

Helium

Calmer seas ahead ?

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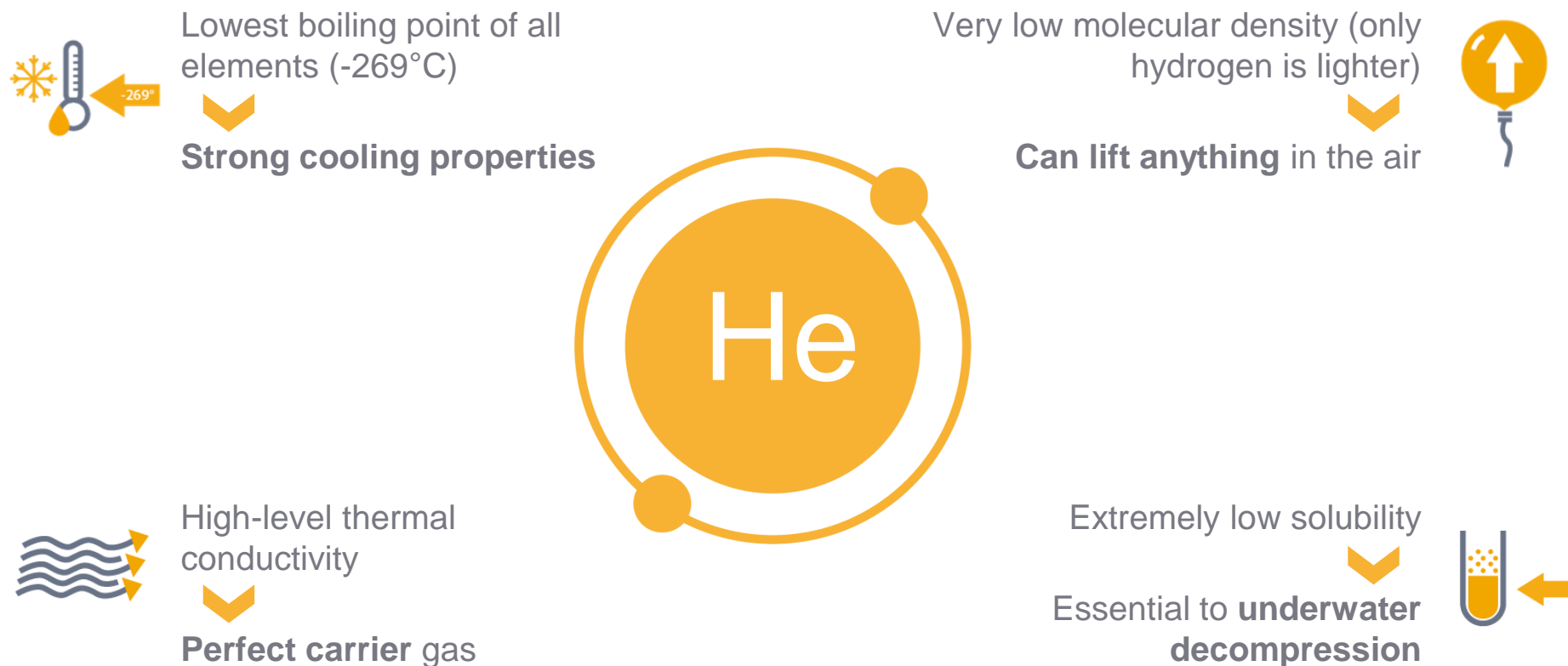


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A rare gas with properties highly looked for

- Helium is classified as a **noble gas** (such as argon, krypton, xenon and neon).
- It is **inert**, colorless, odorless and non-flammable.



