation of the Xiaomi power strip, with its sleek design, instantly became a bestseller in the power strip category. The design feature of having three sockets and USB ports quickly became the industry benchmark, and soon the appearance of power strips all over China began to exhibit the "Xiaomi style."

Refined scheduling capability of Xiaomi HyperOS: Xiaomi HyperOS boosts refined scheduling capabilities that can accurately command hardware and tasks in diverse and complex scenarios. This is achieved through technical means such as dynamic thread priority adjustment and dynamic task cycle evaluation, resulting in optimal performance and power efficiency. Running resource-intensive games on a smartphone equipped with Xiaomi HyperOS allows for a more stable frame rate and lower power consumption compared to stock Android and other heavily customized operating systems. On lightweight devices with limited processing power, the scheduling advantages of Xiaomi HyperOS are even more apparent—it supports task splitting across multiple computing units for cooperative processing, which maximizes hardware performance. Furthermore, Xiaomi HyperOS has undergone an extensive restructuring of technical modules, including the file system, memory management, imaging subsystem, and network system, all aimed at efficiently harnessing and optimizing the varying hardware capabilities of different devices, thus providing optimal performance.

Streamlined operation leading a low-carbon and smart lifestyle: Leveraging AIoT technology, Xiaomi has introduced a one-stop access feature that seamlessly connects not only Xiaomi's smart home devices, but also other branded household appliances, providing users with real-time data on their energy usage and efficiency. This service encourages users to save energy through automated energy-saving settings such as "automatic lights turning on when someone enters" or "switching off air-conditioner when someone leaves" without compromising daily comfort. Moreover, Xiaomi has acquired several leading energy-saving patents in smartphone interaction and user environment customization control technologies to enhance user experience and reduce energy use even further.

Three approaches to developing AIoT platform capability based on connected ecosystem

Connectivity and interaction

An upgrade of the world's largest human-centric consumer AIoT platform

Xiaomi launched its AIoT business in 2014 and, through extensive R&D and integrated application of technologies such as the Internet of Things, artificial intelligence, and big data, built a leading global consumer AIoT platform from the ground up. As of September 30, 2023, the number of Xiaomi's AIoT-connected devices reached 699 million (excluding smartphones, laptops, and tablets), and the growth trends of connectivity and interaction are both strong and steady. Meanwhile, the open-source and collaborative nature of Xiaomi's AIoT platform pairs well with technological advancement, fostering an enriched smart home scenario while lowering entry barriers for small and medium-sized companies committed to creating smart products. As a result, a slew of Chinese products and brands have been promoted to the global stage.

From just 100 users to a cumulative 1.175 billion users worldwide; from having no hardware to running a diverse ecosystem spanning over 200 categories; in the era of Everything Interconnected, Xiaomi faced the unique challenge of navigating complexities arising from the multitude of device operating systems and the interoperability challenges between various ecosystems that few tech companies may understand as profoundly as Xiaomi does. For this reason, Xiaomi HyperOS was born. In development since 2017, Xiaomi HyperOS is designed to unify all ecosystem devices—over 200 categories and 820 million devices—into a single, integrated system framework, covering over 95% of user scenarios. The goal is to deliver peak device performance, bring coherence, ensure consistent user experience, and facilitate seamless connectivity across all Xiaomi devices so that redundancy can be eliminated and energy efficiency improved. This directly contributes to the reduction of electronic waste and promotes the global goal of sustainable consumption.

The Eco-friendly Xiaomi AI Assistant

Xiaomi's AI Assistant has established a full-scenario voice control ecosystem within our diverse and interconnected scenarios. As of September 30, 2023, Xiaomi's AI Assistant reached 124 million monthly active users (MAU) with a total of 265 billion cumulative interaction times, and was embedded in 6,161 Xiaomi products across 79 product categories. In multi-device scenarios, Xiaomi's AI Assistant saves redundant computing, perception, and hardware devices through functions such as cooperative wake-up, unique response, and centralized control. The underlying energy-saving technology in Xiaomi's AI Assistant smart wake-up function will help reduce $3.92 \times 10^{-3} kgCO_2$/person every year.

Leveraging the power of AIoT to substitute virtual interaction for physical control

In the age of Everything Interconnected, cross-device connectivity and capability integration are essential beyond pursuing excellence in single-end performance. Xiaomi HyperOS takes this a step further by incorporating the self-developed Cross-End Intelligent Connectivity framework, HyperConnect, to realize real-time networking between a myriad of devices. With the introduction of the integrated device center, users can now actively control nearly their entire array of connected devices, rendering them the ability to effortlessly monitor and manage their interconnected ecosystem from anywhere. Xiaomi HyperOS consolidates complex application scenarios and product interaction functions, reducing the need for terminal modules, and maximizing utility through connectivity and reconfiguration. For example, in a household setting, a Xiaomi smartphone can serve as a central portal and a digital dashboard, allowing users to manage their devices easily through the IoT platform which interconnects devices on the backend. This, in turn, effectively reduces energy consumption and lowers the product's carbon footprint while it is being used.

With continuous improvement with each update, the Mi Home App delivers a more streamlined and automated smart home experience. It seamlessly integrates device connectivity, display, and scene combinations to unlock advanced automation capabilities. In the new Mi Home, frequently used devices such as lighting, curtains, environmental controls, and security are intuitively grouped for unified control—simply toggle all on or all off. At present, Xiaomi has developed over 1,000 Xiaomi and Mijia smart home products, which can be controlled and managed via the Mi Home App to optimize energy efficiency. Just the intelligent scenario interaction feature alone can save approximately 7.4 million kW/h of energy annually by eliminating unnecessary energy use.

Energy-saving at the platform: eliminating unnecessary energy usage through cross-end connectivity and intelligent algorithms

Xiaomi HyperOS renders a single integrated platform for all devices within its ecosystem. Its exceptional compatibility and precise system resource management capabilities enable every device to deliver ideal performance within its processing power limit, avoiding excessive computing power and energy consumption for overindulgence in performance. The system embeds an innovative Cross-End Intelligent Connectivity framework to facilitate seamless cross-device connectivity and minimize resource inefficiencies.

Xiaomi HyperOS has an "integrated device center" that displays all connected devices and their operating status from anywhere, allowing isolated devices to be linked into one system so that software and services can adapt to user needs. For example, users can seamlessly switch to the rear camera of their smartphones when using a tablet or laptop for video conferencing, access car cameras from a smartphone while driving, or even connect a tablet to the internet via smartphone. Furthermore, apps, clipboard content, and notifications can be easily moved between devices as per users' needs, thereby maximizing hardware usage efficiency.

Building a large-scale low-carbon edge intelligence model

The strengths of Xiaomi HyperOS's large foundational model are evident in the field of "Edge Intelligence vs Edge Computing". While most large AI models hinge on a powerful cloud system to process data and tasks, Xiaomi HyperOS leverages its AI subsystem to integrate large foundational models into the device's Neural Processing Unit (NPU), enabling more efficient computation right on the device. This has many benefits over the "Cloud Intelligence + Edge Computing", as it enhances performance while using less power, which results in higher efficiency and a lower carbon footprint.

The deployment of large foundational models reduces dependency on centralized data centers, which generally consume a significant amount of energy, especially during data transmission and large-scale computations. Edge processing reduces data transmission circulations and hence data traffic on the network, thus cutting down energy use and carbon emissions. Now that data is less centralized on one data centre and more dispersed across devices, edge intelligence also reduces the energy needed to cool the data center. In the space of image processing, Xiaomi's self-developed NPU solution has slashed the size of large foundational models and memory usage by 75%, and shortened the drawing time from 100 seconds to just five seconds on smartphones. This optimization enables devices to carry out complicated AI computational tasks more quickly and with greater energy efficiency.

Establish a unified operating system for efficient interaction

Xiaomi HyperOS is designed to unify all ecosystem devices into a single integrated platform, ensuring optimal performance for each device while minimizing resource inefficiencies through its Cross-end Intelligent Connectivity framework. Xiaomi HyperOS incorporates cutting-edge AI subsystems to support the application of advanced AI technologies, endowing devices with intelligence and providing users with unprecedented experiences of Everything Interconnected. Meanwhile, Xiaomi HyperOS adheres to the principle of open source, actively nurturing an open software ecosystem, and welcomes partners to join us in shaping an intelligent ecosystem and providing a better user experience together.

Low-level Refactoring: releasing the full potential of devices: The core of Xiaomi HyperOS is formed by Linux and Xiaomi's self-developed Xiaomi Vela system. Its exceptional compatibility and precise system resource management capabilities enable every device to deliver ideal performance. Xiaomi HyperOS's underlying layer supports over 200 processor platforms and over 20 standard file systems, covering hundreds of device types and thousands of SKUs. It allows for flexible configuration, operation, and deployment in accordance with hardware requirements. The range of compatible device RAM sizes covers as small as 64KB to as large as 24GB.

Xiaomi HyperOS focuses on refined scheduling, through technical means such as dynamic thread priority adjustment and tasking, which can accurately match scenarios, performance, and capacity. For instance, on lightweight devices with limited processing power, the system supports task splitting across multiple computing units for cooperative processing to achieve better performance across both high-processing power devices (e.g. smartphones) and lightweight devices (e.g. wearables), optimizing the varying hardware capabilities of different devices.

Cross-End Intelligent Connectivity, enabling efficient connectivity across devices: Xiaomi's proprietary Cross-end Intelligent Connectivity Framework, "Xiaomi HyperConnect", enables real-time networking across devices to optimize interconnection and synergy. Xiaomi HyperOS harmonizes all connected devices, allowing software and services to adapt to user needs. This is not only limited to personal devices such as smartphones and PAD, but is also extended to a smart home scenario where its visual and auditory perceptual capabilities can be fully utilized. For example, Xiaomi's smart air-conditioner can regulate temperature automatically based on how many people occupy a room, allowing users to personalize multi-device connections in any way they see fit.

