



# Pitch Deck

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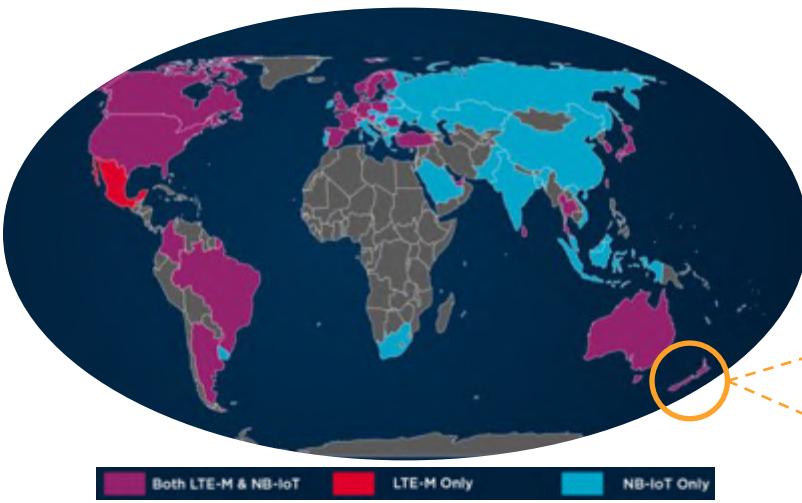
# Executive summary

- OQ Technology is the **first and only 5G IoT LEO satellite operator** with 10 satellites in orbit and a global coverage operating on standard fully notified international spectrum.
- Established in 2016, OQ Technology's vision is to **connect all cellular phones and devices seamlessly** to its satellite constellation using the standard cellular 3GPP technology.
- OQ Technology's mission aims at **unlocking a large untapped IoT Direct-to-Device market estimated at US\$10.4 billion\*** by 2035 thanks to its disruptive 5G IoT ecosystem, already serving well-known customers. Once successfully established into the 5G IoT market, OQ Technology's future roadmap is to upgrade its technology and satellites to address a larger untapped market, that of **the Direct-to-Mobile connectivity estimated at US\$ 19.9 billion\*** providing messaging and voice services to mobile phones and wearables globally.
- To implement its vision and business plan, OQ Technology requires EUR 30 million to invest in the **scale-up of its business model and launch Batch 2 (additional 20 satellites) of its constellation to provide larger coverage of IoT Direct-to-Device services.**

# Today's IoT Networks Have Limitations

## CELLULAR is limited

- Cellular covers <20% of the world. \*
- Fragmented
- Rural coverage gaps
- No roaming
- No mobility



## SATELLITE IoT not viable.

- Bulky and Power-hungry
- Hardware & Connectivity VERY EXPENSIVE
- Non-Cellular Standard / Proprietary
- No indoor reach



\* Source: GSMA, 2021

# The OQ ONE SOLUTION



## → ONE NETWORK

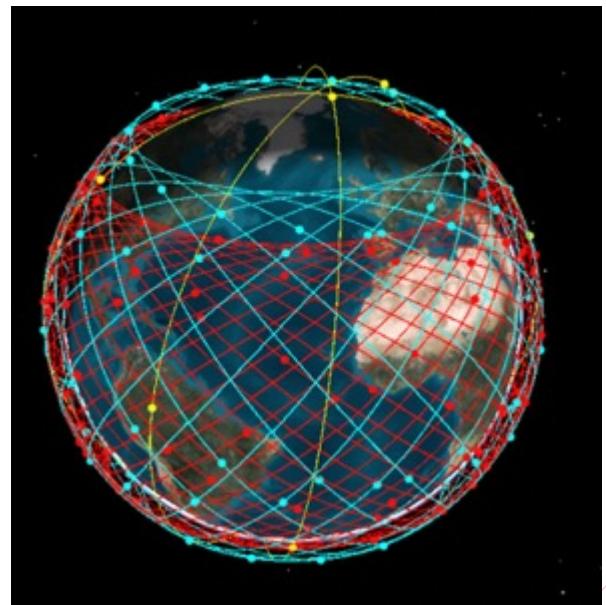
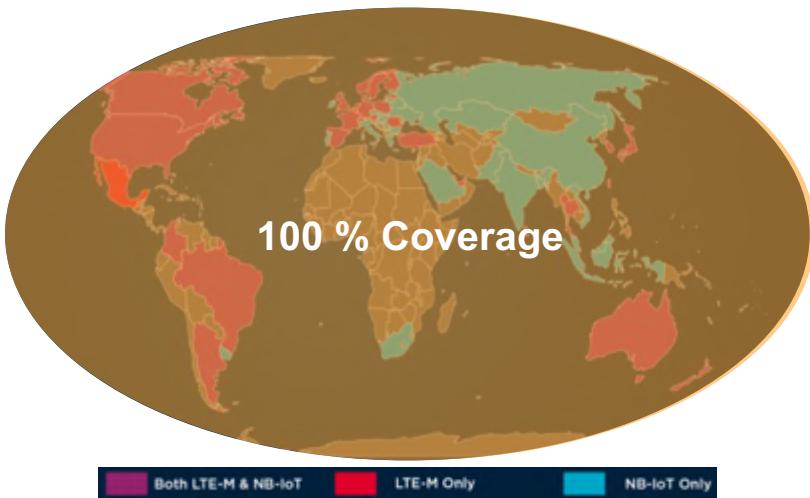
TRULY GLOBAL COVERAGE → NO COVERAGE GAPS → ULTRA-LOW, ULTRA-RELIABLE LATENCY

## → ONE SIM

GLOBAL ROAMING → NO FRAGMENTED NETWORKS → OPERATIONALLY SIMPLE

## → ONE STANDARD

CELLULAR 5G 3GPP COMPATIBLE → WHOLESALE MNO MODEL



# Problem / Solution Overview

OQ Technology enables sustainable growth to vital industries



## Problem:

- 80% of the world has no mobile coverage
- Limited sustainable growth for vital sectors such as logistics, energy, agritech and utilities without connectivity

## Solution:

- OQ is a comprehensive solution providing full coverage IoT connectivity in (4G/5G) offering a global roaming service for all IoT applications based on a LEO constellation of nanosatellites
- Billion of devices can be accommodated on OQ's network with a truly global coverage, no gaps, ultra-low & ultra-reliable latency

### Land Transport and Maritime

A smartphone displays a mobile application interface for a truck scale. The screen shows fields for 'Total weight', 'Average load', and 'Temperature'. In the background, several shipping containers are stacked at a port terminal.

- \$54m of lost containers in 2021 only
- 10%-40% per year of global supply chain assets<sup>3</sup> are lost
- Cold chain interruptions result in \$300m of lost vaccines and \$179m of food loss each year in US

### Utilities

An aerial photograph showing a network of tall, lattice-style power transmission towers. They are interconnected by a complex web of power lines against a backdrop of a clear sky with some distant clouds.

- Manual meter reading across Ireland cost \$245m
- \$9B of water is lost in Asia due to unmonitored leaking pipes

### Agriculture

An aerial view of agricultural land divided into various plots. Some plots have circular crop marks or irrigation patterns. Overlaid on the image are several data visualization elements, including a circular progress bar at the bottom center labeled '49%', and two small graphs in the bottom left corner.

- 90% of global crop losses are due to weather and lack of predictive measures
- \$225m of untracked cattle theft in the US in 2021

### Oil & Gas

A photograph of an offshore oil and gas platform situated in the middle of a body of water under a cloudy sky. The platform has multiple levels and structural supports.

- Avg. 300 oil and gas pipeline leaks per year in US only resulting in annual \$2B losses
- Nigeria: \$42B in theft and \$145M repair cost
- More than 3.2 million unmonitored oil and gas wells together emitted 281 kilotons of methane in 2018

