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Building the Internet of Environmental Sensors

This educational guide introduces the benefits of enabling connectivity as a feature to your environment monitoring products and solutions. It recommends the special considerations to account for when selecting a connectivity choice out of a range of options. Finally, it provides a check list of questions to help you make your final connectivity selection.
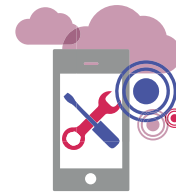
IoT provides policy levers for sustainability and accurate road usage pricing

Environmental monitoring covers a wide range of applications for the IoT. It involves everything from air quality (levels of Carbon Dioxide, Nitrogen Oxides and particulates in urban environment) to water quality and smoke detection when forest fires start. Using IoT environmental sensors for these various applications can take an otherwise labour-intensive process and make it simple and efficient.

After IoT Connectivity

- Supports government policies and incentives for responsible behaviour.
- Adds to richness of data available for insights in adjacent industries such as smart grid and smart cities applications.
- Enables responsible audit and compliance of environmental commitments.
- Opens up public data for societal benefit.
- Fine-tunes road usage pricing based on granular emissions data.

Before the Internet of Environmental Sensors

- Static collection of environmental metrics data; no iterative use of available data.
- Manual compliance activities for meeting environmental commitments.
- Lack of granular data on environment metrics for policy development.
- Absence of a road usage pricing that captures each type of on-road vehicles.

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Adding connectivity as a feature creates revenue opportunities for the value chain

The environment monitoring value chain, from sensor manufacturers to solutions providers to applications service providers, can facilitate end-user benefits by making connectivity a default feature in their products and solutions. As illustrated in **Figure 2**, once connectivity is enabled, everyone on the value chain can move closer to the end customer. Through resultant data about measurements of environmental metrics, each value chain participant including application service providers can offer aftermarket services such as maintenance, upgrades, support and consultancy bundles.

Enabling IoT connectivity benefits everyone on the value chain

Sensor manufacturers differentiate from their peers by simplifying the connectivity decision making for the rest of the value chain.
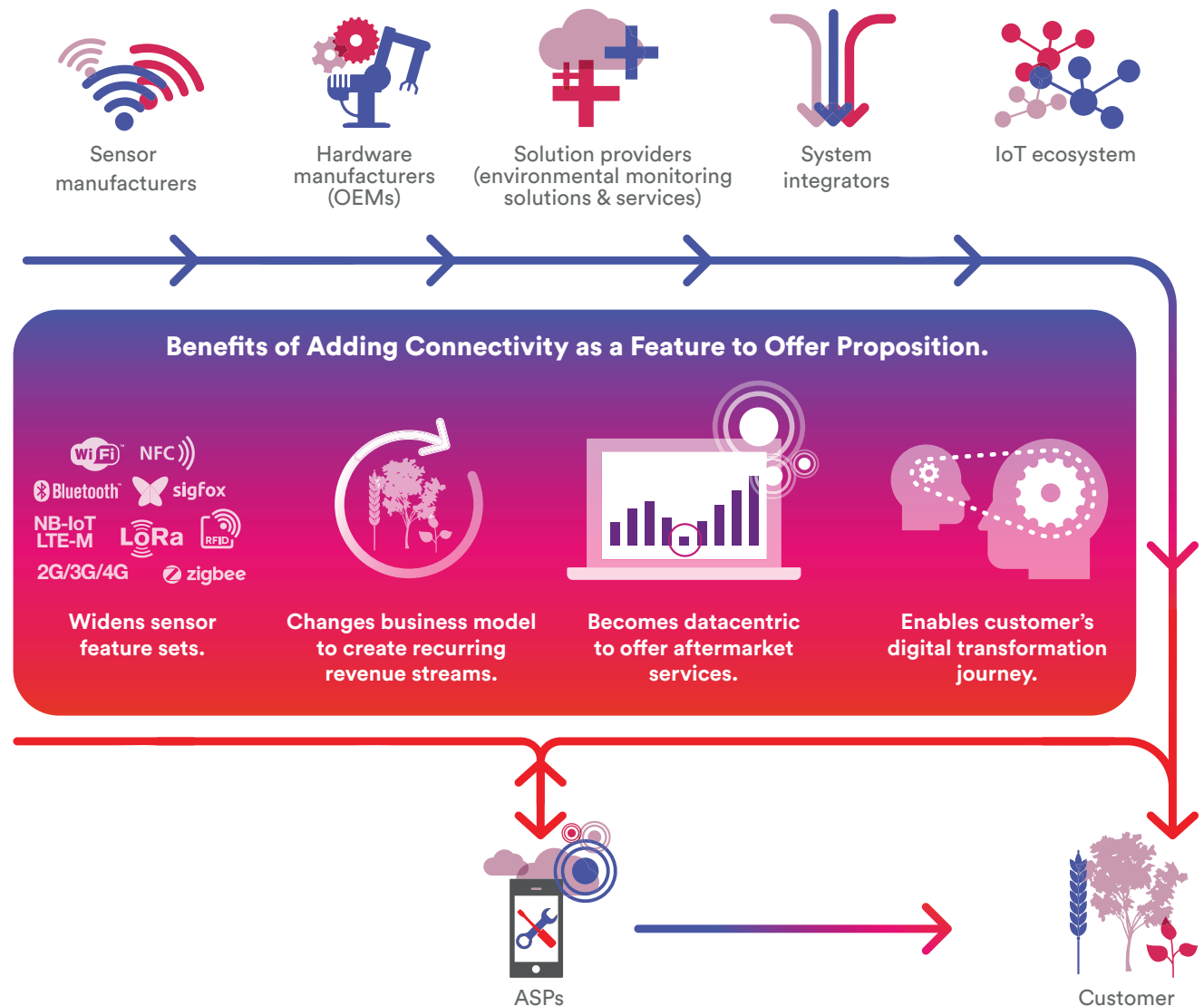
Hardware Manufacturers (OEMs) differentiate from others by offering a connected environment monitoring product from the beginning, simplifying their customers' connectivity decision.