Six key applications in high-end sectors

MRI (Magnetic Resonance Imaging)

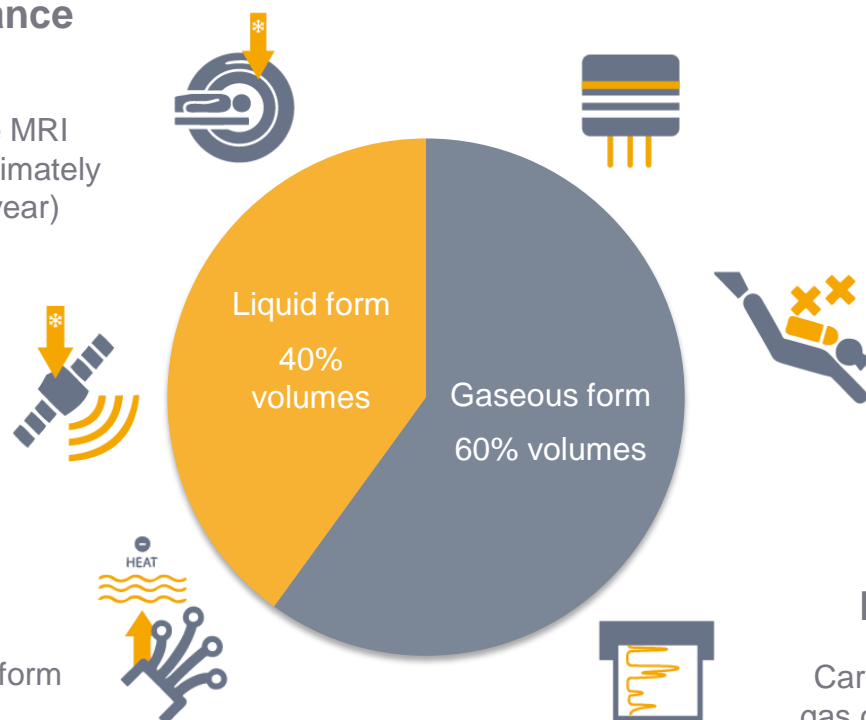
- Magnet cooling (a single MRI scanner requires approximately 700 liters of helium per year)

Rockets & Satellites

- Systems cooling & fuel pressurizing

Fiber Optics

- Highly purified glass preform creation & fiber cooling



Electronics

Production cooling

Breathing Atmospheres

Faster, easier and safer decompression

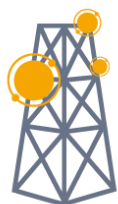
Chromatography & Laboratory Applications

Carrier gas & purge gas, zero gas or neutral atmosphere gas

NB: there are several other sectors for which Helium is a key molecule: leisure (balloons), airbags, welding...

A sophisticated process requiring a unique expertise

From extraction...