# Our missions so far

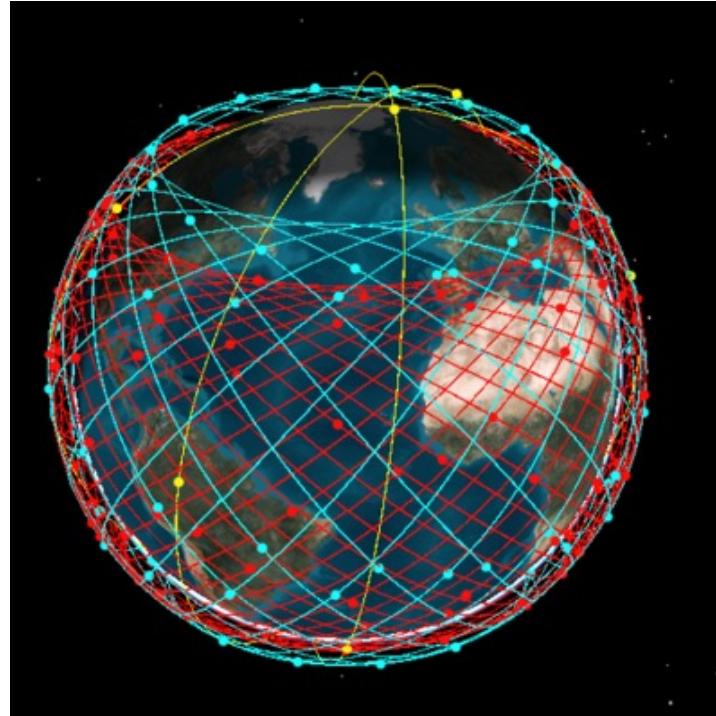


# Global Satellite Service Coverage

Constellation of LEO satellites in different planes offering worldwide coverage



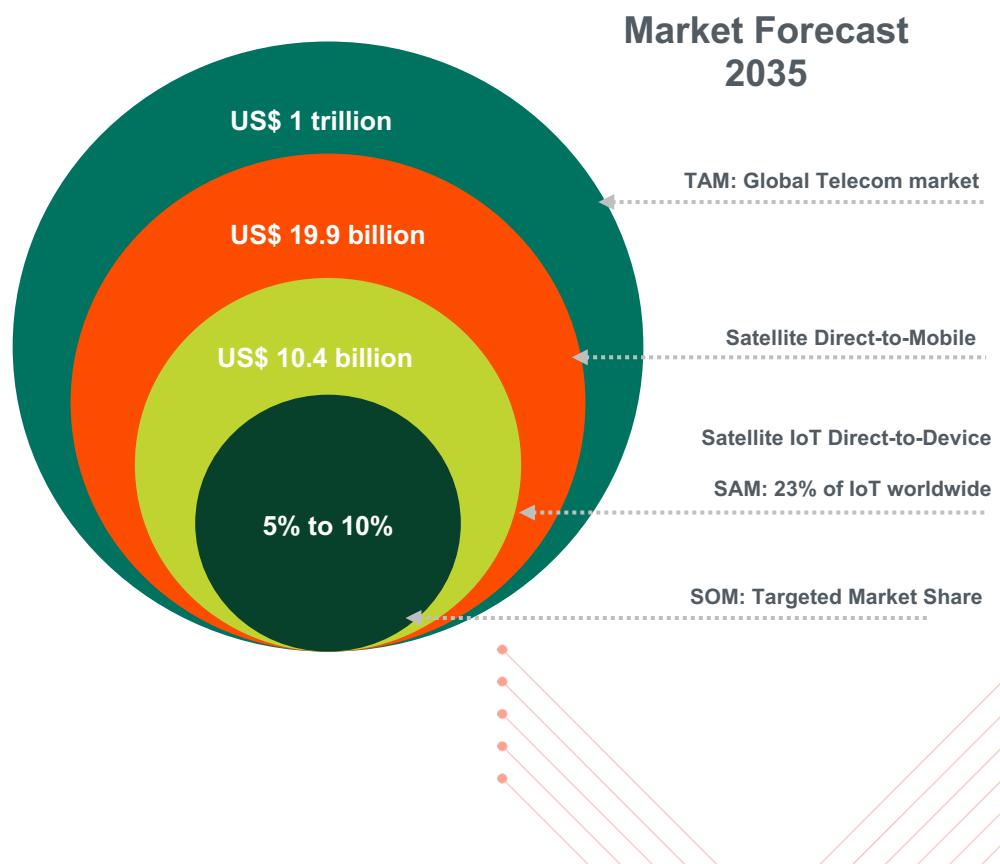
- OQ provides global coverage
- OQ is expanding its commercial licensing and landing rights in many countries through direct licensing or partnerships.
- Service Level Availability:
  - High Service Availability (Level 1): Middle East, Africa, International Waters, Australia, Asia, South America
  - Medium Service Availability (Level 2): Europe
  - Unavailable, will be available in future (Level 3): North America, India, China



# Market Opportunity

Satellite IoT market to reach US\$10.4 billion by 2035

- OQ Technology is well positioned to address the Satellite IoT Direct-to-Device market **as early as 2024** with its 10 satellites in orbit.
- OQ Technology's short-term growth will be driven by **real-time IoT applications**, requiring the completion of the full satellite constellation.
- OQ Technology's business plan reasonably targets a **market share** of the Satellite IoT Direct-to-Device market **of 5% to 10% by 2035**.
- OQ Technology's long-term growth will be fuelled by the demand for **Satellite Direct-to-Mobile services** estimated at US\$19.9 billion.



# Disruptive technology enabling end-to-end solutions



## Comprehensive 5G IoT ecosystem

### Hardware

Interoperable SAT/Terrestrial  
Competitive prices – Product ecosystem  
Dual-mode – Works indoors

OQ ONE



OQ TrackMe-Pro & TrackMe



OQ Modules



BYOD: Bring Your Own Device

### Connectivity

Wholesale distribution  
Global Coverage – Roaming with Mobile Carrier (World SIM Card) -  
Flexible data plans bundled with HW

Technology/Solution Partners  
Channel Partners – Service Providers  
MNOs/MVNOs



10 kB/month



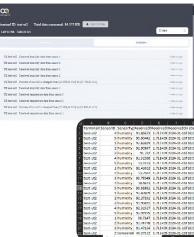
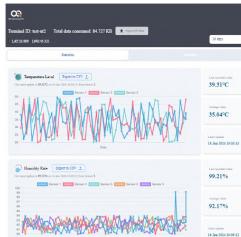
50 kB/month



1+ MB/month

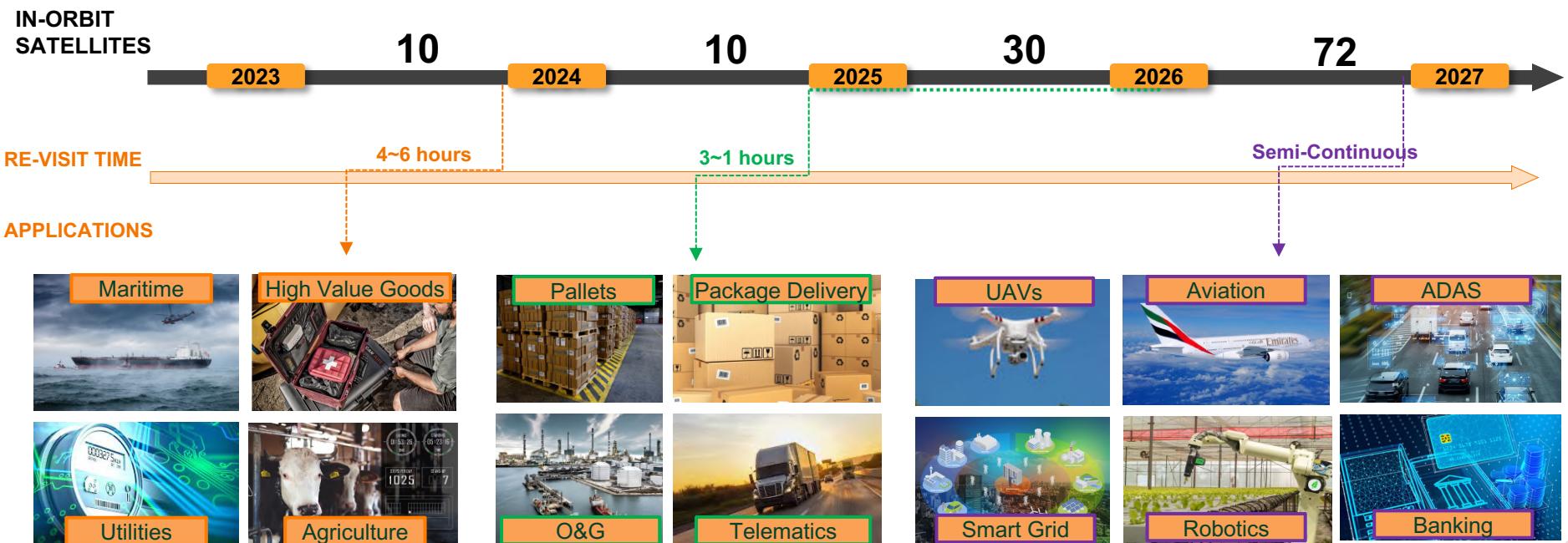
### Platform

OQ Network Management System:  
Comprehensive dashboard  
designed to improve operational  
performance



# Deployment plan

OQ Technology is the fastest growing 5G constellation that is addressing increasingly critical customers' needs - use cases



# Value Proposition

## OQ Technology Advantages



### 3GPP Standards:

- Players following the 3rd Generation Partnership Project standard of 5G
- Rich cellular chipset manufacturers and device vendors globally
- Low-cost service and hardware
- OQ has more than 14 contributions to 3GPP NTN standards



### Patents:

- OQ Technology has been granted 9 NTN Patents (more in progress)
- Patents are part of company's IP strategy, encompassing hardware and software as well as payloads
- Protection and barrier to entry
- **OQ patent claims map into the 3GPP NTN standard**



### Operating on Regulated 5G Spectrum:

- OQ has notified and brought-into-use own ITU spectrum filings allowing the system to be used for premium enterprise, controlled applications that require high reliability and service quality without leasing expensive spectrum