Proactive Intelligence, landing advanced AI technologies to application: HyperMind is the cognitive center of Xiaomi's device ecosystem, bringing pioneering cross-device connections into the era of 'Proactive Intelligence.' This enables devices to understand user needs proactively and act accordingly. HyperMind utilizes the four perceptual capabilities of devices—environment, vision, sound, and behavior, to learn user requirements and automatically adapt devices to their needs, transforming the 200+ SKUs and 820 million devices into sensory antennae to perceive the world. For instance, if a user always turns on the living room light upon unlocking their smart door lock, HyperMind will automatically illuminate the room after learning this pattern with user's consent. This innovation simplifies complex cross-device connectivity and reduces traditional machine learning costs, enabling users to enjoy the convenience of device connectivity without needing to understand the intricate logic comprehension or trigger mechanisms.

Open-source ecosystem, an efficient mode for developers: Xiaomi adheres to the principle of open source and actively nurtures an open software ecosystem. For device developers, ramping up intelligence levels from zero to one is very costly, while moving from one to N is a formidable technological gap. For this reason, Xiaomi has initiated an IoT open-source program for its ecosystem partners, opening up access to a total of ten device categories, including electrical lighting, smart security, environmental cleanliness, and sports health, for our smart device partners, practitioners in the home sector, as well as individual developers to take their first step. The open-source sharing will cover over 95% of smart devices to help our developer partners achieve device intelligence more easily. Xiaomi's IoT platform can abstract underlying hardware differences and offer a unified software interface for upper-level developers with a rich array of plug-ins and standardized software frameworks. This unifies disparate application scenarios, connects multiple devices, enables connectivity, streamlines development, significantly reduces learning costs, and enhances efficiency. By making Xiaomi's IoT platform open source, we are fostering IoT device innovation, improving performance, and enabling real-time connectivity capabilities across a wider spectrum of devices. To date, Xiaomi has already collaborated with over 9,000 IoT partners, and we welcome more partners to join hands in shaping an intelligent ecosystem and providing a better user experience together.

Scenario-based energy-saving

By using precise identification and defining specific user scenarios, Xiaomi continues to refine the operational efficiency of communication modules, display screens, and intelligent ends in smartphones and AIoT devices, and optimize algorithms to enhance seamless connections across multiple scenarios, offering stronger product efficiency and a better user experience.

Smart and efficient technology for enhanced device efficiency

In the field of telecommunication, Xiaomi employs 5G energy-saving technologies, such as self-adaptive broadband and energy optimization technologies, to reduce energy consumption during 5G signal transmission and improve communication efficiency. In addition, Xiaomi combines WLAN power monitoring and dynamic transmission technology, which effectively lowers the power consumption of the product's WLAN module by approximately 30% compared to the previous generation. Through software updates, hundreds of millions of smartphones have been loaded with this optimization, contributing to substantial carbon emission reduction.

When it comes to screen display, Xiaomi remains at the forefront of terminal screen technology, adopting advanced screen materials to optimize energy use and reduce the carbon footprint of smartphones. For instance, Xiaomi smartphones use the latest OLED luminescent materials with a stacked structure, which can boost screen brightness efficiency by over 16% compared to the 2020 generation, bringing notable improvement in energy efficiency. On top of that, the energy-efficient screens and high-performance screen processors have been upgraded to enhance display efficiency by approximately 7%.

In the realm of smart terminals, Xiaomi has undertaken systematic research on chip design, battery materials, and charging algorithms, and has pioneered an intelligent fast-charging system that integrates high charging rates, high energy density, and efficient low-heat features. Currently, Xiaomi has launched the world's first 3-in-1 fast-charging infrastructure—comprising wired fast charging, wireless fast charging, and reverse wireless charging, along with groundbreaking single-cell 100W fast-charging technologies. This breakthrough has put Xiaomi among the global leaders in charging technology. By 2022, this technology had been implemented in more than 100 million smart devices. Compared to traditional fast-charging technologies, it can save around 570 million kilowatt-hours of electricity consumption on an annual basis, which is equivalent to roughly 21,700 tons of reduction in greenhouse gas emissions.

*Note: Energy consumption = Charging efficiency * Battery capacity * Battery voltage * Number of charging * Number of smartphones. Among these, a battery capacity of 4,500mAh and an average voltage of 3.87V are used. Assuming each device is charged once a day, with an efficient charging solution having a charging efficiency of 97% and a traditional solution with an average efficiency of 88%.

Highlights: Xiaomi HyperCharge Technology

Battery material: Xiaomi has achieved a significant milestone in battery material technology in 2021 with the introduction of the world's first high-energy-density, long lifespan, and high-performance silicon-oxygen anode battery, which has been successfully mass-produced and used in Xiaomi's smartphones.

Charging algorithms: Xiaomi's thorough research on energy management of terminal devices has led to the development of its Smart Battery Management System 2.0 (SBMS2.0), which incorporates advanced machine learning technology. This charging system is able to gather insightful data about users' daily sleep and wake-up patterns and adjust the charging cycle through advanced algorithms to prevent overcharging of the battery overnight, which extends the battery lifespan significantly.

Proprietary "Dual-charging chips": Xiaomi's proprietary Surge P1 is the industry-first resonant charging chip with multiple conversion models that can output over 60W of power. This was soon followed by the release of our second generation Xiaomi Surge P2 charging chipsets, which enhanced HyperCharge to 90W+ with a 19% reduction in chip size and an 1% improved efficiency compared to its predecessor, resulting in an annual carbon emission reduction of approximately $16.93*10^{-3}kgCO_2$/unit. Combined with the Xiaomi Surge G1 battery management chipset, the dual-chip battery management system can further reduce energy transmission losses, enhance battery charging efficiency and performance, and extend battery lifespan.

Optimizing algorithms to enable energy-saving across scenarios

Xiaomi is devoted to "joining together all individual devices into one unified system" by linking household appliances to the network through "Smartphones x AIoT". By optimizing algorithms, Xiaomi uses its wit to enhance the operational efficiency of key components of its smartphones and AIoT devices, thereby improving the energy efficiency of household appliances. With this AIoT-interconnected setup, users are able to control all of their appliances, including air conditioners and washing machines, with just one smart terminal. Xiaomi concentrates the energy-saving algorithms of its products on the user end to enable carbon reduction through product combinations in various scenarios.

Take the Xiaomi air-conditioner as an example. Its advanced electronic control algorithms can determine the necessary cooling and heating power, based on the actual indoor temperature and user settings, to reach an optimal balance between temperature regulation and energy consumption. The performance of the air-conditioner is enhanced by more than 20% in all conditions through an intelligent control engine and load adaptation function, and it can be further reduced by up to 30% when the user-friendly 'intelligent on-off' mode is toggled on. Based on an estimated 400 million household air-conditioner units in China in 2018, this comprehensive approach of energy-saving design and AIoT-empowered operation mode can potentially reduce CO_2 emissions by approximately 8-200 million tons from household air conditioners every year.

Office Intelligent Management System: Best practice in building a green and low-carbon work environment

Xiaomi has introduced an intelligent management system in its office environment to engage actively in low-carbon practices. This system incorporates a sophisticated network of sensors capable of capturing environmental attributes such as temperature, humidity, and light intensity with accuracy. This data forms the basis for the algorithms to compute optimum decision flows and automate command adjustments. This ensures not only a reasonable allocation of energy but also, through precise environmental perception and response, reduces unnecessary energy usage and lowers carbon footprint. Temperature and humidity sensors, for instance, can autonomously regulate the air conditioning system to cool or heat as needed, whilst brightness sensors can automatically control lighting based on natural light intensity, maximizing the use of natural light and reducing electricity consumption.

The Intelligent appliance control function also helps avoid energy wastage from idling devices. Security-used human sensors and smart sunshade systems work in tandem and are only activated when human activities are detected. Xiaomi's office spaces have been brought up to a whole new level of comfort through these advanced methods of management, as well as seeing significant savings on energy consumption and carbon emissions.

Green microgrid

Adhering to a human-centric approach and harnessing the power of green innovation, Xiaomi will continue to explore green transformation technologies and smart hardware, aspiring to provide "minimal" new energy solutions for residential, office, and travel, bridging the "last centimeter" to connect these scenarios with the new power system. This endeavor seeks to enhance the interaction between buildings, travel, and large-scale power grids, ultimately increasing the ability and capacity to consume renewable energy.

From portable photovoltaic panels and energy storage devices to the interconnection of voltage weak DC microgrid

Xiaomi will build on its existing line of low-power solar PV panels and mini energy storage devices used in households, and continue to expand its product range and offerings to tailor for customers, homes, offices, and other settings. It will also develop smart hardware with DC technology and group intelligent control capabilities. The ultimate goal is to create a complete ecosystem of energy generation, consumption, storage, and control in residential, office, and travel scenarios. This is coined as the "Light, Storage, Direct, Agile" active response terminal.

Explore demand-side response to support renewable energy consumption

Leveraging its deep expertise in the AI sector, Xiaomi will strengthen collaboration with power grid companies to develop an IoT platform that encourages closer interaction between urban users and the power grid through developing algorithms for energy consumption monitoring, demand-side response, and smart scenarios. This platform is intended to facilitate green energy supply for devices heavily used during specific seasons or periods, such as air conditioners, electric water heaters, and washing machines. Surplus renewable electricity from end-users can also be re-transmitted to the power grid, promoting energy balance at large and reducing regional total energy consumption. In sum, Xiaomi is working to integrate a community-level "Light, Storage, Direct, Agile" system with the municipal power grid system in order to boost renewable energy consumption in everyday life.

Xiaomi's green energy-related products:

Renewable energy and charging product combo: Xiaomi's portable renewable energy product, the Mijia Solar Panel, incorporates the innovative Meta Wrap Through (MWT) technology with a 100W MAX fast power output. It is designed to be used with the Mijia Outdoor Power Supply 1000 Pro, the combined use of which will make outdoor power supply and storage possible. These products' efficient performance and portable design have made them an ideal choice to use for outdoor travel, camping, and in emergency situations.

Electric scooter setting the trends in Europe: In 2022, Xiaomi's electric scooters sold in Europe achieved an average annual user mileage of 5.4 billion km per year. According to the baseline scenario of European travel patterns, this can avoid approximately 620,000 tons of CO_2 emissions on an annual basis.

New Energy Vehicle Expansion: In 2021, the Board of Directors of Xiaomi Corporation officially approved the initiation of Xiaomi's smart electric vehicle (EV) business, with an initial investment of 10 billion RMB and an anticipated total investment of 10 billion USD over the next decade. Mr. Lei Jun, CEO of Xiaomi Group, concurrently holds the position of CEO for the smart EV business. Aside from self-research and development, Xiaomi has made strategic investments in core technologies connected to the new energy vehicle industry, covering all essential functional modules. As of October 2023, Xiaomi had invested in over 70 high-quality companies across the value chain of the automotive industry, with a cumulative investment exceeding eight billion RMB and a combined revenue of more than 110 billion RMB.