EXTRACTION

Limited sources



PURIFICATION

Filtration and pressure-swing adsorption **on-site**



LIQUEFACTION

Liquefaction **on-site**



PRIMARY
TRANSPORTATION

In highly insulated
cryogenic ISO 37,000-L
containers

... to delivery



STORAGE

Liquid: 65-L to 1,000-L
Gas: 3 to 160m3



SECONDARY
TRANSPORTATION

Dedicated fleet of trailers



CUSTOMERS

A limited set of **sources...**

... but undergoing a **deep reorganization**

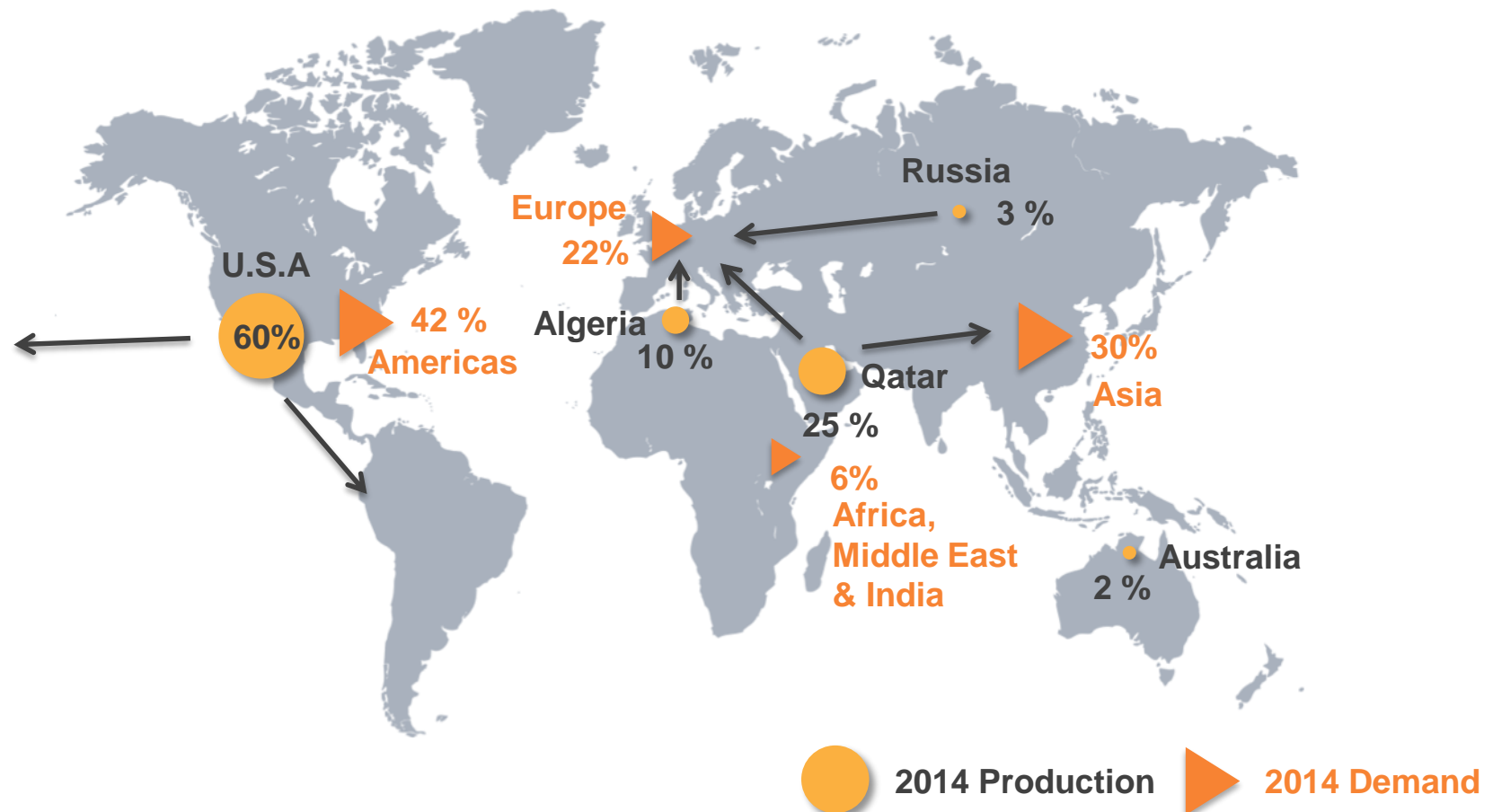
2014 overview: a limited set of sources

Only about **10 sources** to meet a constantly growing demand.



2014 overview: production areas vs. consumption areas

- Helium needs to be transported from production zones to 3 main consumption areas.
- The rise of the production in Qatar brings **new logistics constraints** on the worldwide level.