### Global Coverage:

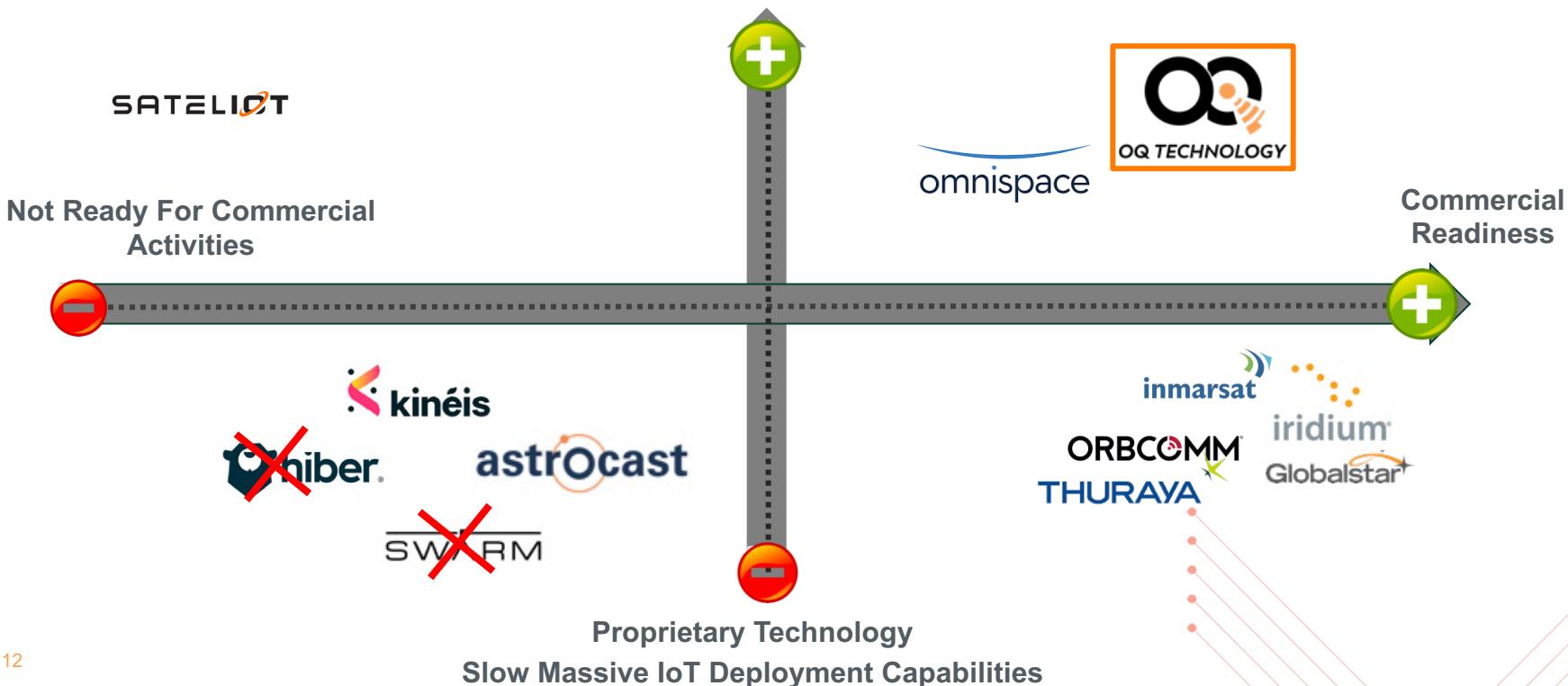
- OQ Technology boasts significant licenses & landing rights across Asia, Africa, Australia, and Europe. Licensing initiatives for the Americas are in progress
- We guarantee high-speed data transfer with our 5G NB-IoT, ensuring that OQ Technology remains at the forefront of the satellite communications industry

# Competitive Mapping

Readiness + Standardized 3GPP Advantages

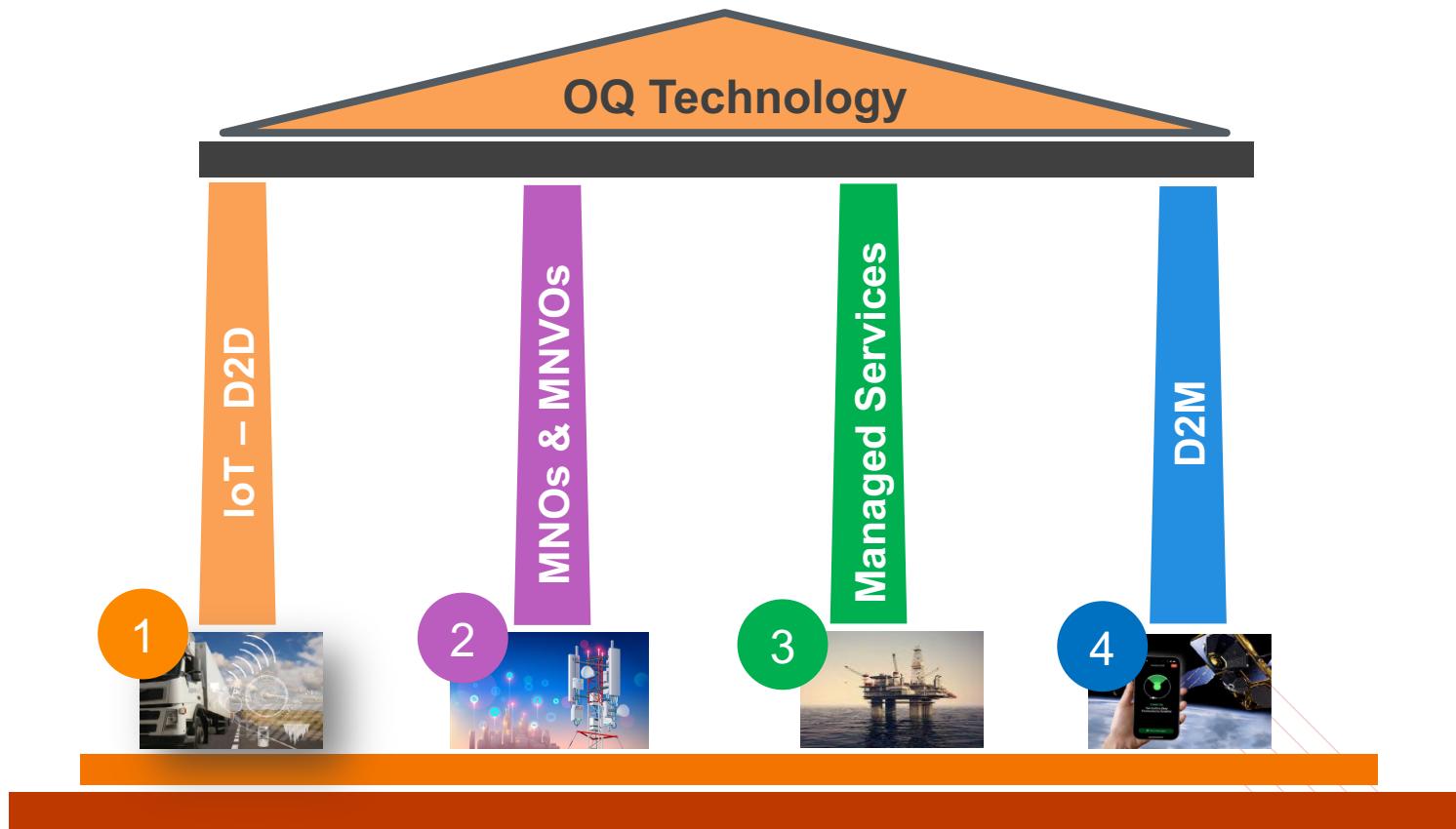


Standardized Technology  
High Massive IoT Deployment Capabilities



# Growth Strategy

4 key pillars



## 4 – D2M

### Innovative 5G applications – making things possible

- World's population becomes more reliant on mobile devices
- Constant satellite connectivity is becoming possible regardless of location
- Race to be the “FIRST CELL TOWER IN SPACE” is ON. This change due to the 5G shift!
- Major players are getting ready: SpaceX, ViaSat/Inmarsat, Iridium, GlobalStar, Lynk Global, AST Space Mobile
- OQ Technology is getting ready also
- Won recently a 300k EUR contract with ESA to study the feasibility of upgrading OQ satellites to address direct-to-mobile.
- We have also passed the European EIC phase 1 tendering for direct-to-smart phone demo mission

