DX and HRX for future refineries

2024.01.25

Cosmo Oil Co.,Ltd.

(1) Cosmo Oil's position within the Cosmo Energy Group

Company Profile of Cosmo Oil Co.,Ltd

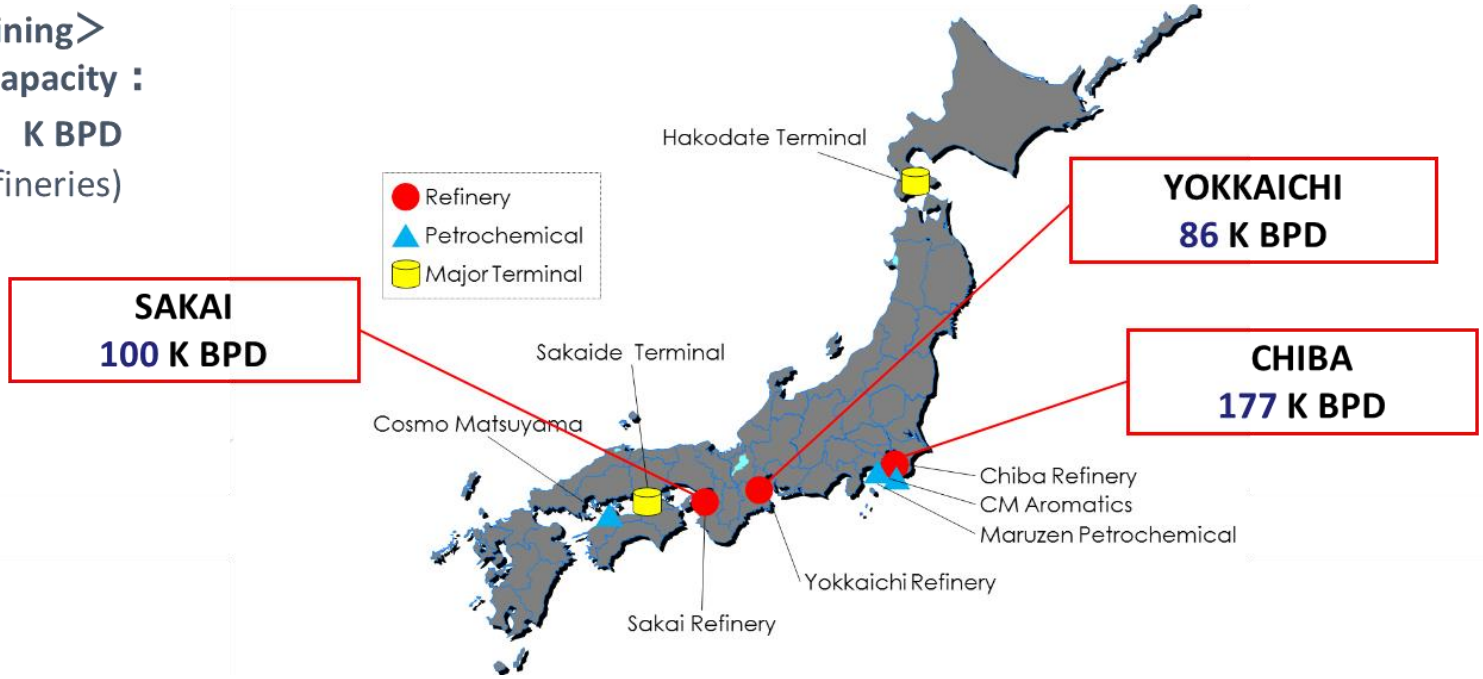
Cosmo Energy Holdings

Cosmo Energy Exploration & Production

Cosmo Oil Co., Ltd.