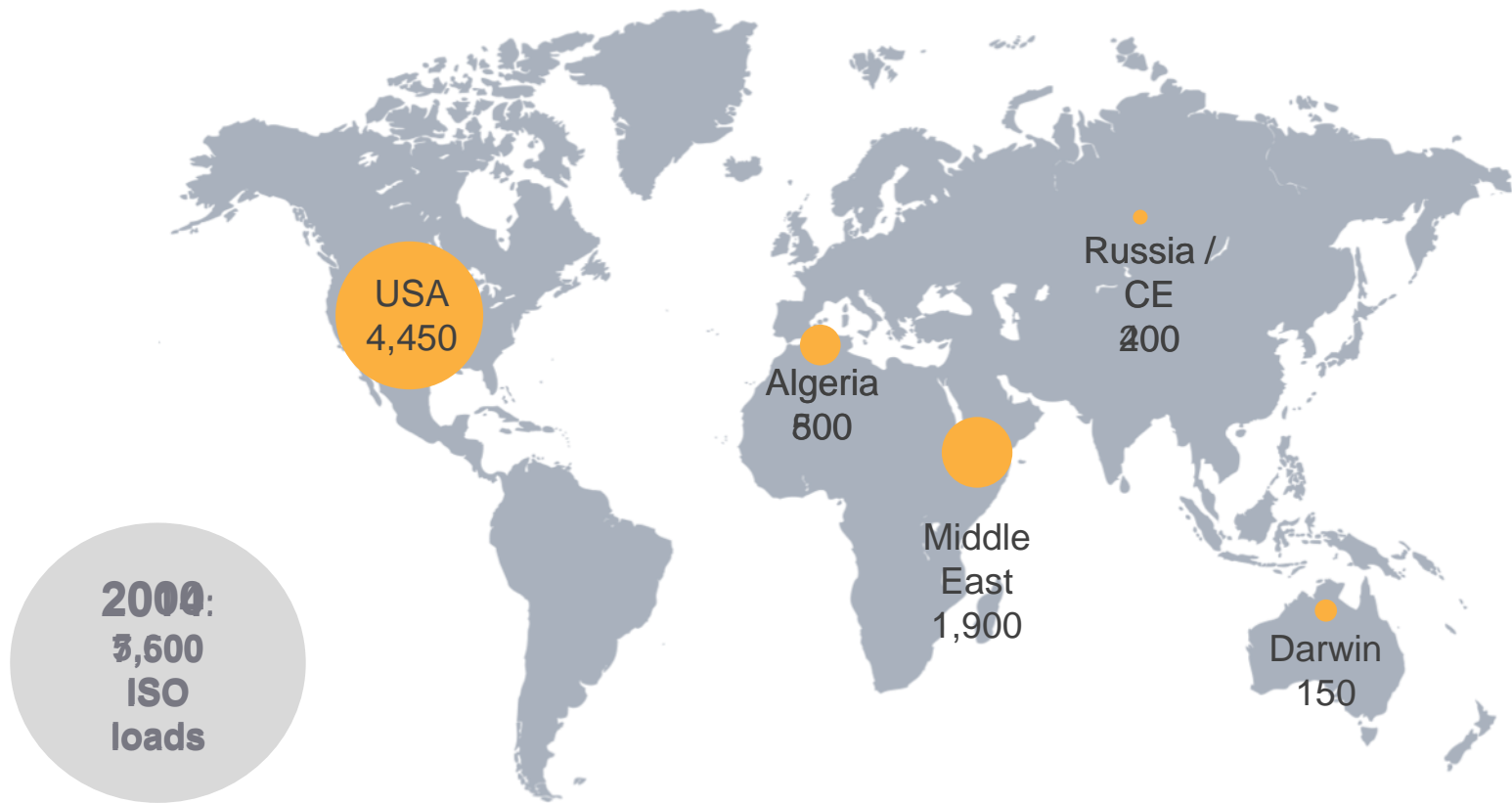
Evolution in the 2000's: strong changes at play

Evolution of helium production in recent years and projection in the coming years