Actively getting ready with ESA for demo satellite

Addressing Mobile and Wearable markets

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Commercial

Satellite operator OQ Technology joins direct-to-smartphone bandwagon

Jason Rainbow February 8, 2024

esa ZEN LUXEMBOURG SPACE AGENCY

OQ TECHNOLOGY

# The Case of Direct to Mobile Market



## Specialized Mobile Phones



Photo credit: Iridium 9555 Satellite Phone

## Indirect via Expensive, Complex Hardware



Photo credit: HAWKEYE™ III LITE VSAT

## First & Only Direct Broadband to Mobile Phones

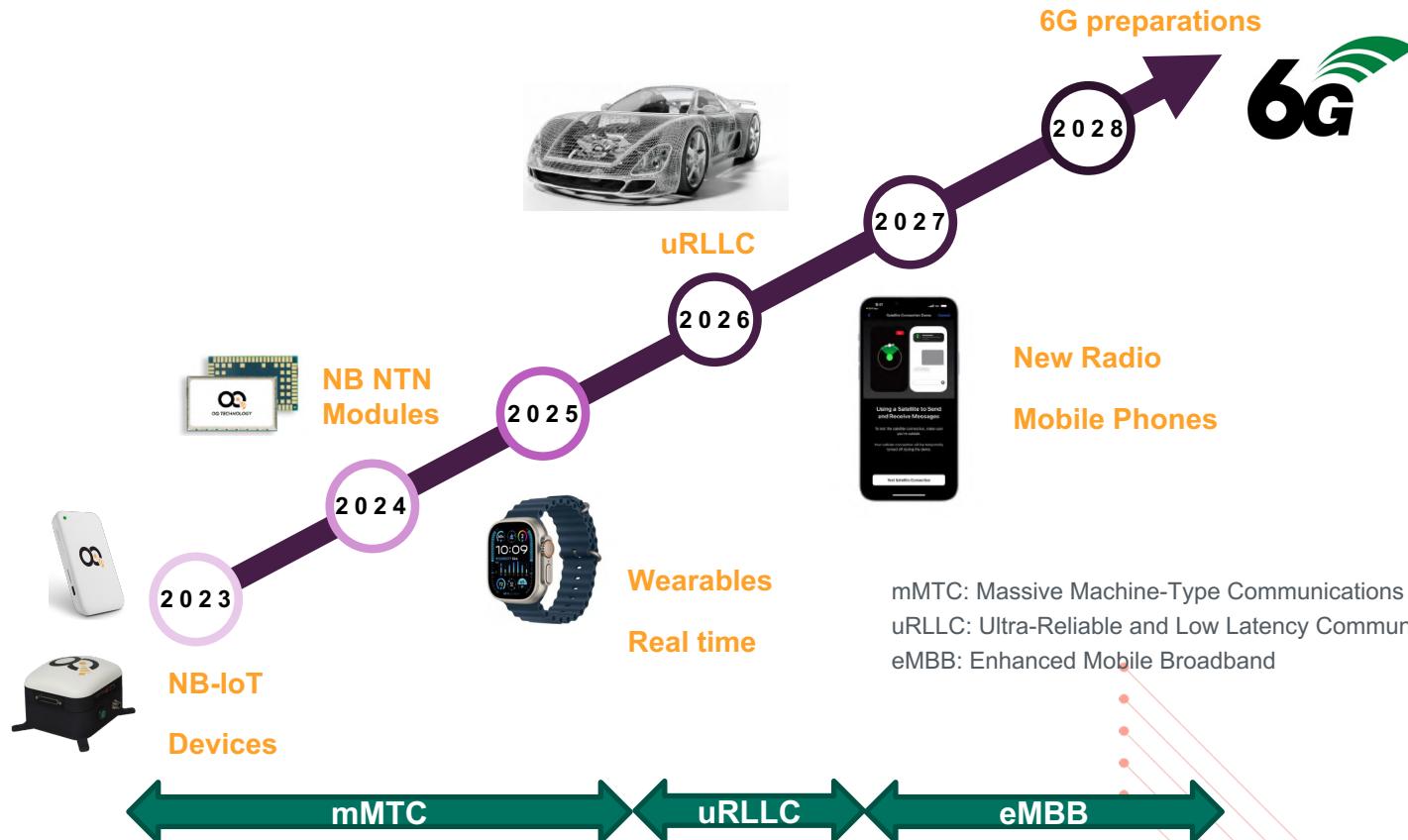


Photo credit: Nokia G42 5G

Providers	Globalstar <sup>+</sup> inmarsat iridium <sup>®</sup>	SES <sup>▲</sup> Viasat <sup>™</sup> OneWeb TELESAT <sup>®</sup> SPACEX iridium <sup>®</sup> amazon   project kuiper	AST SpaceMobile <sup>®</sup> OQ TECHNOLOGY <sup>®</sup> LYNK <sup>®</sup> SPACEX <sup>®</sup> ECHOSTAR <sup>®</sup>
End Users	Narrowband service on satellite phones	Enterprise, Maritime, Aviation, Government, Residential	Mass market mobility and the unconnected
Market Size	< \$1.5 billion revenue	< \$15 billion revenue	> \$1 trillion

# Technology roadmap

Satellite constellation reflecting evolving 3GPP NTN features



# About OQ Technology



Founded in  
2016



HQ in Luxembourg  
KSA, Greece, UAE, Rwanda



Global coverage: 10  
satellites in orbit



International  
partnerships and  
customers



20+ 3GPP  
contributions  
made  
  
One standard  
3GPP – 5G NB-  
IoT / NTN Rel.  
17



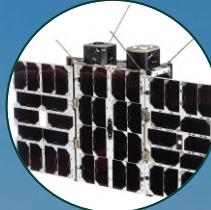
9 Patents granted  
in EU & US



Notified OQ  
own ITU filings  
– Licensed  
spectrum and  
landing rights

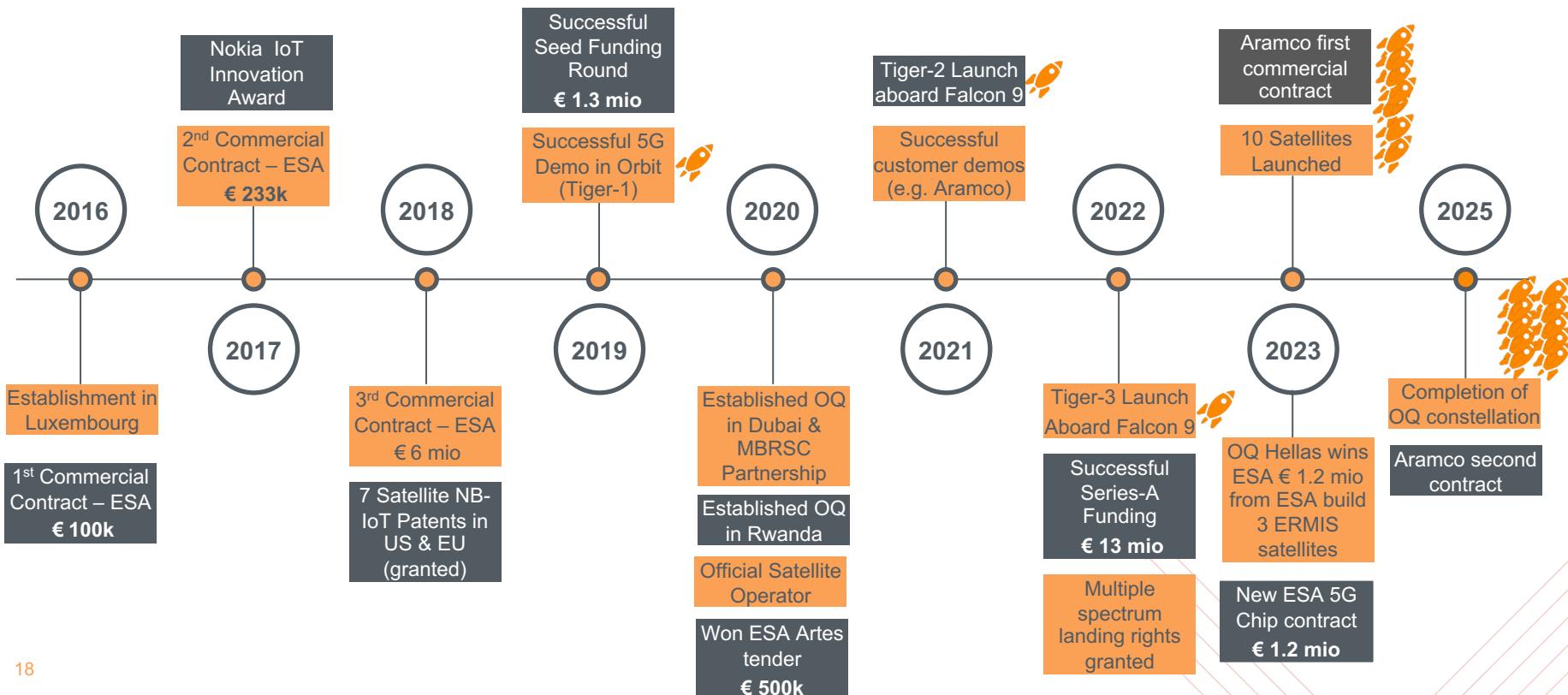


€ 20 Million Funding  
raised up to date



# Journey

The only 5G LEO operator with 10 satellites in orbit by end of 2023 with a successful commercial POC



# Our Leadership Team

30 employees by 2024



Mohammed Al-Muhairi - Investor Co-Founder



Omar Qaise - Founder & CEO



Cyril Dufoing - CTO



Prasanna Nagarajan - CIO



Marwah Naseem – Acting COO



Igor Arias – VP Products



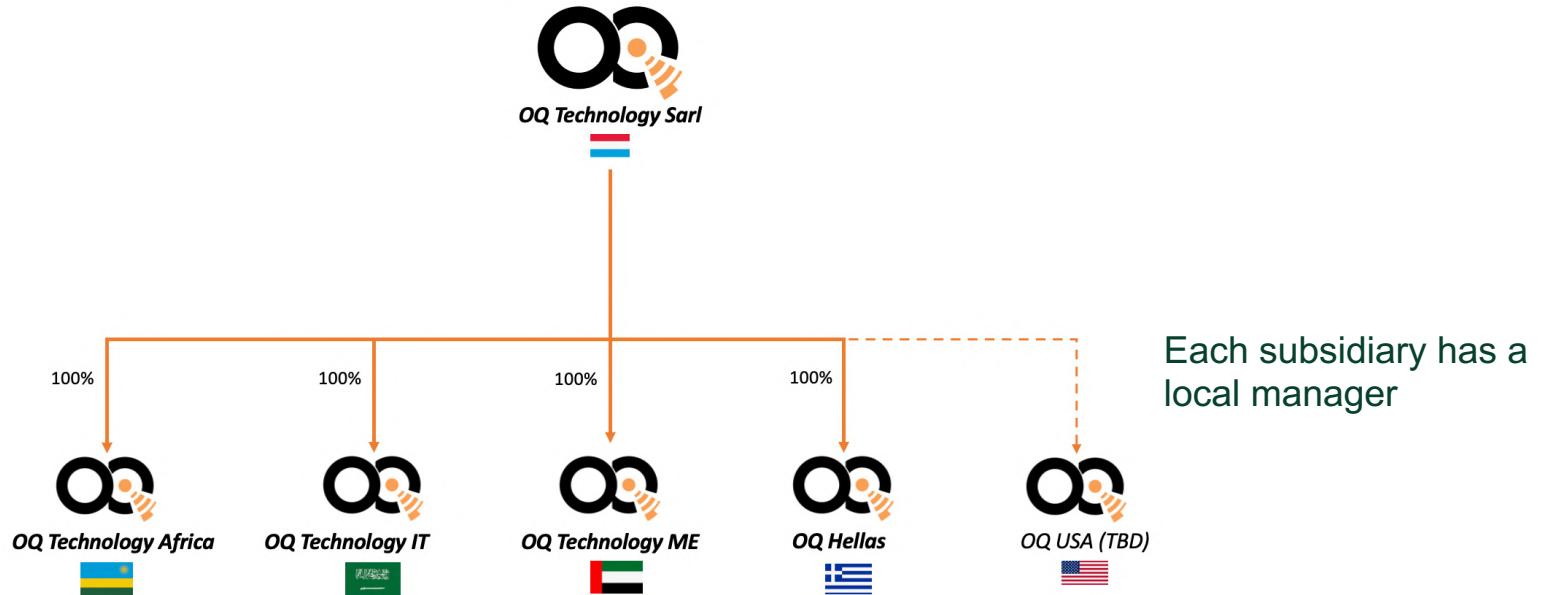
Michael Haller - Finance



CCO – Advance Negotiations



# Company Structure



\* Note: OQ is in the process of opening OQ Technology US

# Partnerships



# Partnership Testimonial

LEO Satellite IoT Case Study: <https://www.cst.gov.sa/en/ntn/Pages/5gnbiot.aspx>

*“ OQ Technology successfully transmitted sensor data, including temperature, humidity, and CO2 emissions, from a remote oil wellhead to Aramco headquarters. OQ is currently establishing a global subsidiary in Saudi Arabia, which will become the only 5G space network operations center in the Middle East ”.*