Cosmo Oil Marketing

<Refining>
CDU Capacity：
363 K BPD
(3 refineries)



Business Portfolio of Cosmo Energy Group

Core Petroleum Business

＜E&P＞
Crude Oil Production
45 K BPD

＜Refining＞
CDU Capacity：
363 K BPD
(3 refineries)

＜Marketing＞
Sales Volume
25,023 Thousand KL
Number of Gas Stations
2,695

Petrochemical Business

(K TPY)
Para-Xylene: 1,360
Benzene: 735
Mixed xylene: 618
Ethylene: 1,293

Power Generation Business

＜Wind Power＞
Generation
Capacity:
300 mW

＜Solar Power＞
Generation
Capacity:
24 mW

＜STM Power＞
Generation
Capacity:
230 mW

(2) Refinery's goal for VISION 2030

Vision 2030

To create energy that shapes the future,
energy that sustains society, and new forms of value

Bolster green electricity supply chain

Build a high value-added supply chain that encompasses power generation, supply-demand adjustment and sales

Expand next-generation energy

Supply SAF and develop hydrogen and other energy businesses

Strengthen competitiveness of Oil Business and pursue low carbonization

Enhance competitiveness by digitizing refineries, etc. and shift to low-carbon operations through CCS/CCUS

Vision 2030_Bolster green electricity supply chain

Renewable energy generation — Expand
2,000 MW
(Wind power ≥1,500 MW)

Supply-demand adjustment/storage — Build
Stored power 500 MW

Green electricity sales — Expand
4.0 bil. kWh

Development capabilities/pipeline

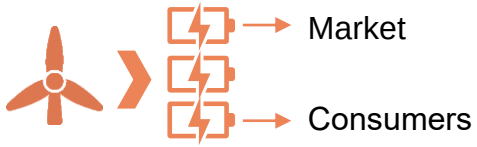
Onshore wind power: current capacity
300MW

Onshore wind power: planned capacity
600MW
(of which 400 MW is under construction/development)

Offshore wind power: planned capacity
600MW

COSMO
Cosmo Eco Power Co., Ltd.
Integrated development/ O&M framework

Power storage business validation start (FY2023-)



Installation of storage batteries at power plants/grid-scale storage systems

Existing customer network

コスモでんき グリーン
Cosmo Denki Green
Introduced at over 1,000 sites

再エネ×EV コスモ・ゼロカボソリューション
Cosmo Zero Carbon Solution
RExEV solution

COSMO
5 mil. app downloads


60,000 Eco Card holders

COSMO コスモMyカーリース
Cosmo My Car Lease
Lease contracts signed for cum. total of 100,000 vehicles

Mass production of Japan's first locally-made SAF

SAFFAIRE SKY ENERGY

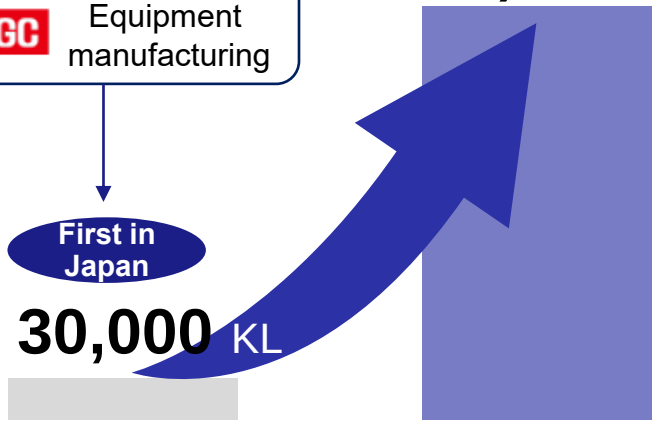
Established LLC

- SAF production (COSMO)
- Waste cooking oil take-back (REVO INTERNATIONAL)
- Equipment manufacturing (JGC)

COSMO / MITSUI&CO. — SAF production

LanzaJet — ATJ technology

300,000 KL



Expand production scale

Produce SAF using Alcohol to JET (ATJ) technology

Produce SAF from waste cooking oil raw materials

Development of hydrogen and other energy businesses

Entry into hydrogen supply chain

◎ **Considering partnering with Iwatani Corp.**

Operation of hydrogen station for trucks

Use of existing assets for entry into hydrogen supply chain

◎ **Exploring new hydrogen production technologies (turquoise hydrogen)**

Joint development with Toda Kogyo Corp.