Solution providers (environment monitoring solutions and services) expand their service portfolio by taking on their customers' non-core data centric functions. Once connectivity is enabled, solution providers can help their customers turn environmental data into insights.

System Integrators in their capacity of running digital transformation project have the potential to expand their consultancies to drive new applications derived from having environmental insights.

Application service providers (ASPs) develop new applications for end customers in the industrial vertical through access to aggregated environmental data.

Figure 2. Environment Monitoring Value Chain

Sensor manufacturers → Hardware manufacturers (OEMs) → Solution providers (environmental monitoring solutions & services) → System integrators → IoT ecosystem

Benefits of Adding Connectivity as a Feature to Offer Proposition.

WiFi™ NFC Bluetooth™ sigfox NB-IoT LTE-M LoRa RFID 2G/3G/4G zigbee

Widens sensor feature sets.

Changes business model to create recurring revenue streams.

Becomes datacentric to offer aftermarket services.

Enables customer's digital transformation journey.

ASPs → Customer

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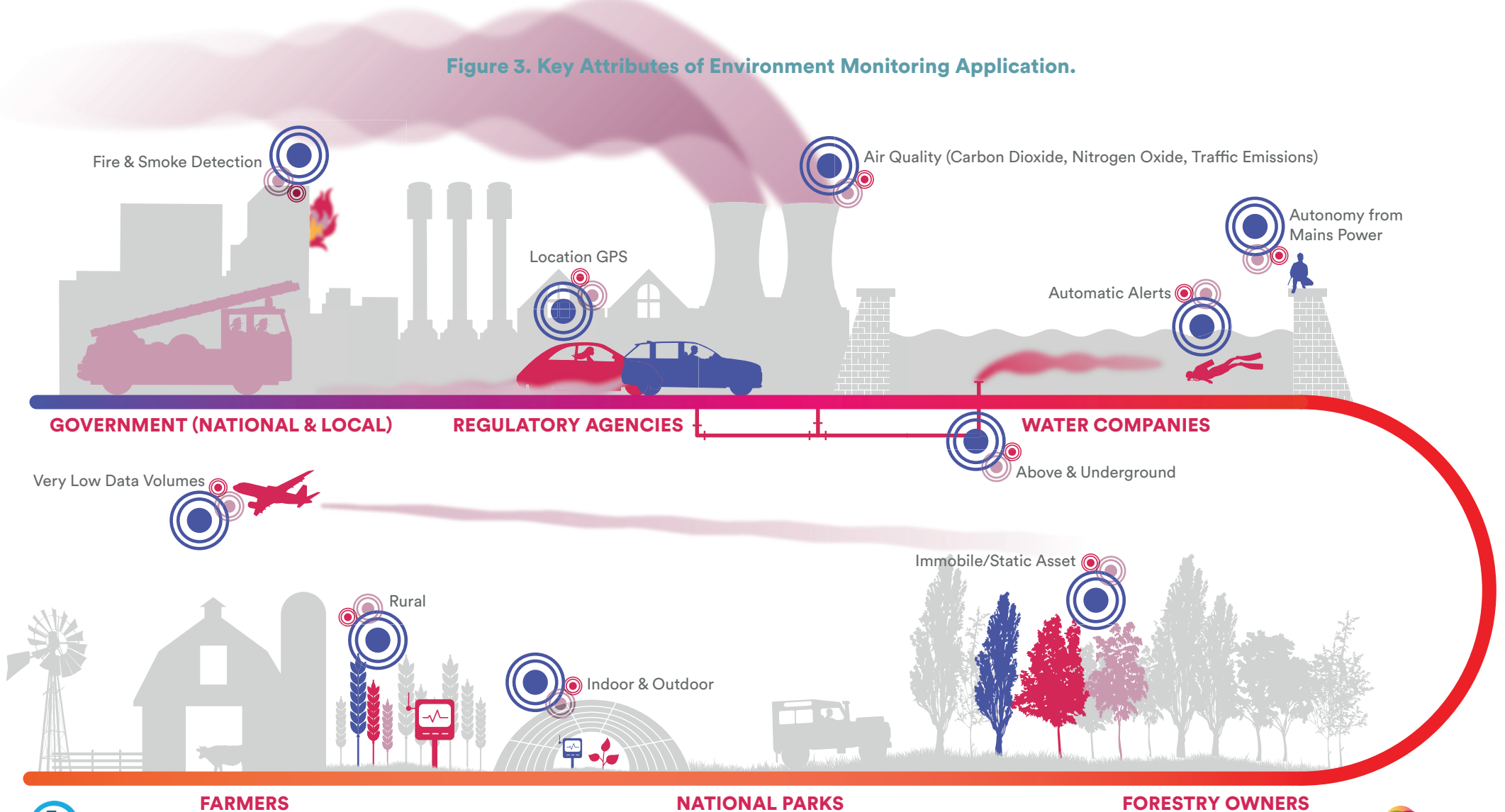br | beecham research
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Understanding the connectivity needs of Environment Monitoring

Environmental monitoring is a relatively under-developed IoT application, limited by the costs and power constraints of the connectivity technology. Low power, wide-area (LPWA) technology is perfectly suited for environmental monitoring, as it can connect devices that need to