**Mr. Nabil Al Nuaim** - Aramco's SVP of Digital & Information Technology



وزارة الطاقة  
MINISTRY OF ENERGY



هيئة الاتصالات والفضاء والتكنولوجيا  
Communications, Space & Technology Commission

أرامكو السعودية  
saudi aramco



# Awards and Recognitions

Recognized Leader in the IoT Industry



Winner Nokia Open Innovation Challenge 2017



Mobile Satellite Newspace Award 2024



ARAMCO Space Age 2024 Award



Space Tech Solution of the Year 2021



Middle East Technology Excellence Award 2023



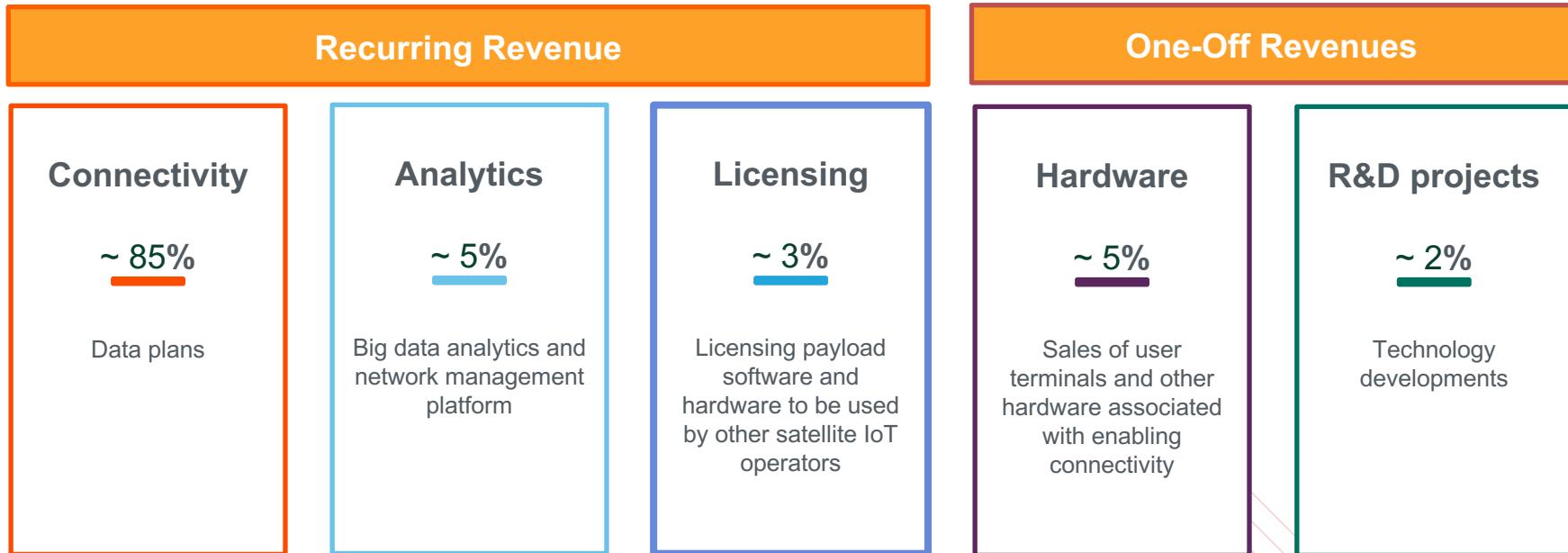
Top 10 Startups in Luxembourg



# Revenue model

Resilient revenue streams primarily based on recurrent subscriptions

OQ derives revenue from multiple streams with forecasted revenues to exceed USD 270 million by 2030



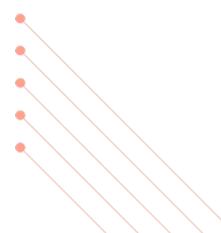
# Financial summary

Strong financial returns underpinned by robust business model and growing markets



- OQ Technology revenues to exceed EUR 270 million by 2030 primarily from recurring connectivity sales from 72 LEO satellites in orbit.
- EBITDA to breakeven by 2025 from the business derived off the current in-orbit fleet of 10 satellites.
- EBITDA margin expected to range between 50% and 60% after the initial launch phase of the constellation, in line with the satellite industry profitability standard

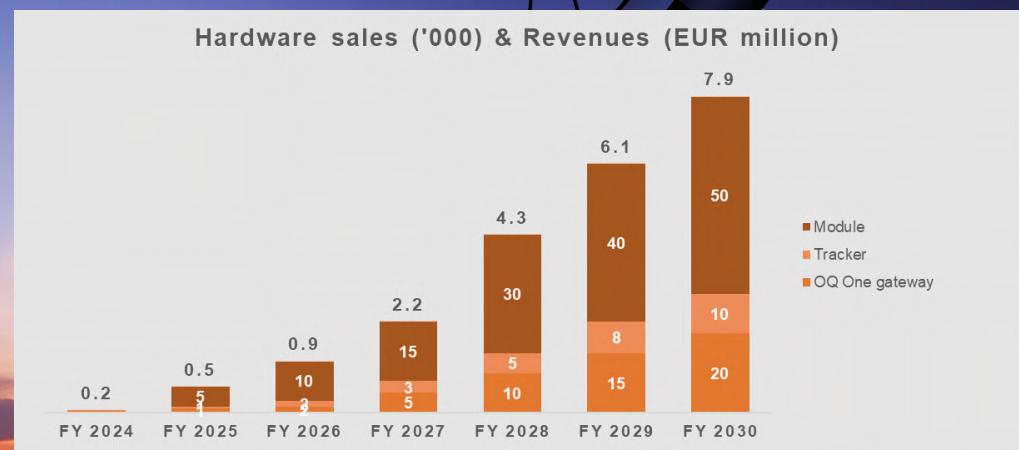
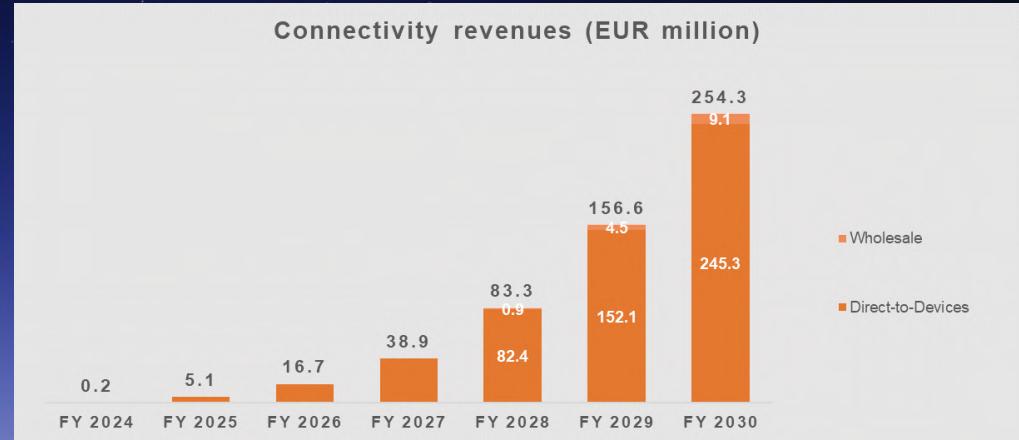
- Cash Flows from operations to be accretive from 2025 onwards and complement the funding of the constellation from Series B investors



# Revenue Forecast

## Sales assumptions

- Connectivity (recurring)
  - Volume-based discount approach
  - Gross margin: from 85% to 90%



# Opex & Capex

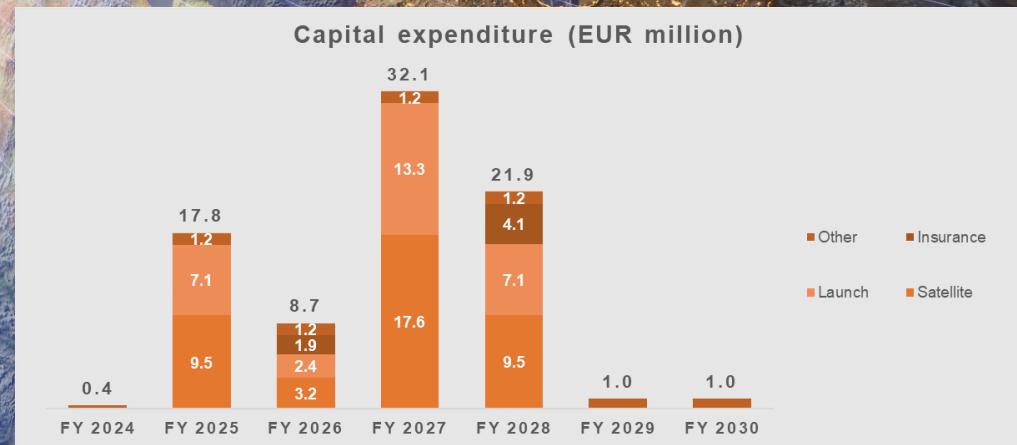
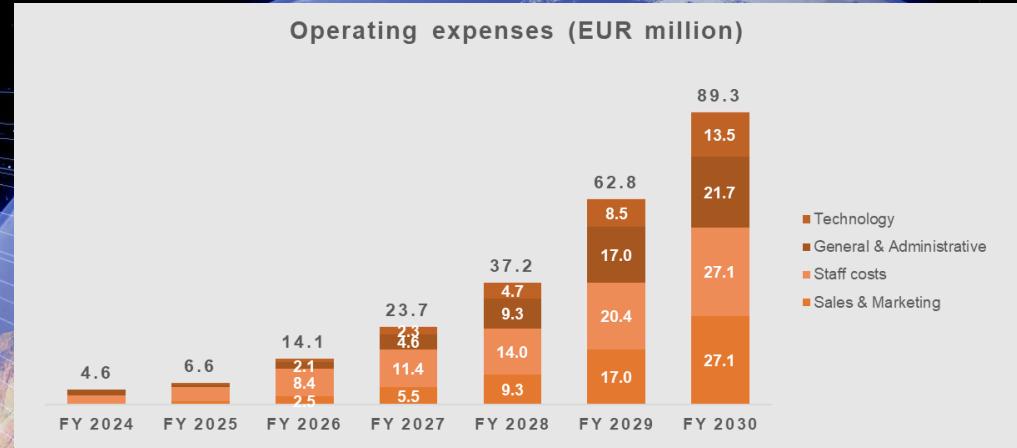
## Opex & Capex assumptions