*In addition, we will undertake R&D and proof-of-concept testing for waste plastic recycling as well as ammonia, synthetic and other fuels.

Strategic investment (-2030 eight-year cumulative)	Ordinary profit (2030)	CO_2 reduction (vs. 2013)
¥100.0 bil.	**¥10.0 bil.**	**-400,000 tons**

Current Status and Opportunity in Refinery Operations and Directions for Improvement

Refinery operations face challenges in terms of “people” ”processes”, and “assets”, making continuous improvement crucial. We believe that the five directions of improvement centered on DX will be the key.

Challenges faced in refinery operations

PEOPLE

✓ It is difficult to recruit new graduates due to the declining birthrate, and it will be difficult to secure a sufficient labor force in the future due to the outflow due to job changes.

PROCESS

✓ Data is not centrally managed in the system, resulting in inefficient manual offline work

ASSET

✓ Many of the assets were installed more than 50 years ago, and the reliability of the equipment is deteriorating as they age.

Direction of Improvement

1 **BE RESPONSIVE**

- Adapts to market conditions and external environment. Realize agile operations that pursue revenue maximization

2 **BE PREDICTIBLE**

- Use analytics to transform reactive operations from passive to predictive

3 **BE INTEGRATED**

- Clarification of operational value levers across refineries and dependencies between refineries

4 **WORK DIGITALLY**

- Maximize digital use to eliminate manual work as much as possible and improve skills and capabilities

5 **OPERATE SAFELY**

- Reduce incidents and operating errors, and realize safer maintenance work realized by “human + machine"

What should refineries look like in 2030?

External environment		Concept required for refineries	Success factors for realization
NEEDS	Domestic Fuel oil demand 170 million kL in 2030 (2017 vs ▲23%)	In Asset Light Toward a structure that maximizes profits	Joint O&M investment decisions
NEEDS	obal demand for petrochemica Continued strong performance (Ethylene in 18年 →+33% in 27)	Utilizing oil refining facilities Increasing production of petrochemical products	Flexible and optimal production planning according to market conditions and supply and Demand
RECRUIT	Working-age population to reach 67 million by 2030 (2020 vs ▲8%)	From human-dependent operation to self-sustaining refinery	Data-driven AI decision-making
RECRUIT	Establishing work from home/ About 80% of job-hunting students I want to work from home	Transform into an attractive work environment.	Breaking away from the old way →Refinery operations from home
CN	Achieving the Carbon Neutrality Target by 2050	Further acceleration of CN & energy-saving	Selection of measures through highly accurate simulations

What to do

It is necessary to build an integrated platform that is not an individual solution