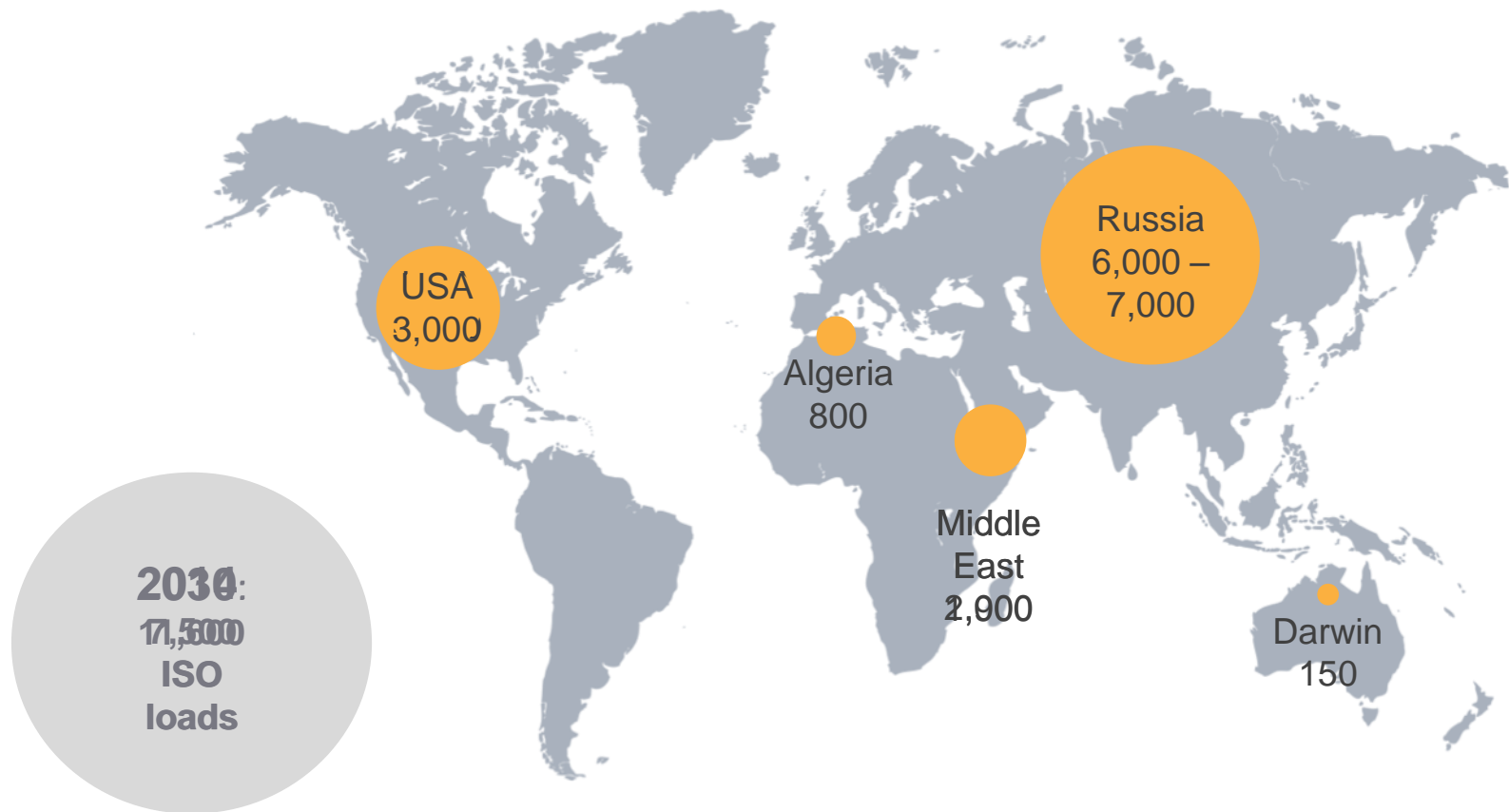
Evolution in the 2000's: strong changes at play

Evolution of helium production in recent years and projection in the coming years



Evolution in the 2000's: strong changes at play

Evolution of helium production in recent years and projection in the coming years



Many challenges implied for market players



ECONOMIC CHALLENGES

- **BLM index** is becoming erratic and unpredictable. Should it remain the reference?
- Rising and volatile **cost**
- Need for **product reliability management** – not all sources produce with the same reliability



TECHNOLOGICAL CHALLENGES

- Increasing **transportation** issues
- Growing need for **recycling** processes