- Operating expenses
  - Sales & Marketing
  - Staff costs
  - General & Administrative
  - Technology expenses

### Capital expenditures:

- 63 LEO Satellites: 20 to be procured in 2025/6 & 43 to be procured in 2027/8
- Module R&D
- Ground stations
- Other capex



# Income statement

EBITDA breakeven by 2025 & Net Profit breakeven by 2027

in € million	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030
	Actual	Forecast	Budget	Bplan	Bplan	Bplan	Bplan	Bplan	Bplan
<b>Revenues</b>									
Connectivity	-	-	0.2	5.1	16.7	38.9	83.3	156.6	254.3
Hardware	-	0.7	0.2	0.5	0.9	2.2	4.3	6.1	7.9
Other (R&D and ESA projects)	1.2	1.2	2.7	3.0	3.5	4.5	5.5	7.0	8.5
<b>Total</b>	<b>1.2</b>	<b>1.8</b>	<b>3.0</b>	<b>8.6</b>	<b>21.0</b>	<b>45.6</b>	<b>93.0</b>	<b>169.7</b>	<b>270.7</b>
YoY growth %	(31.0)%	+56.4%	+64.2%	+184.7%	+144.2%	+117.0%	+104.1%	+82.4%	+59.5%
Direct costs	(0.8)	(0.5)	(0.5)	(1.7)	(3.5)	(7.7)	(11.4)	(19.9)	(30.3)
Operating expenses	(0.8)	(2.7)	(4.6)	(6.6)	(14.1)	(23.7)	(37.2)	(62.8)	(89.3)
<b>EBITDA</b>	<b>(0.5)</b>	<b>(1.3)</b>	<b>(2.1)</b>	<b>0.2</b>	<b>3.5</b>	<b>14.2</b>	<b>44.4</b>	<b>87.0</b>	<b>151.1</b>
<i>EBITDA margin %</i>	(38.6)%	(72.3)%	(70.3)%	2.8%	16.6%	31.1%	47.7%	51.3%	55.8%
Depreciation & Amortisation	-	(0.6)	(2.1)	(2.8)	(6.4)	(7.4)	(9.4)	(14.8)	(14.4)
<b>EBIT</b>	<b>(0.5)</b>	<b>(1.9)</b>	<b>(4.2)</b>	<b>(2.6)</b>	<b>(2.9)</b>	<b>6.8</b>	<b>35.0</b>	<b>72.2</b>	<b>136.7</b>
<i>EBIT margin %</i>	(38.6)%	(102.2)%	(139.4)%	(30.1)%	(13.7)%	14.9%	37.7%	42.5%	50.5%
Financial Profit / (Loss)	0.0	0.1	0.2	0.2	0.1	0.1	0.2	0.6	1.4
Tax	(0.0)	(0.0)	-	-	-	-	(0.1)	(15.7)	(34.5)
<b>NET PROFIT / (LOSS)</b>	<b>(0.5)</b>	<b>(1.8)</b>	<b>(4.0)</b>	<b>(2.4)</b>	<b>(2.8)</b>	<b>6.9</b>	<b>35.1</b>	<b>57.1</b>	<b>103.6</b>
<i>Net profit / (loss) margin %</i>	(38.6)%	(96.8)%	(133.5)%	(27.5)%	(13.2)%	15.1%	37.8%	33.6%	38.3%

# Cash Flow statement

Operating CF to breakeven by 2025

in € million	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030
	Actual	Forecast	Budget	Bplan	Bplan	Bplan	Bplan	Bplan	Bplan
<b>EBITDA</b>	(0.5)	(1.3)	(2.1)	0.2	3.5	14.2	44.4	87.0	151.1
Change in Working capital	1.1	(0.5)	(0.1)	(0.6)	(0.9)	(1.7)	(4.5)	(6.2)	(9.3)
Financial profit / (loss) excl. loan interests	0.0	0.1	0.2	0.2	0.1	0.1	0.2	0.6	1.4
Tax payments	(0.0)	(0.0)	-	-	-	-	(0.1)	(15.7)	(34.5)
<b>Cash Flows from operations</b>	<b>0.6</b>	<b>(1.7)</b>	<b>(2.1)</b>	<b>(0.1)</b>	<b>2.7</b>	<b>12.6</b>	<b>40.0</b>	<b>65.7</b>	<b>108.7</b>
Capital Expenditure	(1.6)	(5.6)	(1.1)	(17.8)	(8.6)	(32.1)	(21.9)	(1.0)	(1.0)
Cash Flows from investing	(0.8)	-	-	-	-	-	-	-	-
<b>Operational Free Cash Flows (before financing)</b>	<b>(1.7)</b>	<b>(7.3)</b>	<b>(3.2)</b>	<b>(17.9)</b>	<b>(5.9)</b>	<b>(19.5)</b>	<b>18.1</b>	<b>64.7</b>	<b>107.7</b>
<i>Cumulated operational free cash flows</i>	(2.0)	(9.3)	(12.5)	(30.5)	(36.4)	(55.9)	(37.8)	26.9	134.6
<b>Cash Flows from financing</b>	<b>13.0</b>	<b>-</b>	<b>30.0</b>	<b>-</b>	<b>-</b>	<b>20.0</b>	<b>-</b>	<b>-</b>	<b>-</b>
<b>Free Cash Flows</b>	<b>11.3</b>	<b>(7.3)</b>	<b>26.8</b>	<b>(17.9)</b>	<b>(5.9)</b>	<b>0.5</b>	<b>18.1</b>	<b>64.7</b>	<b>107.7</b>
<i>Cumulated free cash flows</i>	11.7	4.4	31.2	13.3	7.3	7.8	25.9	90.6	198.3

# Why invest in OQ Technology?

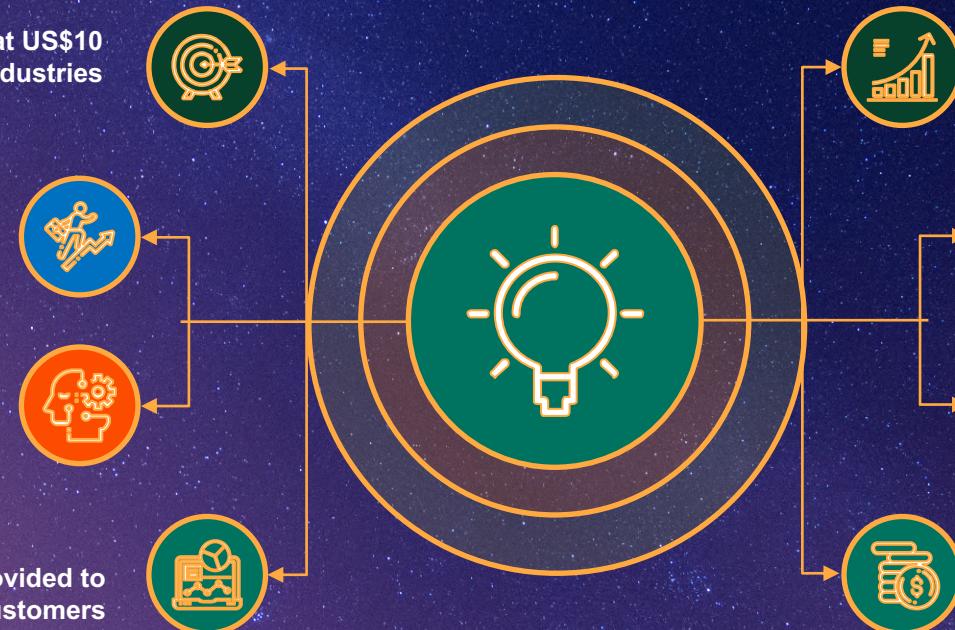
OQ Technology is the First & Only 5G IoT satellite operator with 10 satellites in orbit

Targeted market estimated at US\$10 billion across numerous industries

Expanding commercial deployment with existing customers

Innovative & Unique 5G IoT technologies

End-to-end solutions provided to customers



Strong growth in demand and robust pipeline in progress

First mover advantage supported by unique IP and patents

Low capex requirements vs traditional satellite operators

Strong financial returns

# The Ask

EUR 30 million in equity to fund its constellation and implement its Business Plan

- OQ Technology's strategy is to leverage **its first mover advantage** into the satellite 5G IoT market by being **the only satellite operator** addressing the vast demand for **global real-time 5G IoT connectivity**
- Providing more coverage and connectivity to the potential **1.9 billion 5G IoT devices** requires a LEO constellation of 72 - We would like to add 20 more satellites so we have a total of 30 satellites to unlock new markets and convert more potential pipeline clients to paying customers - 20 more satellites **for an additional Capex of EUR 30 million**\*
- OQ Technology envisages the following funding sources:

EUR 30m

New Private Investors  
& Existing Investors



@oqtec



@oqtechnology



[oqtec.com](http://oqtec.com)



**Thank You**  
**[www.oqtec.com](http://www.oqtec.com)**



# Annex



# Problem / Solution Overview

OQ Technology enables sustainable growth to vital industries



## Problem:

- 80% of the world has no mobile coverage
- Limited sustainable growth for vital sectors such as logistics, energy, agritech and utilities without connectivity

## Solution:

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- Billion of devices can be accommodated on OQ's network with a truly global coverage, no gaps, ultra-low & ultra-reliable latency

### Land Transport and Maritime

- \$54m of lost containers in 2021 only
- 10%-40% per year of global supply chain assets<sup>3</sup> are lost
- Cold chain interruptions result in \$300m of lost vaccines and \$179m of food loss each year in US



### Utilities

- Manual meter reading across Ireland cost \$245m
- \$9B of water is lost in Asia due to unmonitored leaking pipes



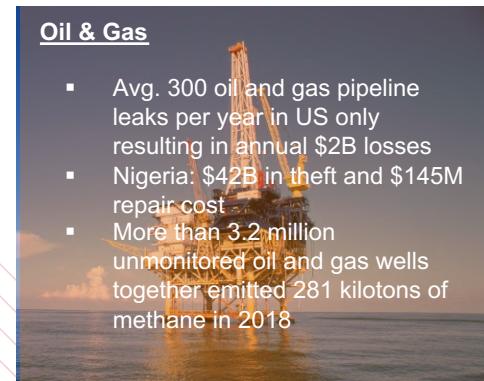
### Agriculture

- 90% of global crop losses are due to weather and lack of predictive measures
- \$225m of untracked cattle theft in the US in 2021



### Oil & Gas

- Avg. 300 oil and gas pipeline leaks per year in US only resulting in annual \$2B losses
- Nigeria: \$42B in theft and \$145M repair cost
- More than 3.2 million unmonitored oil and gas wells together emitted 281 kilotons of methane in 2018



# ESG Enabler

Our satellite IoT applications have a positive impact on ESG programs

## E: Environment

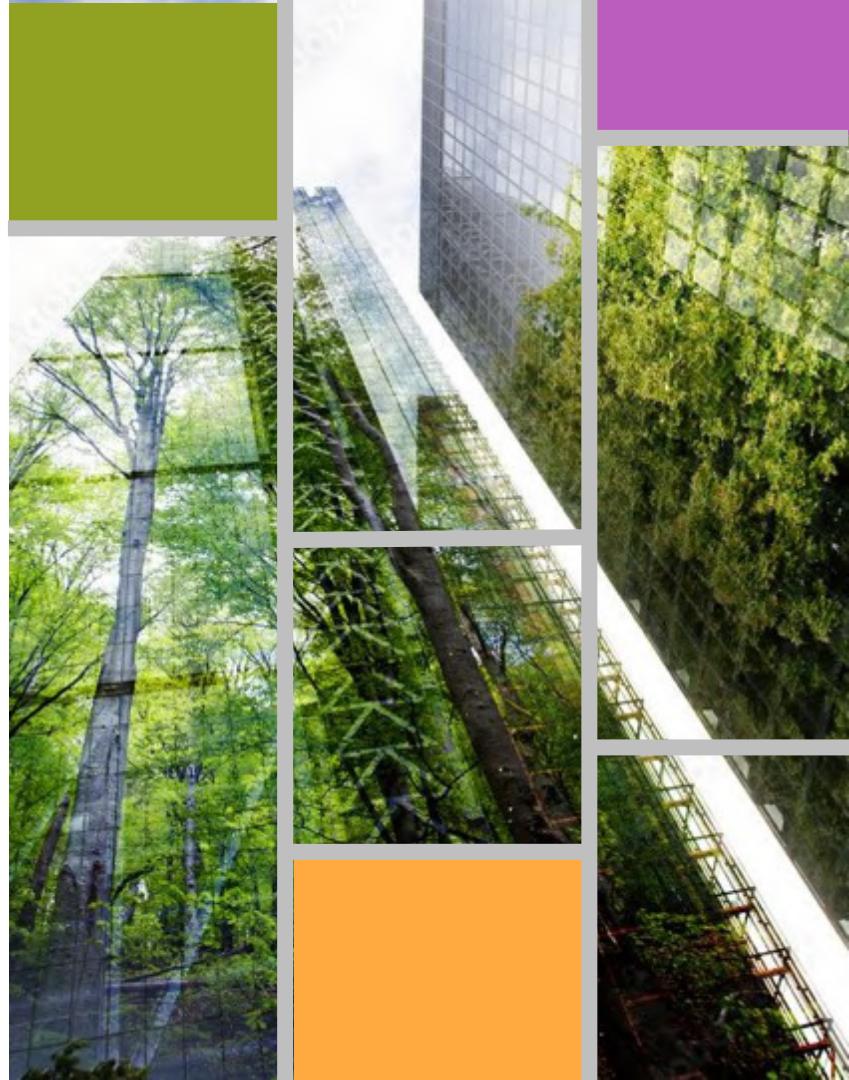
- Better use of resources
- Reduced energy consumption & lower carbon emissions
- Monitoring and conservation efforts

## S: Social

- Improving quality of life
- Enabling diversity and inclusion
- Access to rural areas

## G: Governance

- Gathering important data & set targets
- Real-time data collection and analysis
- Better compliance and governance