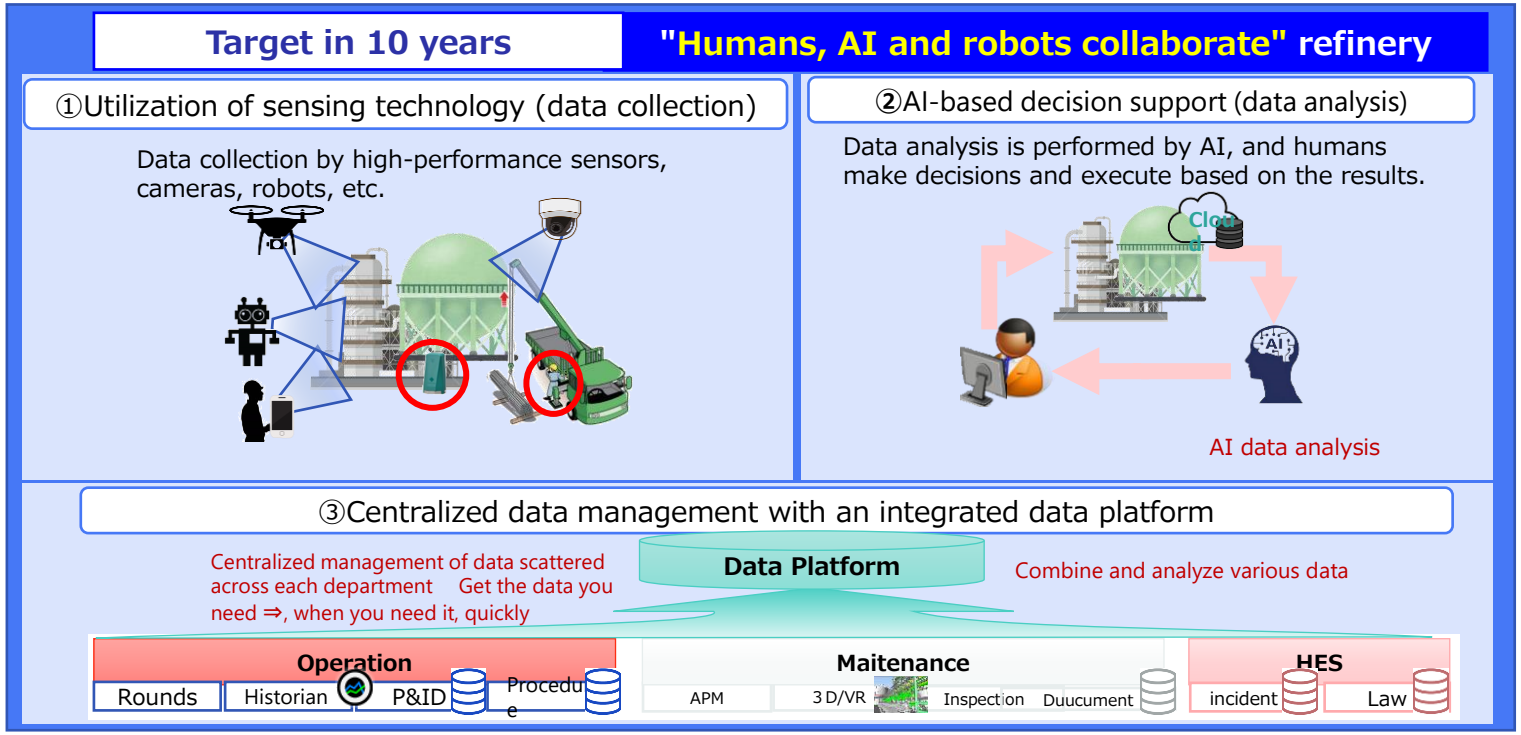
↓

It takes time to build, so it is essential to start moving now with an eye on the future

Digitalization concept for refineries

By promoting the digitalization of refineries and utilizing advanced technologies, we will achieve the following two points and achieve a high level of safe operation.

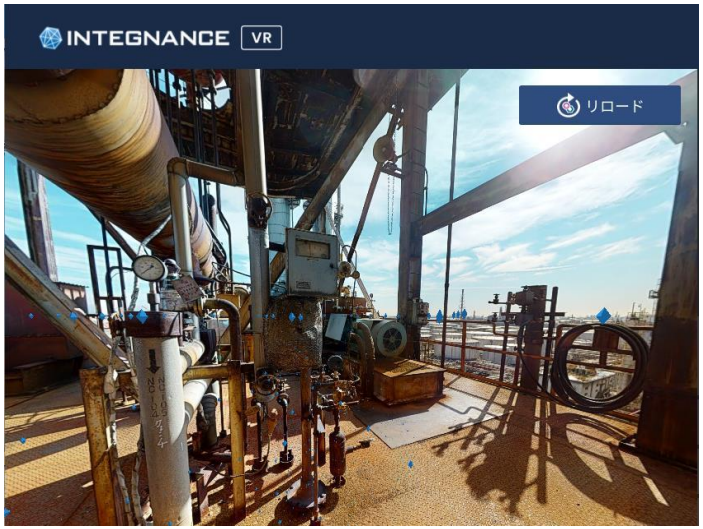
- Improvement of safety and operational availability by improving equipment reliability and early detection of abnormalities
- Realization of an efficient work environment with maximum productivity



To transform the way of working in refineries by 2030, we will work on the advancement of data utilization and equipment inspections using robots.