GEOPOLITICAL CHALLENGES

- **Risk** associated with the new production areas

Looking ahead

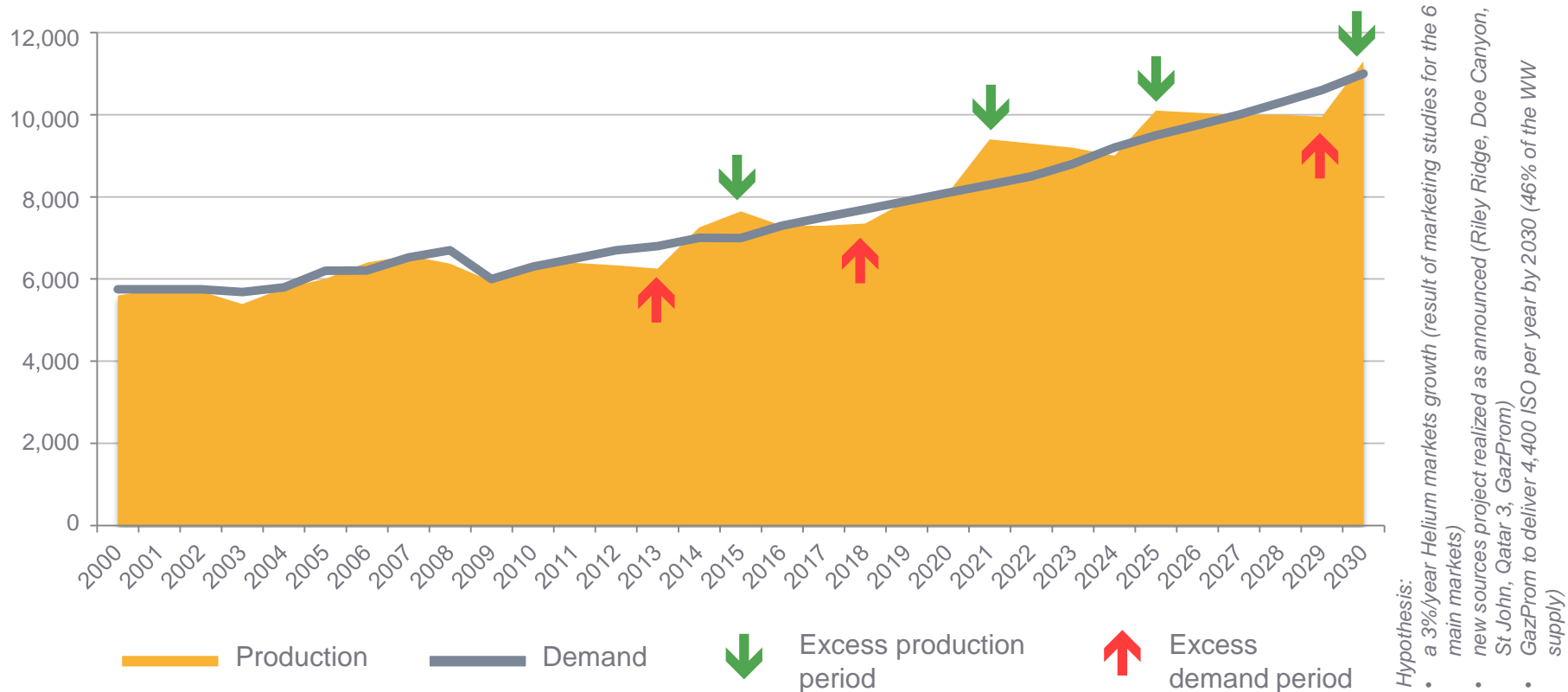
A market likely to **alternate** between periods of excess demand and of excess offer