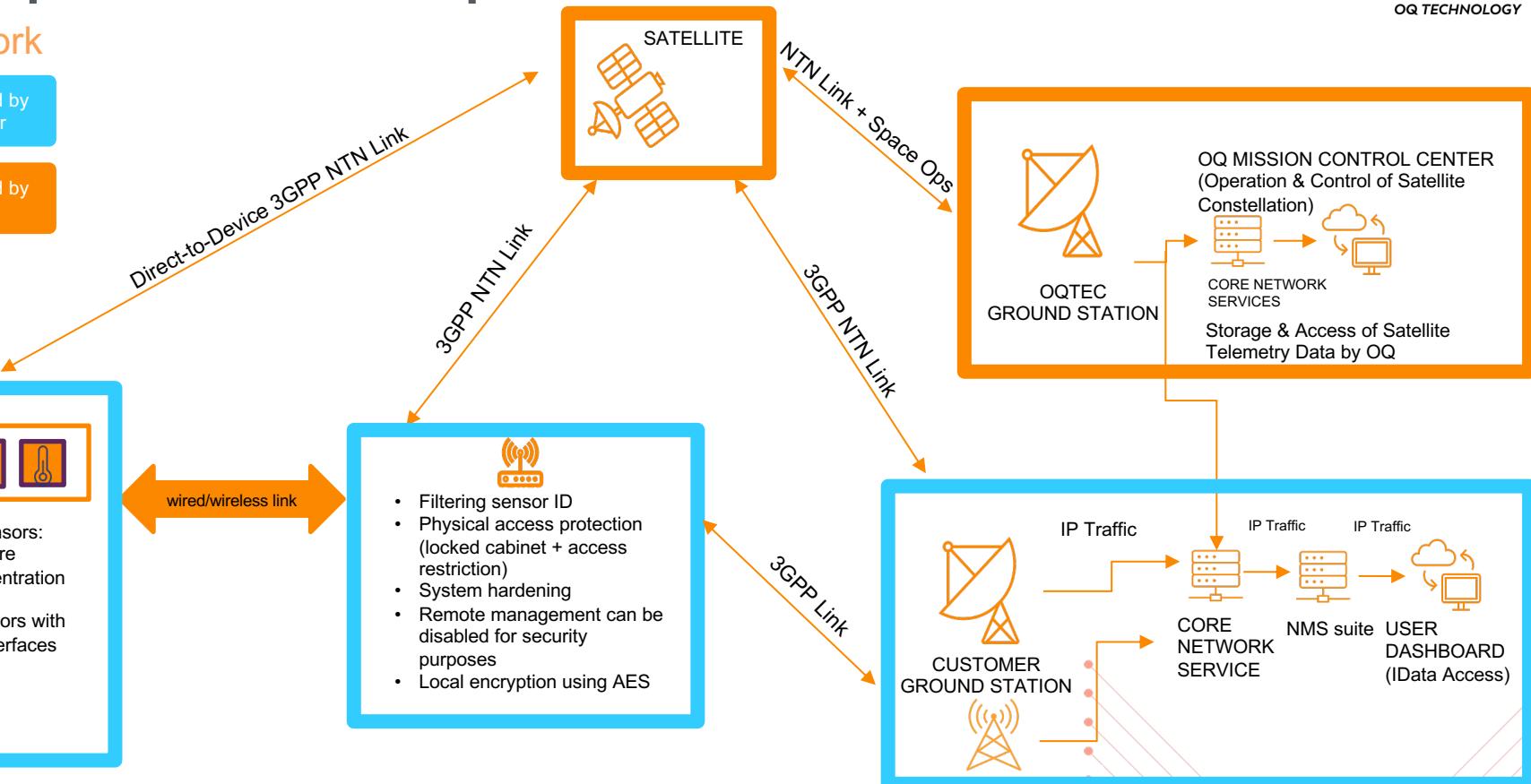


# Example of Network Implementation

## Network

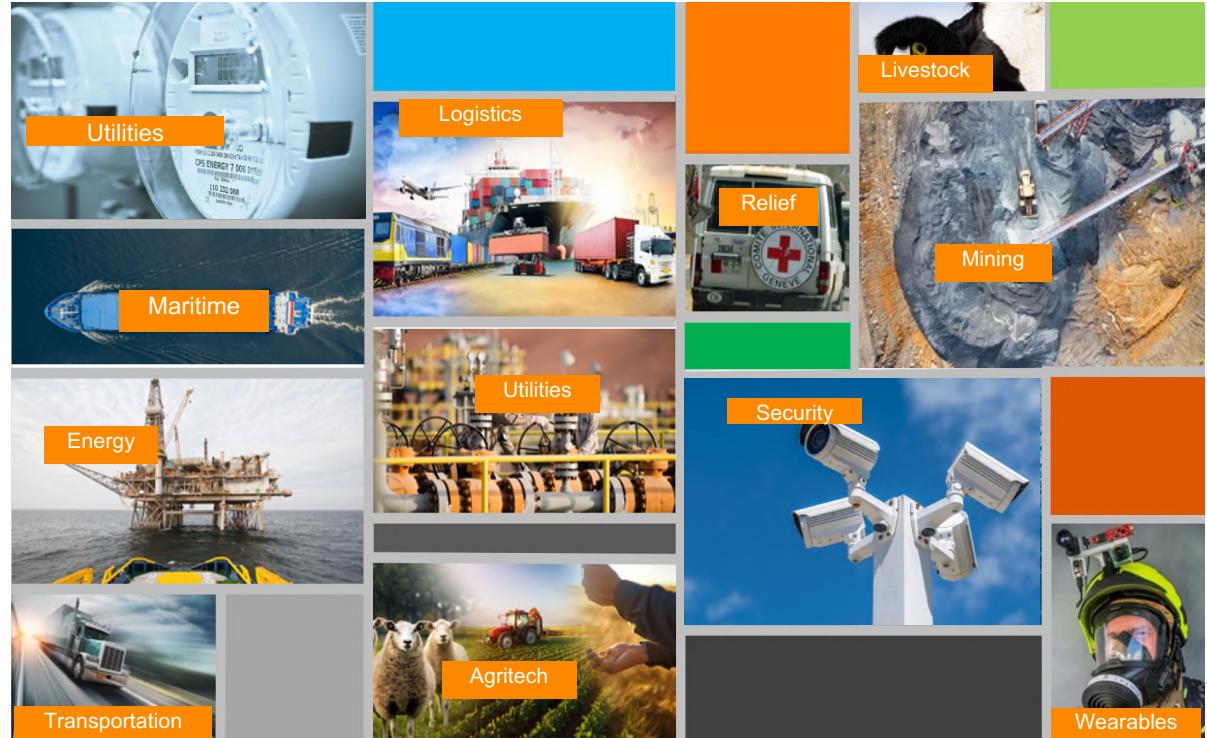
Managed by Customer

Managed by OQTEC



# 1 – 5G IoT – D2D

- Comprehensive IoT services
  - Hardware – SIM activation – Airtime Bundles
- Secure applications
- Industry specific
- Customizations
- Integration
- Direct-To-Device:
  - OQ ONE as a gateway connecting hundreds of sensors
  - Rugged and compact
  - Quick installation
  - Low power consumption
  - Indoor coverage
  - Wide range of data transfers



## 2 – MNOs – MVNOs

### Important enterprise customer base

- Great Market Access
- Complementarity of business and coverage
- Interoperability: Seamless connectivity SAT/Terrestrial – Continuity for customers
- MNOs need to bridge the connectivity gap for their Enterprise customers where they have no coverage
- Contracts & billing
- Simple or no hardware integration requirements
- Leveraging roaming agreements
  - Reciprocal and cross selling opportunities



# 3 - Managed Services

Beyond end-to-end connectivity / Build Your Own IoT Ecosystem



## One Global Network

- A single private network
- Government and Enterprise
- Complete connectivity requirements for existing and upcoming assets
- Closed Secure Network
- Possibility of signal lands directly at customers' gateway or through the cloud

## BLOS – Beyond the Horizon

- Extends your coverage – No Geo Restrictions
- Usage of Satellite / Terrestrial

## Satellites & Ground

- Advanced 5G secure & redundant gateways linked to your own core network

## Products & Services

- State-of-the-art terminals, advances capabilities with NB data, D2D, Dual-Mode, Secure Two-Way Connectivity, OQ Network Management System

## Analytics & Business Continuity

- Reliance on reliable and continuous stream of data for improved decision making

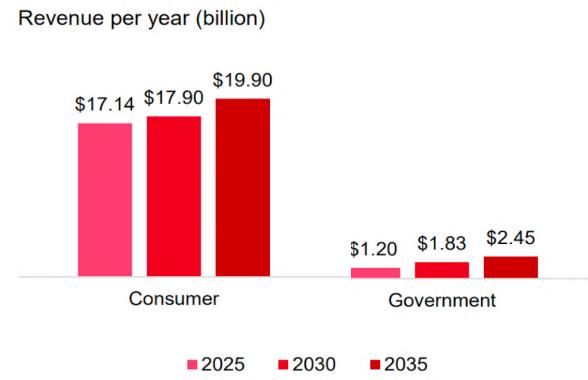


## 4 – D2M

### Innovative 5G applications – making things possible

Actively getting ready with ESA / GEO satellites  
Addressing Mobile and Wearable markets

- World's population becomes more reliant on mobile devices
- Constant satellite connectivity is becoming possible regardless of location
- Race to be the “FIRST CELL TOWER IN SPACE” is ON. This change due to the 5G shift!
- Major players are getting ready: SpaceX, ViaSat/Inmarsat, Iridium, GlobalStar, Lynk Global, AST Space Mobile
- OQ Technology is getting ready also
- Won recently a 300k EUR contract with ESA to study the feasibility of upgrading OQ satellites to address direct-to-mobile



Source: GSMA Intelligence

# LEO VS GEO COMPARISON AND WHY LEO IS BETTER



	OQ Tech	GEO Competitors
Reliability & Service Availability	LEO constellations is composed of large number of satellites, and failure of small number of satellites does not interrupt the service and satellites can be easily.	GEO satellites cover large footprint of Earth and failure of 1 satellites leads to huge service unavailability and it is very expensive and slow to replace GEO satellites (e.g. this year ViaSat & Inmarsat lost 2 GEO satellites leading to massive coverage and subscribers loss).
State of the art technology & Agility	Smallsat with a lifetime of 5 years and lead time less than 1 year, allowing new technologies or HW upgrades to be immediately deployed in the network	GEO have a lifetime of 15 years and a lead time of min. 3 years Technology is outdated before the satellite is launched. The QA process is very long and rigorous and costly, the components are expensive due to the high radiation on outer belts, this leads to an astronomical cost (\$250 million) of a GEO satellite and a launch of \$150 million which is not comparable to a LEO microsatellite (~\$ 650k)
Gateways (hardware)	Low-cost gateways and flexible locations	Expensive gateways located at fixed locations which are defined by the design of the satellite
Gateways (frequencies)	S-band spectrum safe from external threat	Generally operated in C-band, Ku-band or Ka-band. Those frequencies are potentially at risk because of Mobile services taking over
Gateways (flexibility)	Possibility to add customer-owned gateways at any locations	Impossible to add a gateway after the satellite is launched/designed Depending on the satellite design, the gateway might not even be in the country
Up scalability /affordability	Possibility to increase capacity by adding new satellites as the demand increases. Operational costs	GEO are designed for 15-yr lifetime, and satellite capacity has to be sized according the 15-yr market forecast. Mission likely to be over specified (and so service overpriced) for the first several years of operation
Spectrum (Coordination)	Small beams means finer and easier coordination, LEO constellations are dynamic and use multiple orbital planes with small footprints which makes it possible to coordinate spectrum access, apply spectrum re-use for same beam and bandwidth, and mitigate interference even with thousands of satellites.	Radio frequency goes beyond borders. Large beams at risk of shutting down if a country complains, hence putting the whole beam off. All GEO satellites are congested in one orbit (36,000 Km) and each operator has historically occupied slots and frequencies, to change that or introduce new frequency bands requires very long and tedious coordination process (which can take up to 7 years) to manage the slots and interference (since most GEO are satellites will see the interference due to the large footprint) and sometimes operators has no option but to split the spectrum which limits the capacity.

# LEO VS GEO (CONT)



	OQ Tech	GEO Competitors
Spectrum (certainty)	Operates licensed spectrum with own notified ITU filings	Quite often spectrum is accessed through commercial agreement with large operators. If the contract is not renewed or price drastically increased, this might dramatic commercial impacts
Security/jamming/interference	LEO have small beams and are moving. Difficult to jam/intercept – also interference is managed due to small footprint but also the hopping and digital signal processing capability on software radio payloads and upgrading algorithms continuously	GEO have large beams and stay fixed. Easy to intercept/jam - GEO satellites suffer from interference due to the large footprint on Earth and also from neighboring GEO satellites but most importantly from other LEO satellites (e.g. risk for Astrocast and Thuraya), for GEO to operate properly the margins have to be high meaning high power equipment and dishes and also exclusivity to their bandwidth.
In-Orbit Upgrades/Processing	LEO smallsat payloads are using advanced software defined radios which can be upgraded with new software in orbit (including future 5G broadband or 6G technologies or any other update) giving great flexibility and high processing capability	GEO satellites are bent pipe old architecture with limited possibility to implement software defined radio or high processing capability for the signals due to the lack of radiation hardened components or expensive qualification needed for a software radio payload in the GEO orbit which includes high levels of protons and radiation and cosmic ray within the outer Van Allen belts (including MEO orbits too).
Weather Effect	S band is resistive to rain and weather conditions, also no pointing is needed and hence antennas not affected by wind	GEO bands (especially Ka) are very sensitive to rain and weather clouds, also satellite dishes are prone to loss of signal due to movement or wind due to the high accuracy pointing requirement towards the GEO arc.
Launch Opportunities	LEO satellites has a breadth of available launchers and launch windows since it is easier and cheaper to launch into LEO orbit (87 companies globally!)	GTO launch (the path to go to GEO) is very expensive with only handful of large launch providers offering limited slots per year to go to that orbit.

# LEO VS GEO (CONT)