Envision the future of Xiaomi's ecosystem

In the future, as direct current supply technology matures and becomes more widespread, alongside the continual increase in the proportion of renewable energy generation, there will be a fundamental shift towards a DC-centric power system across various facets of electricity production, transmission, distribution, usage, and auxiliary utilities. At this stage, Xiaomi can leverage its unparalleled ecosystem advantage to revolutionize the power supply systems of its smart home devices into a DC system. This would begin with the concept of setting up an "energy router" at the household's electricity inlet to centrally manage the conversion of grid-side AC to household DC. The energy router will then distribute power to various smart terminals within Xiaomi's ecosystem. This is Xiaomi's solution to enhance the resilience of our ecosystem and to prepare for the forthcoming transformation of direct current delivery systems.
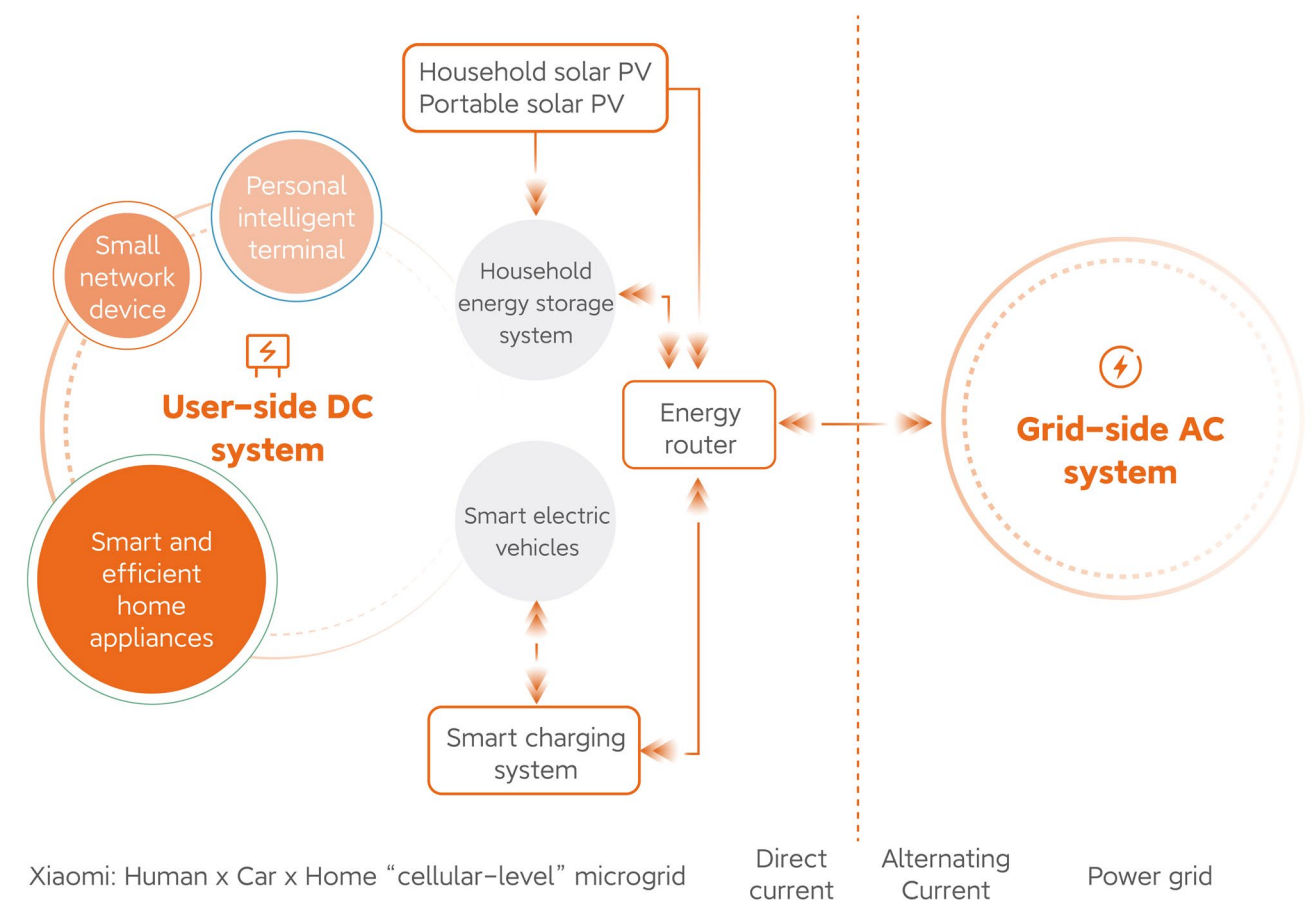

Figure 8. Envisioning the Future: Human x Car x Home "cellular-level" smart microgrid

Three approaches based on industry technology assimilation capability

Smart manufacturing

The emergence of smart manufacturing and digital technology is accelerating more efficient use of resources, waste reductions, and ecological restoration. Digitalization is an important enabler in the initial stages of resource utilization, and continuously taking resource management to a new level. Technologies such as the IoT and AI generate new data-driven insights that **enhance industrial productivity, maximize material and energy efficiency, make green energy and materials more compatible with existing systems,** and reduce resource consumption and waste generation.

As we take strides towards a greener future, smart manufacturing will be pivotal in averting climate change. China's 3C manufacturing accounts for 70% of global capacity, with fast product iterations, diverse categories, and varying batch sizes, all posing higher demands on delivery schedule, reusability, and quick changeover of production lines.

Pain points in the manufacturing sector:

1 ▶ Long equipment stabilization cycle: takes 3-4 weeks from equipment installation, test and commissioning, to stable operation

2 ▶ Long equipment delivery schedule: takes 1-1.5 month to deliver equipment which makes it difficult to scale production

3 ▶ Long recovery downtime: Average recovery downtime is >30 minutes

4 ▶ Downtime for feedstock replenishment: Change or replenishment of feedback requires equipment to cease operation, hence affecting the overall production output

5 ▶ Low equipment reuse rate: <50%

6 ▶ Large space occupancy: Low UPH (units per hour) per unit area

7 ▶ Bottleneck risk: Potential supply risks as certain components come from foreign suppliers

Providing agile and efficient smart solutions for "Made in China"

Being flexible and maximizing resources are essential elements to achieve success in modern business and manufacturing. In response, Xiaomi Smart Factory has deployed a fully automated "Lego-style" production line, effectively tackling some of the industry's most intractable challenges and highlighting the immense potential of this innovative solution.

With our deep understanding of industry trends and the peculiar needs of the sector, Xiaomi has developed a unique "platform + module" architecture. This is an on-demand and adaptable assembly line system that is specifically designed to match the needs of different materials and manufacturing processes, allowing for flexible production and quick assembly line alterations at the user end. The solution offers tremendous flexibility and allows for quick adaptation to the constantly changing market requirements.

In the production stage, Xiaomi establishes a data-based factory by integrating data across "equipment—industrial control—data acquisition and monitoring—operational management—enterprise". This approach enables automated production, enhances production efficiency, and reduces material and energy consumption in product processing.

Improve material utilization and production efficiency

Xiaomi's engineers have reinvented the production line by introducing a new conveyor-line structure with automated material handling and built-in testing compartments. This design is compact, eliminating the hardware clutter, substantially increasing production efficiency, and preventing any potential loss of materials that could happen in a traditional robotic arm setup.

An entirely wireless and parallel testing protocol is employed along the process for the final testing terminals, minimizing hardware requirements while maximizing the testing terminal utilization rate. This design makes the testing process much more efficient and helps bring products to market much faster.

Automated production line and energy reduction

Xiaomi's Smart Factory has achieved fully automated lights-out production through production management, mechanical processing, packaging, storage, and transportation processes. The factory implements an innovative "module + platform" approach across its smart devices, allowing for rapid assembly line alteration based on material and process requirements. This creates a standardized manufacturing platform that could be adopted to accommodate diverse production needs and dynamic market demands. Using this LEGO-like modular approach, over 180 types of process equipment have been installed in the assembly line which led to a reduction in line-alteration costs. The average delivery cycle has been expedited from 1.5 to 0.5 months, and the equipment module reuse rate has increased from 50% to over 80%. In this agile production model, the first-pass yield rate has raisen by over 5% compared to the conventional process, with a production efficiency boost of approximately 60%, while significantly reducing unit equipment processing capacity and energy consumption.

Case study: Xiaomi Smart Factories

As of today, Xiaomi's first self-constructed Smart Factory in Yizhuang has been in operation for nearly four years with multiple industry-leading practices. Its production efficiency has increased by 25% compared to the most advanced factories for outsourcing manufacturing.

Xiaomi's second Smart Factory—Changping Smart Factory—which will officially commence operation at the end of 2023, is also expected to boost annual production capacity upon full operation. It is designed to produce 10 million high-end smartphones annually with an output value of approximately 60 billion RMB, setting a new benchmark for Chinese manufacturing.

In addition to in-house development, Xiaomi has strategically invested in various aspects of the intelligent manufacturing sector, backing over 30 equipment and core component enterprises with a total revenue exceeding 20 billion RMB.

Clean energy adoption

Xiaomi exerts its leadership presence in the industry to support and foster the development of green energy and clean technology, and works to increase the use of green electricity in Xiaomi's ecosystem and supply chain.

Joining Green Electricity 100% Initiative to advance green electricity adoption in the value chain

China "Green Electricity 100%" Initiative

Having a leading responsibility to influence the value chain, Xiaomi answered the call to join the China "Green Electricity 100%" Initiative* in 2023 with the aim to collaborate with value chain partners to increase the use of green electricity and reduce carbon footprints. The action plan includes:

Footnote: The China "Green Electricity 100%" (GE100%) Initiative is co-launched by the Industrial Carbon Efficiency Committee of the China Industrial Energy Conservation and Cleaner Production Association, Tsinghua University Institute of Climate Change and Sustainable Development, and 2060 Zero Carbon Corporation Initiative, with the purpose to accelerate widespread adoption of renewable energy and support China's carbon neutrality goals. This initiative defines three directions for action to encourage the disclosure of renewable electricity usage, promote renewable energy adoption in more end-use scenarios, and enable more companies to achieve 100% use of renewable electricity by 2050.