A historic **market reference** depleting quickly

A need for all stakeholders to better **anticipate price evolutions**

The helium market offer vs. demand issue

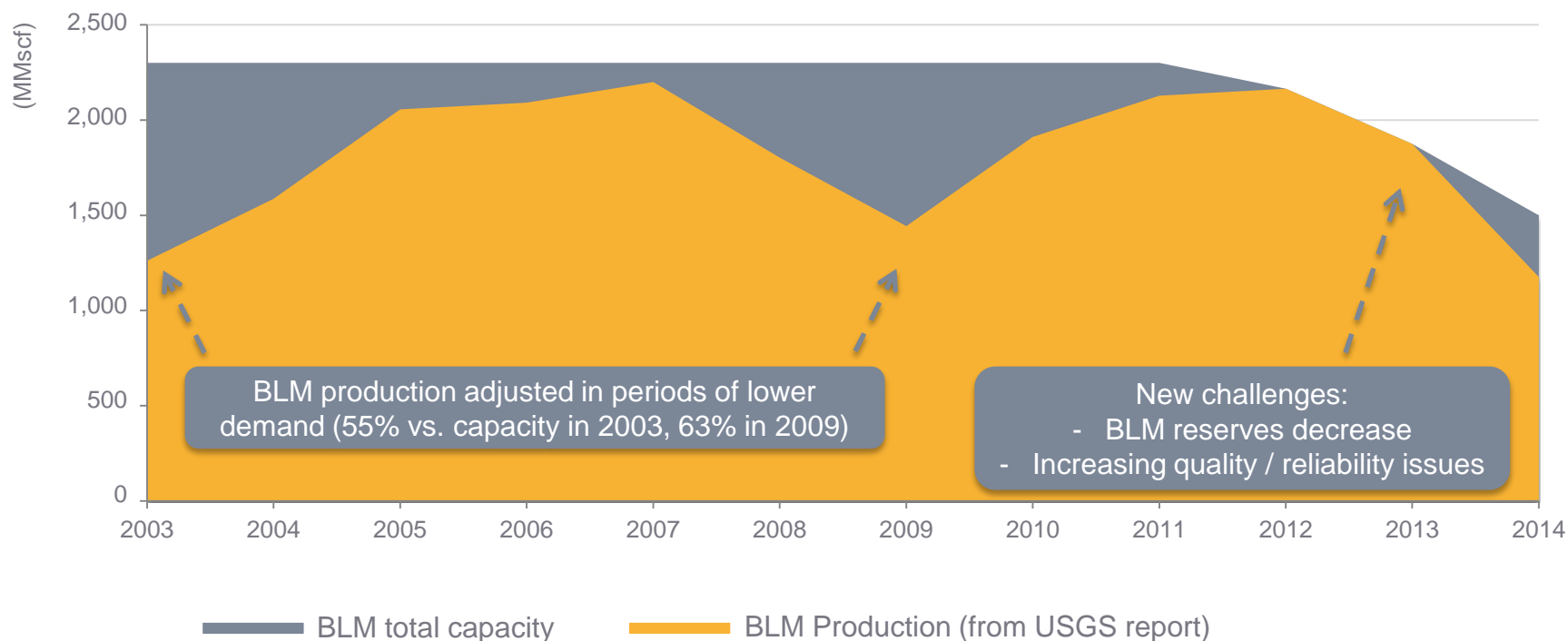
Evolution of helium production and demand on the 2000 – 2030 period



Adjusting for the end of the “BLM buffer” era

- ➔ Since 2012, the BLM annual capacity is decreasing. **Its extinction is anticipated for the early 2020's.**
- ➔ Reduction in the BLM output will put an **end to its capacity to act as the market buffer** it has been for half a century.

BLM production vs. capacity 2003 – 2014



In a nutshell...

1

A **new paradigm** is appearing on the helium market

- The US-dominated phase is ending...
- ... as is the buffer protection the BLM stocks provided

2

New frontiers open as new production areas develop

3

Challenges arise along with these, for which all markets players need to prepare

- Cost-related
- Technological
- Geopolitical

Air Liquide, a major player ready for the new paradigm



SOURCING CAPACITIES

- Helium primary **sourcing volume multiplied by 3 since 2000** (market share rising from 11% to 19% on the same period)
- **Diversified portfolio** of helium sources around the globe



KNOWLEDGE & EXPERTISE

- Historical presence on the market = **know-how and experience**
- **Cryogenic expertise** including helium liquefaction and purification equipment