Digital twin of refinery

Realizing the world view of Google Maps in refineries



Equipment Inspection by Robot

Efficient equipment inspections utilizing robots, not just people

■ Shift employees' core work to judging the results of AI and robot analysis and further tuning of AI, etc.

■ Create a digital twin to realize an efficient work environment that is not restricted by location.

(3) HRX positioned within the three transformations

Management Foundation Transformation

	Policy	FY2023	FY2024	FY2025	KPI
HRX	**Pursue a people strategy that motivates employees and harnesses their skills**	Introduce compensation system to boost motivation (increase wages)			**Engagement index ≥60 point**
		Bolster autonomous career development (expand/improve job challenge system)			
		Increase investment in strengthening HR and employees' skill (double investment in HR development)			**HR dev. investment ¥180,000 /person**
		Step up recruitment of women/mid-career hires (double proportion of female managers, achieve ratio of 50% mid-career hires)			
DX	**Transform business model through digital capabilities and change management**	Strengthen competitiveness of existing businesses/operations through DX			
		Cultivate core digital personnel and hold DX Forum			**Core digital personnel 900 people**
		Upgrade data utilization infrastructure and strengthen data governance			
			Leverage data analysis in development of New businesses		
				Complete shift to paperless operations	
		Increase operational efficiency leveraging IT/DX			
GX	**Realize roadmap to achieve net zero carbon emissions**	Realize roadmap for net zero carbon emissions			**2030 GHG emissions reduction ≥-30% (vs. 2013)**

Human Resource Requirements to Achieve Vison 2030

Challenge

- Discover issues on your own and take on challenges without turning away from them.
- Do not be afraid of "friction" and express your own opinions to pursue better results.

Develop

- Each employee decides their own career vision and continuously develops their abilities.
- Accept the diversity of our members and support the development of their abilities to realize their careers.

Master

- Each employee will define and improve their own axis of expertise and apply them to their work.
- Pursue own business results and carry them through to the end.

Cosmo's Actions for Human Resource Requirements

Challenge

- Job Challenge Program
- Assignment to new projects such as SAF and wind power generation

Develop

- Planned development and placement with a succession plan in mind
- Clarification of one's own career vision, Introduction of a new talent management system to clarify one's career vision

Master

- Specialist positions will be institutionalized and operational from FY2023.
- Utilization of safety engineers in refineries

Key performance indicators for establishing DX promotion infrastructure and developing digital personnel

Core digital personnel	Develop **900** core digital personnel by the end of FY2025	Number of projects conducted with CDO CUP Support	Total of **60** over three years
DX event participation	Total **20,000** people per year	IT/DX-driven operational efficiency improvement	Up **10**% (vs. FY2022)
Number of DX Forum events	**24** per year		

Core digital personnel cultivation

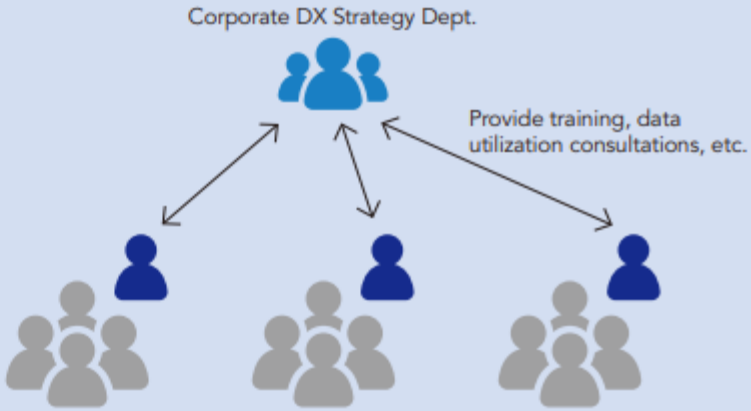
Nurture data utilization leaders in each department

Core digital personnel
(900 data utilization leaders)

Data users
(approx. 7,000 group-wide)