Green power procurement

Xiaomi will enter into long-term agreements with power supply companies to procure green power and attain the corresponding green power attribute certificates. This measure will cover Xiaomi's self-operated campus, production base, and suppliers' facilities. The procurement volume and unit price will be reviewed annually.

Xiaomi will leverage its influence to coordinate and consolidate green electricity demand across the value chain. Meanwhile, we collaborate with key stakeholders, including the power grid, power supply, and power generation companies, to drive the decarbonization of the power sector, and promote green power procurement and consumption.

Collaboration for empowerment

Case study: Implementing green manufacturing

To advance the low-carbon transition of the manufacturing industry, Xiaomi has been full-fledged in developing its green and advanced manufacturing system. In 2023, Xiaomi's Yizhuang Smart Factory pioneered a carbon-neutral pilot project. This process involved a comprehensive review of the factory's energy management measures, exploring the use of renewable energy sources, and purchasing carbon credits derived from wind power, which are fully compliant with the I-REC standard, to offset remaining carbon emissions. As a result of these efforts, Xiaomi Yizhuang Smart Factory has successfully become carbon-neutral, laying a robust foundation for setting up future Xiaomi Lighthouse Factories and green factories, and driving decarbonization across the supply chain.

Invest and innovate in clean technologies

Xiaomi has been keen to invest in and support businesses from all corners of the energy storage industry, including new energy battery manufacturers, battery material producers, portable energy storage solution providers, battery thermal management technology companies, as well as new players in the EV charging and equipment sector. Having collaborated with partners including Linecore, Inventchip, and SVOLT Energy, Xiaomi has driven sustainable technologies and green intelligent innovation products to come into being in many areas. As of 2023, Xiaomi has backed and incubated 157 clean technology and green manufacturing start-ups, with 30 of them yielding over 10 billion RMB annually. Through joint innovation and investment, Xiaomi and its partners are continuously speeding up the growth of businesses committed to sustainability.

Exploring the Energy Internet and Smart Infrastructure

Drawing on our profound knowledge of smart hardware manufacturing and Zero-carbon Philosophy, Xiaomi has a unique vantage point to provide demand-side energy management solutions for the Energy Internet. This solution extends beyond the spectrum of energy data generation, transmission, and application, encompassing a wide range of consumer electronic devices (such as smartphones and wearables), smart homes, smart electric vehicles, and smart robots. In 2023, Xiaomi initiated the "Xiaomi Grand Electrification Feasibility Study Project," which consolidated its foundational capabilities and outlined a strategic plan for the development of digital intelligent infrastructure in the following areas:

Generation of electrical data

Equip all Xiaomi's AIoT-connected hardware and devices with sampling sensor modules to establish the basis for digitizing energy attributes such as voltage, current, power efficiency, and operational status.

Transmission of electrical data

Integrate communication modules into all hardware products to lay the foundation for intelligent functionalities, enabling data upload or download from central servers and digital information exchange between devices.

Application of electrical data

Establish an intelligent central hub—the energy edition of "Xiaomi's AI Assistant"—to oversee the intricate dynamics of energy flow and handle the extensive energy data, facilitating a "smart" approach to managing energy production, distribution, storage, and utilization.

Innovative materials

Xiaomi always keeps abreast of the decarbonization potential of key raw materials used in products. During the product design phase, the lifecycle environmental impacts of components are thoroughly evaluated. Minimalist design configurations and mono-material packaging are prioritized to enhance product recyclability. Xiaomi is expanding its product take-back and recycling capabilities through in-house initiatives and collaborations. In partnership with stakeholders, Xiaomi seeks to pioneer regenerative, bio-based, high-performance green materials, as well as carbon-neutral materials to increase the share of sustainable materials used in products.

Continuous exploration of sustainable materials to enhance product efficacy

To advance a circular economy, Xiaomi prioritizes the use of sustainable materials right from the product design phase. A key focus is exploring opportunities to substitute component materials with bio-based or recycled alternatives to enhance overall product recyclability. For instance, bio-based polymer materials are used in specific components and accessories of smartphones to achieve a bio-carbon content of over 30%. Xiaomi also beefs up the use of recycled metals in smartphones, including aluminum, gold, and copper. Each of our smartphone products includes components made from recycled ocean fishing nets with a recycled content exceeding 70%. Even the leather materials used in smartphones are derived from apple fibers, with a bio-based content of 26%, serving as a sustainable alternative to petroleum-based polyurethane leather.

Continuously strengthening hazardous substances management

Xiaomi strictly complies with national, international, and other local laws, regulations, and standards governing the restricted use of hazardous substances and chemicals in products and their packaging, including but not limited to the Directive on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS), the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH), and the Directive on Packaging and Packaging Waste (94/62/EC). Based on the requirements of various standards and supplier feedback, Xiaomi continuously updates its protocols for managing hazardous substances. Regarding product characteristics, Xiaomi has established a more stringent hazardous substance restriction standard and demands strict compliance from suppliers. For instance, in the TV business line, Xiaomi conducts both regular (at least once a month) and ad-hoc inspections on suppliers' use of hazardous substances and requires them to submit self-inspection reports.

Building refurbishment factory to advance material recycling and reuse

As one of the core initiatives in our circular economy agenda, Xiaomi is committed to advancing the recycling and reuse of electronic products. Globally, Xiaomi has rolled out product take-back programs and worked to improve the ease of taking back electronic products through collaborations and self-established initiatives. The adoption of efficient sorting methods facilitates categorized recycling, steering away from a linear model of take-make-waste toward a circular regeneration approach.

On a global scale, Xiaomi directed approximately 4,500 tons of electronic waste, including smartphones, toward recycling. In 2022, Xiaomi's refurbishment factory successfully revitalized around 94,000 smartphones, 5,600 electric scooters, and 6,200 smart TVs. All refurbished products received official certification and were resold in the market.

An approach based on digital agile operational capabilities

Digital and intelligent operation

Digital efficiency has gradually become a key differentiating factor in helping corporations and nations stay ahead of the competition. Digital and intelligent operation improves not only operational efficiency, but also brings significant economic and environmental benefits. For the past decade, Xiaomi has been devoted to providing the manufacturing industry with cutting-edge solutions that enable a fully digitalized management system across the entire value chain. Through precision tracking of production processes, and effective operation of energy flow and material distribution, Xiaomi is able to save costs, reduce emissions, and unleash more productivity in its own operations.

Building a fully digitalized system to manage product lifecycle operation

Xiaomi has developed a range of advanced digital tools, including the AIoT platform, retail management platform, and smart manufacturing and supply chain management platform. These technologies enable Xiaomi to create a data loop across the "supply chain and manufacturing—distribution—product—user" cycle. Utilizing big data and artificial intelligence algorithms to build a central control platform, Xiaomi drives self-evolution and applies intelligence in coordinating and predicting user value in multiple scenarios. This results in an intelligent operation system that seamlessly integrates every step of the company's operation throughout the entire product lifecycle, enhancing the overall efficiency of the industry. Such a model brings huge advantages and helps Xiaomi stay ahead of the market competition and spearhead the growth of the whole industry.

In the application of digital intelligent operations in the supply chain, Xiaomi values close collaboration with our ecosystem partners, including suppliers, manufacturers, logistics companies, and more. Together, we develop a digitalized management system to facilitate information sharing and synchronized operations, optimizing the efficiency of the entire value chain. This collaborative model not only reduces costs and increases efficiency but also sparks innovation and contributes to sustainable development. Thanks to digital efficiency, Xiaomi is seeing higher productivity and positive environmental benefits that support sustainable development.

In the retail end, Xiaomi's new retail model has changed the game of the industry through our complete digitalization of the entire process and all underlying elements, encompassing people, goods, stores, rewards, promotions, and training. We have implemented the ROI models, traffic models, and user management models to establish an end-to-end digitalized closed loop, empowering us to make data-driven decisions and grow the business. Our new retail model employs a unified set of pricing, models, and systems capable of addressing diverse levels, industry trends, and market demands. This approach successfully integrates digital infrastructure into sustainable development innovation solutions (Ecomagination).

Extreme efficiency empowering climate actions

Xiaomi's new retail digital operation system will play a more central role in climate adaptation and clean technology innovation.

Digitalization and Data Analysis: We leverage advanced data analytics to optimize resource allocation, reduce energy consumption, and minimize waste generation. In the future, we will further strengthen data-based resource efficiency models, including climate-related indicators and analysis, to guide sustainable decision-making and operations.

Supply chain climate adaptation: By utilizing AI-based stock allocation models, we can predict and mitigate the impact of climate-induced disruptions on our supply chain while meeting consumer demands. This includes optimizing logistics operations to reduce carbon emissions and adopting climate-resilient practices among our supplier network.

Product lifecycle management: Through end-to-end digitalization, we take a "cradle-to-cradle" approach to managing product lifecycle, reducing waste and minimizing the demand for new and virgin resources.

Guiding consumers toward making sustainable choices: By providing precise digital flow data about products, we offer information on environmental footprints and incentives for consumers to foster sustainable consumption choices and behavior, and create a more enjoyable customer experience.

Intelligent Inventory Management: Leveraging AI and big data analysis for smart inventory management ensures efficient stock levels to meet consumer demands, while minimizing excess inventory and emissions related to storage and waste generation.

Xiaomi's New Retail: boosting retail efficiency

Xiaomi's New Retail Model* stands out as a pivotal element in driving the efficiency revolution of the manufacturing industry and addressing genuine user needs. By capitalizing on the massive attention and internet traffic flow generated by Xiaomi's hot-selling products, we strategize a two-pronged approach to reach consumers—both online through Mi.com and offline at our Mi Home stores—to align our ethos of "delivering products and services to users" with Xiaomi's efficiency model. Users benefit from the best prices without bearing any channel costs, while Xiaomi achieves high product turnover efficiency by saving on channel construction and operational expenses.