WORLDWIDE PRESENCE & SUPPLY CHAIN

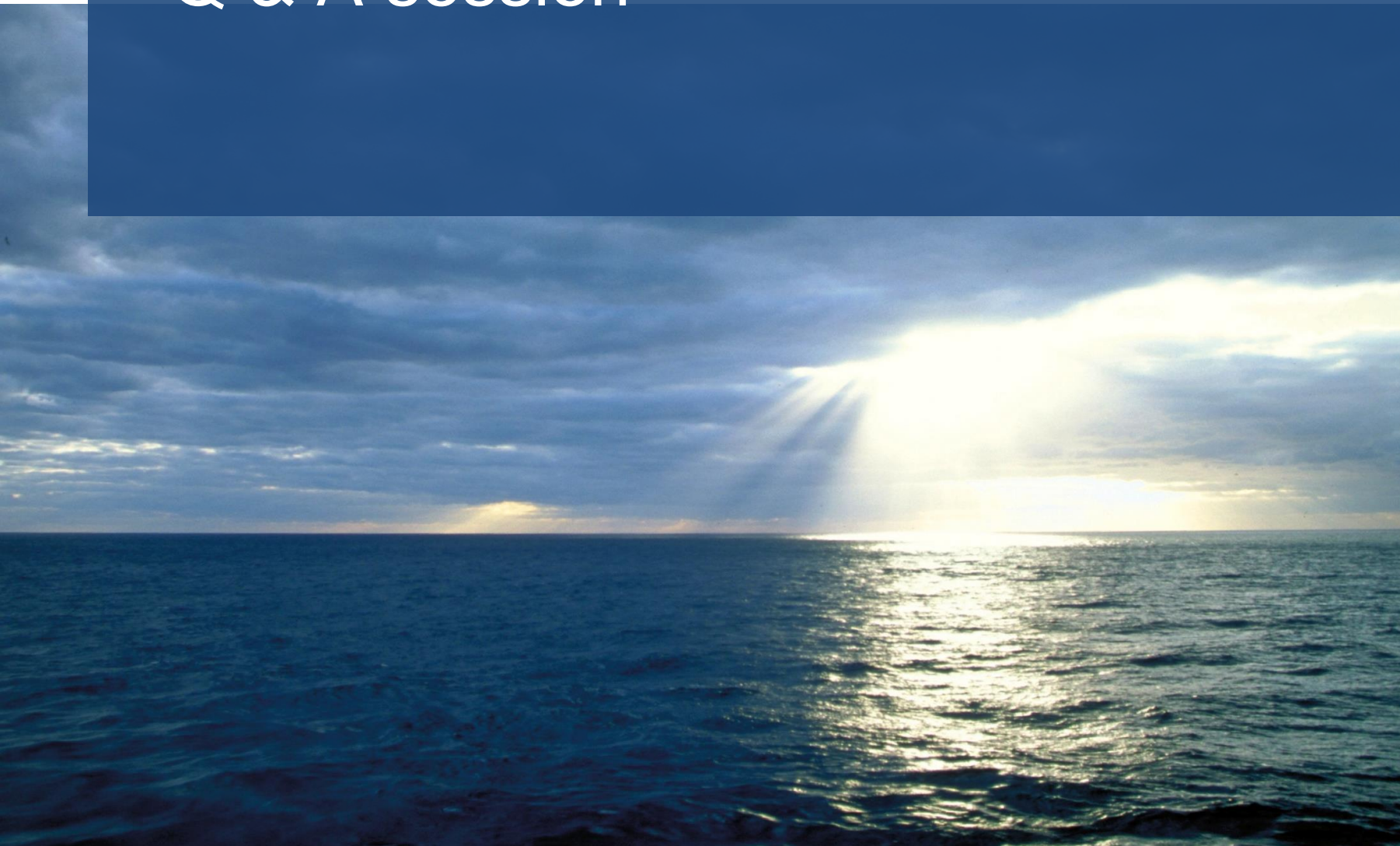
- One of the largest fleets of **helium trailers** in the world
- Operating a significant number of filling centers in **Europe, Asia and the Americas**
- Among the main players on the offshore market (**sites in more than 90% of offshore supply bases**)



STRONG INNOVATION CAPABILITIES

- Direct involvement in **major international projects** like ITER, the International Thermonuclear Experimental Reactor, and the Large Hadron Collider (CERN)
- Heading innovation in **helium recycling**

Q & A session



Back-up slides

Air Liquide at a glance

WORLD LEADER

IN GASES, TECHNOLOGIES AND SERVICES
FOR INDUSTRY AND HEALTH

Present in
80
COUNTRIES

MORE THAN
50,000
EMPLOYEES

MORE THAN
2 MILLION
customers and patients

10 Research & Development centers
15 Engineering centers

Around **300** patents per year

2013 Revenue: **€15,225 million**

2013 Net profit: **€1,640 million**

Strong logistics capabilities

FLEXIBILITY
in supply to match
CUSTOMER NEEDS

MORE THAN
500
facilities worldwide

Present in
80
COUNTRIES

A network of more than
10,000
distributors



PACKAGED GASES

- Strategically-sited filling centers to serve customers within a **200km radius**
- Standardized filling units for **product consistency** across the world
- The **easiest to use cylinders and valves** on the market, for safer, more ergonomic and efficient use of gas (SMARTOP™, ALTOP™)



BULK SUPPLY

- Our dispatch centers are located in the **heart of industrial basins**
- World-class logistics ensuring **improved supply reliability** to 4,000+ customer sites
- **Automatic re-ordering** through self-powered wireless telemetry units (monitoring supply level on-site)