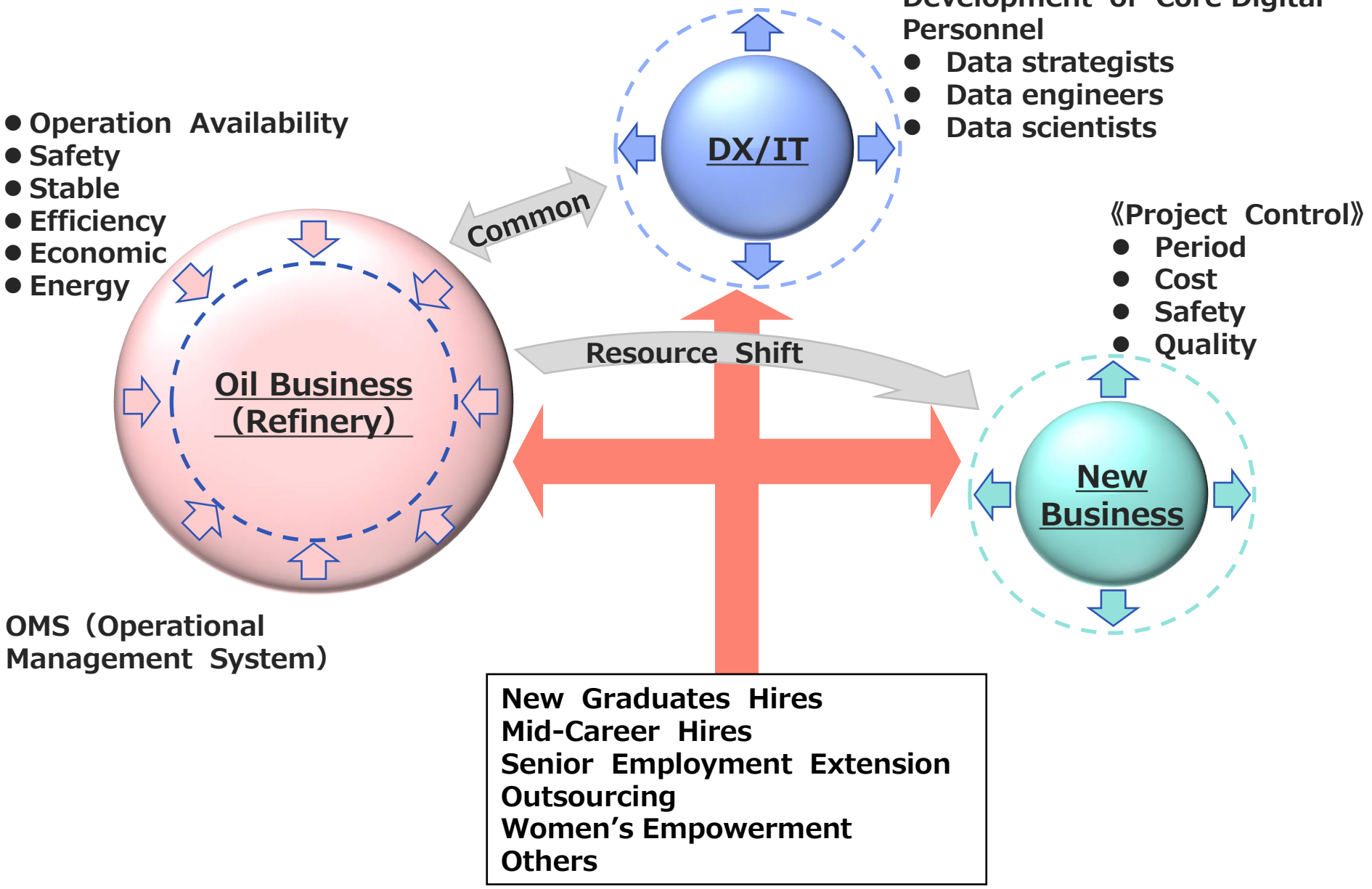
COSMO Data Campus

Enhance employees' data utilization skills



(4) Image of the human resources of 2030

Image of the human Resources of 2030



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Thank You