Warehouse and logistics efficiency

The digitalized new retail system will seamlessly blend online and offline sales and marketing, shortening the logistics distance from factories to users to improve circulation efficiency and lower the logistics carbon footprint. Xiaomi takes it a step further by enhancing the full-loaded rate of logistic vehicles and optimizing route planning through intelligent logistics systems, increasing the number of customer orders distributed in each delivery to reduce emissions per unit of goods. Other specific measures include optimizing product warehousing planning, reducing product distribution turnover, and increasing direct delivery, thus improving delivery efficiency and ensuring the quality of delivery services.

Eight direct distribution routes were added from our warehouse to retail stores to minimize interchange and reduce CO_2 emissions.

A smart logistics management system was deployed to monitor real-time truckload rates and make instant optimization, maintaining a 75% load rate or above in distributing small and medium-sized products.

The logistics fleet for washing machine products now has larger-capacity and more cost-effective vehicles, which can reduce fuel consumption by 50% for the same product volume. The logistics process has shifted from single orders to full-truck shipments, making it possible to directly load products from the production line to warehouses across the country. This process minimizes loading and unloading times, and streamlines the process by more than double.

Carriers are encouraged to use new energy vehicles, and they receive support from Xiaomi to explore the substitution plan for conventional vehicles. From our research, the proportion of new energy vehicle fleets deployed by carriers in mainland China reached 8% in 2022.

Note: "New Retail" in this White Paper refers to Xiaomi's New Retail operational model in China.

Xiaomi's resource efficiency model enhances product circulation efficiency

Xiaomi is dedicated to making sure all of our products delivered to users are created responsibly and with the environment in mind. By integrating our online and offline sales, offering a more diverse product range in stores, and taking advantage of an efficiency model, we strive to increase product turnover and reduce the carbon footprint of the sales process.

Retail Connect

To keep up with the demand for opening stores, Xiaomi systematically disentangles and analyzes underlying data to create analytics modules and information management tools that can be used at every step of the process from products to locations and sales channels. This digitized system allows Xiaomi to connect finance, R&D, production, warehouse logistics, and user management to achieve end-to-end user lifecycle operations.

Scan and purchase

Mi Home stores will have a lower stocking level for certain bulky items or those with a low repurchase rate. If customers are interested in such displayed items, they can make a purchase by scanning the product's QR code, and the delivery will be instantly arranged. Customers can then choose between one-hour home delivery or regular shipment. Once prepayment is received, Xiaomi takes care of the shipment, logistics, and related tasks.

AI allocation model

By shifting from a supply system based on experience to one driven by AI that takes user demand into account, Xiaomi has been able to gather insights on consumer behavior and improve the ability to select products, allocate resources intelligently, and replenish supplies conveniently. This has allowed us to significantly enhance capital and resource utilization efficiency, boosting inventory turnover from 50% to 80%.

Digitalized collaboration to enhance material efficiency

Xiaomi has forged digital collaborations with over 2,000 suppliers by leveraging a digital supply chain management platform. This effort has reduced the overall material delivery cycle from placing orders to the destination to just five business days, with an inventory turnover cycle of 14 days. Concurrently, Xiaomi has established three bonded consolidation warehouses and five central warehouses globally. Comprehensive coordination is also applied in supply chain planning, including activities such as material preparation and formulation, end-to-end visibility, early warning, and control of the delivery process with suppliers.

Stride toward 1.5°C

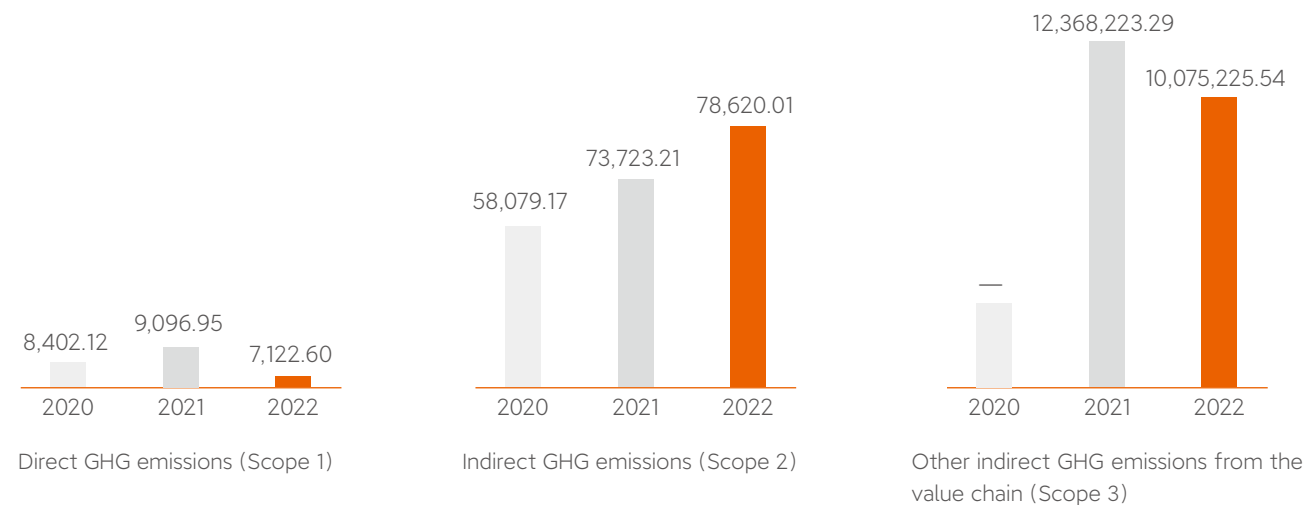Xiaomi's Climate Goals and
Zero-carbon Aspiration

Greenhouse gas emissions measurement

Xiaomi's greenhouse gas emissions

The journey to achieving long-term greenhouse gas (GHG) emission reduction targets begins with accurate data collection, assessment, and tracking of Scope 1, 2, and 3 GHG emissions. Xiaomi's GHG data standard and accounting models are established in accordance with international protocols, including the Greenhouse Gas Protocol: Corporate Accounting and Reporting Standard, ISO 14064-1:2018—Specification with Guidance at the Organization Level for Quantification and Reporting of Greenhouse Gas Emissions and Removals, as well as other applicable national, local, and industry standards.

The GHG emissions from our operations for the past three years* are listed below:

Scope (MT tCO$_2$e)

8,402.12 / 9,096.95 / 7,122.60	58,079.17 / 73,723.21 / 78,620.01	12,368,223.29 / 10,075,225.54
2020 2021 2022	2020 2021 2022	2020 2021 2022
Direct GHG emissions (Scope 1)	Indirect GHG emissions (Scope 2)	Other indirect GHG emissions from the value chain (Scope 3)

*Remark: Xiaomi's GHG emissions mainly include carbon dioxide (CO$_2$), methane (CH$_4$), nitrous oxide (N$_2$O), and hydrofluorocarbons (HFCs). The total GHG emission is reported in terms of carbon dioxide equivalent. We calculated the GHG emissions from facilities and operations owned by Xiaomi, as well as those from the upstream and downstream of Xiaomi's value chain. Details of our GHG emission scope include:
1. Direct GHG emissions (Scope 1): GHG emissions directly generated from the use of natural gas and gasoline for operations and fugitive emissions from refrigeration, fire suppression equipment, and fugitive emissions of GHG from the wastewater treatment process.
2. Indirect GHG emissions (Scope 2): GHG emissions generated from consumed electricity and consumed heat for operations.
3. Other indirect GHG emissions (Scope 3) from the value chain: All of Xiaomi's products are sold directly to customers without further downstream processing activities. We take the operational control approach to consolidate our GHG emission data, therefore, our GHG emissions from the value chain include those from the purchased goods and services, capital goods, fuel, and energy-related activities (which are not included in Scope and Scope 2), upstream transportation and distribution, waste generated in operations, business travel, employee commuting, upstream leased assets, downstream transportation and distribution, processing of sold products, use of sold products, end-of-life treatment of sold products, downstream leased assets and franchises.

Product carbon footprints

Xiaomi has initiated and completed product lifecycle carbon footprint assessments for five representative products (including two models of smartphone products, one model of wearable product, and two models of air-conditioner products). In collaboration with an independent organization specializing in carbon accounting and certification, we developed a smartphone-oriented carbon footprint assessment framework and methodology with reference to the PAS 2050 Standard for quantifying product carbon footprints. In the next phase, we will extend this approach to assess and manage the product carbon footprint across a broader spectrum of our products, encompassing more smartphone models, air-conditioners, smart TVs, and other Xiaomi ecosystem products.

The lifecycle carbon footprints of Xiaomi's smartphone products:

Xiaomi 13 Pro (International version, 12GB+256G) Lifecycle carbon footprint: 62.8kg

Xiaomi 13 Pro (International version, 12GB+512G) Lifecycle carbon footprint: 65.68kg

Redmi note 12 pro 5G (6GB+128GB) Lifecycle carbon footprint: 42.82KG

Redmi note 12 pro 5G (8GB+128GB) Lifecycle carbon footprint: 45.93KG

Redmi note 12 pro 5G (6GB+256GB) Lifecycle carbon footprint: 50.94KG

Includes the carbon emissions from raw materials, production, storage, transportation, usage, and end-of-life disposal.

CAPTURE THE MOMENT

xiaomi 14

Our climate pledge and zero-carbon aspirations

Xiaomi Group officially announced its carbon-neutral commitment on August 28, 2023.

Xiaomi Group commits to achieving carbon neutrality in its own operations by 2040

Climate change is the defining challenge of our time. Faced with the intensifying climate crisis, it is imperative to take immediate and deep emissions reduction cuts to achieve sustainable development. To uphold our mission of letting everyone in the world enjoy a better life through innovative technology, Xiaomi Group has committed to achieving carbon neutrality and using 100% renewable energy in its own operations of existing businesses* by 2040.

Xiaomi Group remains steadfast in taking a "technology-centric" approach to foster low-carbon development and create a better future for all. Starting with its own operation, Xiaomi prioritizes initiatives such as energy efficiency improvement, clean energy adoption, and smart manufacturing to deliver its commitment to carbon neutrality. To support the Paris Agreement targets and limit global temperature rise to 1.5℃ , Xiaomi is in the process of formulating its Science-based targets, and concurrently exploring solutions and best practices to cut value chain carbon emissions. In driving the entire industry and ecosystem toward a green and high-quality transformation, Xiaomi encourages its key suppliers to set up GHG emission reduction and renewable energy adoption targets that match or even surpass Xiaomi's own commitment.

In the future, Xiaom Group will be resolute in upholding corporate social responsibility, tackling climate change, and refining the scope of carbon neutrality goals with the latest science as business expands. Xiaomi adheres to the principles of "prompt action, practicability, steady progress, and continuous improvement" to lead the low-carbon transformation of the industry, bringing customers and consumers green, intelligent, and sustainable products and services, and shaping a low-carbon future together.

*Note: Existing businesses refer to the business scopes stated in Xiaomi Group's latest Annual Report, including Smartphones, IoT and Lifestyle products, Internet Services, and others.
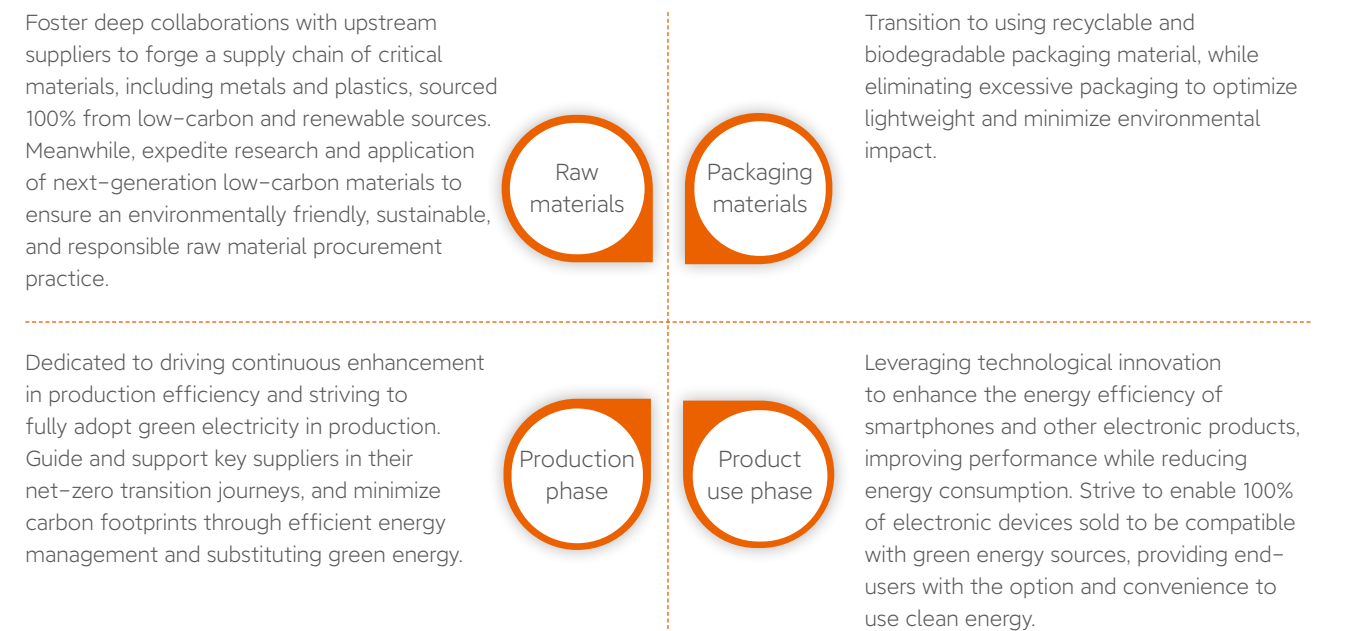
Adhering to global net-zero pathway* to reduce carbon footprint

We have established a net-zero pathway In accordance with the ISO Net Zero Guidelines [IWA 42:2022]. Our key pathways include the widespread application of energy-efficient technologies, electrification, and smart management systems to maximize carbon reduction in operations and throughout product lifecycles. Additionally, we are engaging in long-term power purchase agreements to facilitate the green transition of our energy structure.

To ensure concrete progress in reducing GHG emissions across our value chain, we are fostering collaboration with our key suppliers and encouraging them to establish ambitious climate targets that align with or even exceed our carbon neutrality pledge. This involves transitioning to renewable energy sources, enhancing material utilization, expanding recycling and reuse rates, and adopting sustainable product design and packaging practices.

Xiaomi pledges transparency, accountability, and regular audits and disclosures to ensure our decarbonization progress remains in line with the 1.5℃ scenario. Through these measures, we are confident in our ability to address and adapt to climate change, contribute to global sustainability goals, and take responsibility for the future of our users, stakeholders, and the planet.

With our 2040 climate goals in mind and our insights into the future trends of the manufacturing sector, we foresee a stepwise progression toward a carbon-neutral value chain covering raw materials, packaging, production, and usage. We will steer our focus toward the following key areas:

Foster deep collaborations with upstream suppliers to forge a supply chain of critical materials, including metals and plastics, sourced 100% from low-carbon and renewable sources. Meanwhile, expedite research and application of next-generation low-carbon materials to ensure an environmentally friendly, sustainable, and responsible raw material procurement practice.

Raw materials

Transition to using recyclable and biodegradable packaging material, while eliminating excessive packaging to optimize lightweight and minimize environmental impact.

Packaging materials

Dedicated to driving continuous enhancement in production efficiency and striving to fully adopt green electricity in production. Guide and support key suppliers in their net-zero transition journeys, and minimize carbon footprints through efficient energy management and substituting green energy.

Production phase

Leveraging technological innovation to enhance the energy efficiency of smartphones and other electronic products, improving performance while reducing energy consumption. Strive to enable 100% of electronic devices sold to be compatible with green energy sources, providing end-users with the option and convenience to use clean energy.

Product use phase

The definition of Net Zero is based on the ISO Net Zero Guidelines [IWA 42:2022].

Green Impacts

Providing Solutions for Industries and Users

From empowerment to permeation

In the global wave of zero-carbon transition, industries are set for a comprehensive overhaul, from organizational structure, energy, material use, and production processes right down to how materials are recycled or reprocessed. These changes hinge on a substantial improvement in production efficiency and the promotion of green benefits as a source of added product value. It will fundamentally alter manufacturing patterns, broaden product efficacy, and pave the way for a green industrial upgrade in the years to come.

The core mission of technology companies is to develop green productivity and create concrete and actionable solutions

To limit global warming to 1.5℃, we have all the technologies today needed to deliver emissions reductions before 2030 on the path to net zero. However, half of the carbon reductions required to reach the 2050 net-zero goal will rely on new technologies that are still in the prototype or pilot stages. The transformative zero-carbon technologies needed to steer the decarbonization progress of the energy, industrial, building, and transportation sectors require increased investment from public funds and research institutions for growth and maturation. In this journey, Xiaomi is dedicated to expediting the decarbonization process through our research and technolotical innovation in areas such as home energy efficiency, smart manufacturing, and intelligent transportation.

> **Green productivity**
>
> The type of productivity encompassing "new energy, new materials, new intelligence, new processes" with a lower carbon footprint and more vital sustainability nature that can enhance economic and environmental efficiencies and generate more green efficacy.

Accelerating the construction of new power systems

In the energy sector, the widespread application of digital technology has the potential to reduce production costs by 10 to 20%. Through our line of smart home products powered by Xiaomi HyperOS, including smart home displays, smart multi-mode gateway, and smart switches, Xiaomi accelerates the digital transformation of energy infrastructure in homes and offices. This enables demand-side resources to respond faster and stabilize the power system balance. Advances in digital technologies such as machine learning and intelligent power distribution contribute to integrating a higher percentage of variable renewable energy sources and better matching the increasingly diverse dynamics of decentralized energy. In end-use applications, digital technology enhances the efficiency of buildings and transportation and promotes a shift toward sustainable lifestyles and low-carbon behaviors.

Enabling the development of a green and circular manufacturing system

Under the IEA's net-zero emission (NZE) scenario, by 2030, emissions from the manufacturing industry need to be reduced by 30%, and by a wowing 95% by 2050. The key to this transformation sits in electrification, intelligent automation, and efficiency optimization within the general manufacturing sector. Circularity and regeneration are also important levers alongside new energy and efficiency technologies. On a global scale, 54% of plastic needs to be recycled by 2050, and both metallic and non-metallic inorganic materials, as well as organic polymers, will need to undergo a zero-carbon transition. A notable technology is the bio-leaching technique, where microorganisms are used to recover valuable metals such as lithium, cobalt, and copper from retired new energy devices, making better and more efficient use of power batteries and solar PV devices. Furthermore, we are working to coordinate and guide key stakeholders participating along the product development cycle to encourage sustainable design for improved reusability and recyclability. We strive to transform pledges into progress through ongoing initiatives and innovations, fostering the transition to a circular economy, and the resilient growth of a green and circular manufacturing system.

Developing smart and efficient zero-carbon building technologies

In a NZE scenario, the share of electricity consumption by public and residential buildings is expected to steadily increase from 33% in 2020 to nearly 50% by 2030 and 66% by 2050. Among these, the proportion of electric energy used for heating and hot water is expected to double from 20% to 40%, while the number of heat pumps installed is anticipated to witness a remarkable tenfold increase from 180 million units in 2020 to 1.8 billion units by 2050. Solar power generated by buildings through distributed systems will surge from 320 TWh in 2020 to 7,500 TWh in 2050. From 2030 onward, all newly constructed buildings are expected to meet the criteria for being "zero-carbon ready", and the goal is for over 85% of buildings to achieve this readiness. These buildings will incorporate various renewable energy technologies, including photovoltaics, solar thermal, and geothermal, with energy storage capacity, and capabilities to interact with the power grid and actively manage their energy consumption. Xiaomi has made significant contributions to promoting building energy efficiency. Its smart home products, such as Mi speakers, wireless switches, and Mi Home solar panels, are designed to regulate the temperature and lighting inside buildings effectively. These products help reduce energy consumption while providing a more comfortable living and working environment, showcasing our intelligent solutions that balance energy efficiency and comfort.

Promoting travel with EV and infrastructure development

Electrification is central to the decarbonization of the transportation sector under a NZE scenario. Many countries have already committed to achieving related goals between 2035 and 2040, with policymakers in some economies setting definitive dates to phase out the sale of gasoline and diesel vehicles. During the 26th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP26), over 100 stakeholders endorsed a declaration to accelerate the transition to 100% zero-emission cars and trucks by 2035-2040. Meanwhile, battery cost has seen a remarkable 90% decline in the past decade, and the sales of electric passenger cars have grown by an average of 40% over the last five years. Triggered by policy interventions and the recent surge in gasoline and diesel prices, global electric vehicle sales soared by around 60% in 2022, surpassing the milestone of 10 million units for the first time. According to the IEA, one in every seven cars purchased globally in 2022 was an electric vehicle. Forecasts indicate that the global count of public EV charging stations will reach 40 million by 2030 and 200 million by 2050. All these developments present opportunities for energy storage to offer greater flexibility through ancillary services or price arbitrage. Using EV battery capacity as a storage solution is increasingly viable for enhancing flexibility in the energy sector. Moreover, Xiaomi is preparing to launch its self-developed electric vehicle, actively participating in the decarbonization of the transportation sector.
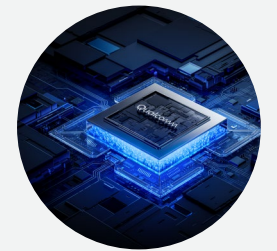
From leading to rippling

Throughout our 13-year growth journey, Xiaomi has demonstrated both its dedication to sustainable development and the vast potential of technological innovations. With climate change imposing an ever-growing threat to future business models, Xiaomi has made significant strides in advancing a cleaner and more resource-efficient smart manufacturing technology through continual investment in research and development. Indeed, this is a reflection and revolution to the conventional manufacturing model.

Xiaomi's technological innovation ecosystem exhibits three levels of evolution in promoting sustainable development

Integrated technological innovation

This involves integrating the distinctive strengths of existing technologies to nurture the birth of new products, catalyzing a transformation in the manufacturing process. This integration goes beyond technological combinations and represents a relentless exploration of optimizing efficiency in both production and consumption methods.

Autonomous technological innovation

Building upon the foundation of proprietary core technologies, Xiaomi constantly works to create new products with greater value. This stands as a testament to our commitment to technological innovation and our dedication to exploring future possibilities of green and smart manufacturing.

Future-proofing disruptive technological innovation

To make disruptive changes means thoroughly reconsidering and overhauling how we design and produce products and services for a sustainable future. This demands technological advancement and deep contemplation, reflection, and courage to embrace a future sustainable production model. Every step of innovation taken by Xiaomi goes beyond business growth; we aspire to build a more sustainable and low-carbon future.

From a broader perspective, Xiaomi's progress in smart manufacturing and digitalization is not simply about production efficiency enhancement; it presents an ongoing re-evaluation of the future needs of the manufacturing industry. In the creation of smartphones, Xiaomi made structural and digitalization improvements in 221 processes, contributing to establishing a future smart manufacturing model supported by three pillars—advanced process, high-end devices, and data intelligence system. Amid the pressing need to address and adapt to climate change, Xiaomi's innovative practices demonstrate how to take into consideration environmental impact while pursuing efficiency and flexibility. This marks a significant paradigm shift from traditional industrial revolution thinking. As of 2022 year-end, Xiaomi's research and development investment reached 16.2 billion RMB, accounting for 0.53% of the national R&D investment—underscoring our belief in smart manufacturing and low-carbon technologies, and our confidence to invest in the future of this field.

From Xiaomi's ecosystem to a future ecosystem that is greener and more phenomenal

The business model of industrial investment may not be novel, but the unique emphasis on the "efficiency revolution" is what differentiates Xiaomi's approach. We have created a synergistic business model by bringing together investment expertise with industry know-how. As our presence gains traction, industrial investments have quickened beyond expectation. Xiaomi's Yangtze River Industry Fund has reached 12 billion RMB and is dedicated to supporting China's manufacturing industry, 5G, integrated circuits, and the AIoT sector. This fund has invested in over 100 companies, some of which have gone public on the Science and Technology Innovation Board.

When making industrial investments, Xiaomi prioritizes long-term returns and industry growth over short-term gains. The emphasis is more on "Industry" than "Investment". Through these investments, Xiaomi deepens partnerships, builds trust, advances progress in the industry, and gains access to vast technological and supply resources. This approach aligns with the overarching goals of the manufacturing revolution, contributing to improved industry efficiency and sustainable growth. It also supports broader objectives such as the Global Sustainable Development Goals and the Paris Agreement target of limiting temperature rise to 1.5° C.

From adaptation to transformation

Household consumption behavior stands out as a significant source of global greenhouse gas emissions. A report from the United Nations Environment Programme (UNEP) in 2020 highlighted that emissions from household consumption account for two-thirds of the world's total emissions. Forecasts from the IEA also suggest that changes in consumer behavior can lead to a 12% reduction in emissions under a NZE pathway toward 2050, a result comparable to the impact achievable through improvements in energy efficiency. Looking ahead, enhancements in energy efficiency and shifts in consumer behavior will be necessary means to deliver emission reductions in two distinct timeframes: i) 2022 to 2030 and ii) 2031 to 2050. Energy efficiency improvements are expected to reduce CO_2 emissions by 2.3 Gt and 2.2 Gt during the respective periods, while behavior changes are projected to cut CO_2 emissions by 2.2 Gt and 2.6 Gt, respectively.

Network devices and home appliances within a household setting

In 2021, the global electricity consumption of small network devices totaled a staggering 1,200 TWh. If these devices had operated at the optimal energy efficiency level of 2018, a total of 180 TWh of electricity could have been saved. These savings could be further elevated to a range between 240 and 600 TWh by incorporating more energy-efficient power supply technologies. As for home appliances, to stay on track with the NZE Scenario, most appliances launched to the market and sold in 2035 would need to match the efficiency levels of today's best available models. Failure to do so could veer global energy consumption in 2030 off course from the net-zero transition pathway. In particular, there is a pressing need to update the energy efficiency standards of air conditioning and refrigeration, so that products with the highest efficiency can comprise a larger market share.

Behavior change

The net-zero pathway implies that users will increasingly opt for new energy products over conventional ones with higher energy usage. By 2030, air conditioners and refrigerators would need to achieve deep cuts in their unit electricity consumption by 70% and 60%, respectively. As a driver for digitalization, the Information, communication and technology (ICT) technology is emerging as a potent solution, leveraging its intelligent and efficient infrastructure and services to address energy consumption challenges at the user end. It provides companies and individuals with the necessary tools for transitioning to a low-carbon lifestyle. This shift replaces carbon-intensive lifestyles that rely on traditional equipment and offers systemic low-carbon alternatives.

Construction of green and intelligent infrastructure

We can transition to a low-carbon future by enhancing energy efficiency or substituting traditional technologies, all without altering our fundamental consumption activities. Whether it is opting for energy-efficient appliances, adopting household renewable energy, upgrading to a more energy-efficient vehicle, or making the switch from conventional fossil-based cars to EVs, each sustainable choice we make across our home, travel, and other scenarios contributes to the shift toward a low-carbon economy.

The Artificial Intelligence of Things (AIoT) is a crucial factor in reshaping user behavior and is key to enabling a zero-carbon lifestyle by connecting smart homes and intelligent mobility solutions to users. The AIoT platform, paired with sensors and algorithms that support a low-carbon lifestyle, empowers users to track real-time energy usage and receive personalized suggestions on how to reduce their carbon footprint. This allows them to manage energy more efficiently, conserve resources, and make a sustainable lifestyle within reach.

Through our endeavor to develop and promote the application of AIoT low-carbon algorithms, Xiaomi has been exemplary by offering users low-carbon and energy-efficiency solutions that help reduce their carbon footprint while also saving costs. As AIoT technology continues to advance, consumers will find it increasingly convenient to embrace and sustain a low-carbon lifestyle, which is paramount to achieving the global net-zero emission targets.

Solution 1: Realizing sense-free energy-saving through AIoT low-carbon algorithms

Xiaomi's Internet of Things (IoT) is currently one of the most comprehensive connected ecosystems on the market. By leveraging sensors, IoT devices, and AI algorithms, smart homes are able to gather data on users' lifestyle patterns and preferences, which can then generate personalized energy-saving recommendations. Beyond enhancing comfort and convenience, it enables users to make informed choices regarding energy management and device upgrades tailored to their specific needs, while helping them save on energy costs.

For small network devices such as the Xiaomi router, its power adjustment feature offers users three different power signal transmission modes: wall penetration, standard, and energy-saving modes. This feature optimizes energy usage by adjusting the power level based on network performance requirements or coverage range. In doing so, it helps reduce the carbon footprint of home network routers and other network devices, which are typically not very energy efficient.

When large appliances, such as air conditioners and washing machines, are connected to Xiaomi's AIoT systems, they are bestowed with intelligent sensing abilities to optimize device performance, reducing unnecessary operating time and hence energy consumption. For instance, Xiaomi's AI algorithms optimize the wake-up process of smart speakers, resulting in a significant reduction of 37% in process energy consumption. And by running air conditioners in AIoT energy-saving mode, approximately eight million tons of CO2 can be reduced annually from household air conditioners' energy consumption.

Xiaomi smart home interconnected scenario

» **Lighting control:** Based on light sensors or preset schedules, smart home systems can automatically adjust the brightness and on-off status of lights to prevent unnecessary lighting.

» **Temperature regulation:** Intelligent temperature control systems can automatically adjust indoor temperatures to the habits of household members and real-time temperature changes, avoiding excessive heating or cooling and thus conserving energy.

» **Energy monitoring:** Smart home systems offer the capability to monitor household electricity consumption, providing real-time data and analytical reports to assist users in understanding and optimizing their energy usage.

» **Appliance management:** Smart plugs and appliance controllers enable remote control and scheduled operation of appliances to prevent prolonged standby or being inadvertently switched on, to reduce standby power consumption.

» **Smart curtains and sunshade systems:** Responsive to indoor temperature and sunlight intensity, smart curtains and sunshade systems can automatically regulate the opening and closing of curtains and sunshades, effective controlling indoor temperature.

» **Appliance compatibility:** When users connect a third-party branded air conditioner to the Mi Home Air Conditioner Companion, they can enjoy various smart interactive features in the Mi Home app. These features include real-time data on energy usage, remote control, voice control, temperature adjustment in sleep mode, and automatic switch-off when a user leaves home.

Case study: The laundry scenario

- Smart scheduling: Allows users to schedule laundry during non-peak hours through the Mi Home app. This avoids using electricity during peak hours and saves energy costs while reducing power consumption due to prolonged activation of the display panel.

- Smart washing: Enables water volume adjustment based on the laundry load. This prevents excessive water usage during small batch washing, enhancing water efficiency and saving approximately 33% of water during the primary wash cycle.

- Smart drying: The intelligent algorithm detects when the clothes are dry and immediately stops the drying process, preventing over-drying and unnecessary energy consumption.

Solution 2: Interlinking devices and scenarios to enable smart energy-saving

Xiaomi is forging a globally leading AIoT platform and an open ecosystem that integrates the Xiaomi Zero-carbon approach. Through Xiaomi's smart ecosystem, we offer users sustainable solutions for home, travel, and office scenarios. In home settings, for instance, our IoT technology enables connectivity and digitalization within the user demand-supply system, while an optimal system performance is enabled and maintained by AI algorithms. This synergy brings more stability to the system and enhances energy efficiency.

In 2017, Xiaomi marked a significant milestone with the official release of its proprietary Vela OS, setting the stage for the gradual consolidation of its IoT device ecosystem. Xiaomi then began the parallel development of the fully self-developed universal system, Mina OS. Fast forward to 2021, Xiaomi initiated the development of Car OS. By early 2022, Xiaomi consolidated the software architecture of MIUI, Vela, Mina, and CarOS, completing the integration of Xiaomi's operating system foundation. Following meticulous refinement by a dedicated team of over 5,000 developers, the Xiaomi HyperOS was born, with the capacity to integrate over 200 product categories and connect to 820 million devices. The global debut of Xiaomi's "Human x Car x Home" smart ecosystem followed suit. With the announcement of this strategy shift, Xiaomi's 2023 IoT Ecosystem Partner Conference went on to disclose our Open-source Sharing Program with our IoT ecosystem partners. Through the open-sourcing of Xiaomi Vela, the launch of Xiaomi HyperOS Cross-end Intelligent Connectivity technology, and other initiatives, Xiaomi aims to empower smart ecosystem partners, practitioners in the home industry, and individual developers to integrate seamlessly into the Xiaomi IoT ecosystem.

Xiaomi's low-threshold IoT platform offers end-to-end smart solutions featuring the four "most":

Lowest threshold	Most comprehensive Modes	Highest efficiency	Most competitive
Xiaomi's IoT platform provides the most flexible development toolkit, along with standardized solutions for over 40 categories, significantly minimizing the entry barriers for smart integration.	In terms of collaboration models, Xiaomi's IoT platform offers diverse choices ranging from autonomous integration to service provider models.	With the experience of having integrated over 6,000 products, Xiaomi's IoT platform stands as the industry's most efficient integration platform with the shortest cycles for integration and certification.	Xiaomi's IoT modules have accumulated a shipment of 230 million, leading the industry in performance and price competitiveness.

As an example, in public amenities, Xiaomi has partnered with a high school in Beijing on an integrated smart management initiative. This project involves integrating multiple smart devices such as smart desk lamps, water purifiers, smart TVs, refrigerators, and others into a centralized system for efficient resource allocation and optimized energy consumption in key area, including the school library, teachers' dormitories, and offices. For example, smart desk lamps in the library can automatically adjust brightness based on ambient light and usage patterns. At the same time, water purifiers and electric fans in teachers' dormitories can automatically adapt to users' needs for enhanced energy efficiency.

Outlook
Accelerating Transition toward a Zero-carbon Future

As the global climate crisis intensifies, the International Energy Agency's (IEA) 2023 "Global Energy Outlook" report foresees a 60% surge in global energy demand by 2040. In this trajectory, the share of renewable energy in power supply is expected to soar from nearly 30% in 2020 to surpass 50%. The report emphasizes the strategic importance of modernizing smart technologies and power grids, where smart homes and electric vehicles have a core role to play. For this transition to be successful, the IEA advocates for an accelerated focus on the research and deployment of smart grid technologies. This approach aims to support the seamless integration of renewable energy, uplifting overall energy efficiency and slashing carbon emissions. From the IEA's estimation, by 2040, one billion households and 11 billion smart and connected devices could actively participate in demand flexibility, providing 185 GW of capacity. Among various smart home technologies, smart thermostats, solar PV, energy storage, EV chargers, smart meters, smart appliances, smart plugs, and connected lighting could all be grid-connected, holding immense demand flexibility potential. Along this journey, Xiaomi will leverage our expertise in smart hardware and AIoT technology to the innovation and application of green energy products.

We remain resolute in promoting the innovation and widespread adoption of **smart home devices**, including smart thermostats, household solar PV, compact energy storage batteries, electric vehicle charging infrastructure, smart meters, connected lighting, and many others. With these devices, households will have access to renewable energy sources and be able to monitor their consumption data in real-time to optimize energy management and efficiency. Furthermore, Xiaomi intends to integrate household portable energy storage and photovoltaic devices to create a novel type of community-level power system, further elevating energy management intelligence.

In advancing **green mobility**, Xiaomi will integrate smartphones, new energy vehicles, and AIoT technology to forge an intelligent transportation ecosystem. Our plan includes connecting new energy vehicles to a community-level "Light, Storage, Direct, Agile" system and extending energy interaction and interconnection beyond the community. With this integration, the smart home ecosystem will be able to supply energy that fulfills social electricity demands, and Xiaomi's green mobility can act as a "mobile charging solution" for building sustainable cities and rural districts.

In **manufacturing**, Xiaomi will employ digital technology and smart manufacturing to cut emissions and resource consumption. We will join hands with our supply chain partners to support their transition to 100% renewable electricity usage. In addition, Xiaomi continues to explore the use of new materials, such as bio-based alternatives, to foster innovation in material science and minimize the carbon footprint associated with raw materials.

Last but not least, Xiaomi is pioneering the establishment of a cross-category electrical technology platform to advance integrated energy management. With the setup of a future Electrical Capability Center, users can better perceive and manage energy on a scale ranging from a single device to multiple systems. This will pave the path for a more efficient, sustainable, digitalized, and smarter use of electrical energy.

Through these comprehensive undertakings, Xiaomi hopes to play its part in driving the green technology revolution, promoting green consumption, and shaping an intelligent "zero-carbon lifestyle". Going forward, we will expand our range of green and low-carbon products, offering users more options to create smart homes, travel sustainably, and make sustainable lifestyles easier for all.

Epilog

Throughout its 13-year growth journey, Xiaomi has demonstrated the vast potential of technological innovations and its dedication to sustainable development. With climate change imposing an ever-growing threat to future business models, Xiaomi has made significant strides in advancing a cleaner and more resource-efficient smart manufacturing technology through continual investment in research and development. This extends beyond resource efficiency. Indeed, it represents a fundamental reflection and reolution to the conventional manufacturing paradigm. When users engage with Xiaomi's "Life Essentials" smart devices and immerse themselves in the "Human x Car x Home" AIoT-connected smart ecosystem, they will be inspired by Xiaomi's aesthetics of living and motivated to make conscious choices for green energy use and low-carbon lifestyles, embracing a "Less is more" philosophy that reduces unnecessary resource consumption. Xiaomi holds the belief that we can create a much larger influence on emission reduction beyond our value chain by empowering and leading the industry and consumers toward green upgrades. On the industrial front, Xiaomi continues to forge ahead in the R&D and application of zero-carbon technology and smart manufacturing solutions. Through the ripple effect of green technology advancement and supply chain empowerment, Xiaomi's quest for ultimate efficiency transcends the boundaries of the value chain to a much broader state.

Faced with the formidable threats of climate change, the Xiaomi Climate Action White Paper not only paints a global picture of challenges and opportunities but also underscores the defining role of technology companies in advancing sustainable development. The journey of Xiaomi's evolution stands as an inspiring testament to how technological innovation can break through barriers. More importantly, it exemplifies how a company's respect for the environment is ingrained in its purpose and core strategy.

In this ever-evolving world, Xiaomi's commitment goes beyond the pursuit of extreme efficiency; we also strive to foster a broader state of efficiency that can propel a global shift toward green transformation. This holistic concept focuses on minimizing our impact on the planet while maximizing contributions to society. When we talk about user-centric design, it is not only about making smarter products; it is about cultivating a lifestyle of wisdom where true luxury is not measured by over-consumption, but by having less, with each possession representing a conscious and meaningful choice.

What the story of Xiaomi shows us, is that technological progress is not a linear storyline but rather an intricate web—an ecosystem intertwining innovation and efficiency, as well as sustainable development and social responsibility. In this web, each node represents an opportunity, a challenge, and a leap forward. Through this White Paper, we are not simply recounting the past; we are also charting a course for the future we hope to make real—a world that is more sustainable, more intelligent, and more harmonious for coexistence.

Therefore, let us use this White Paper as a launchpad to explore a new paradigm—one that emphasizes the equilibrium between global cooperation, technological innovation, and environmental protection. This is not just a commitment from a company; it is our collective mission, a pledge to the next generation, and a shared responsibility we all face. Let us join hands to go far in this enduring climate action journey, grow together, innovate together, and witness a more sustainable future together.

About this White Paper

This is the first White Paper on Climate Action released by Xiaomi Corporation. It depicts Xiaomi's reflection on the global transition toward a zero-carbon future, its climate goals, and zero-carbon vision, while spotlighting Xiaomi Group's innovative practices and zero-carbon approaches. This White Paper is published in both Chinese and English. In the event of any discrepancies, the Chinese version shall prevail.

Disclaimer

This White Paper contains forward-looking statements, which are in compliance with the provisions of the Securities and Futures Ordinance. These statements reflect our predictions, expectations, and beliefs based on currently available information and involve known and unknown risks and uncertainties that may cause actual results, performance, or achievements to differ materially from any expectations or descriptions presented herein. These risks include, but are not limited to, uncertainties in technological developments, market acceptance, changes in the regulatory environment, and broader fluctuations in the economic, political, and social environment.

Future events and circumstances may cause our current views to change. While we intend to timely update these statements to reflect new events or circumstances, we do not assume any obligation to update any statements, whether due to new information, future events, or other reasons. Therefore, readers should consider the risks and uncertainties associated with these statements before making any decisions based on them. Future disclosures will be revised and updated as needed, and previous forecasts and assumptions will be replaced upon the release of new disclosures.

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