stay in the field for many years and send small amounts of data over a long range. Some IoT applications need to transmit only tiny amounts of information, an example being a sensor that sends data only if it senses smoke in a forest. **Figure 3** illustrates the diversity of connectivity requirements across different types of environment monitoring deployment in different environments.

Figure 3. Key Attributes of Environment Monitoring Application.

Fire & Smoke Detection

Air Quality (Carbon Dioxide, Nitrogen Oxide, Traffic Emissions)

Autonomy from Mains Power

Location GPS

Automatic Alerts

GOVERNMENT (NATIONAL & LOCAL)

REGULATORY AGENCIES

WATER COMPANIES

Very Low Data Volumes

Above & Underground

Immobile/Static Asset

Rural

Indoor & Outdoor

FARMERS

NATIONAL PARKS

FORESTRY OWNERS

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Environmental Monitoring requires low data rate connectivity access

Transformation opportunities for both end customers in the industry vertical and environment monitoring applications stem from building an internet of environmental sensors. The choice of which connectivity must therefore be made with a view on cost, performance and benefit. There are a variety of connectivity options, from traditional cellular technologies such as 2G/3G and recent ones such as LPWA. There are two groups of LPWA technologies. Those that use unlicensed spectrum such as Sigfox and LoRa and those that use licensed spectrum that is cellular-based such as NB-IoT and LTE-M. The last are part of the 5G roadmap according to the GSM Association, which as a licensed and standardised technology, offer carrier grade connectivity reassurances. **Figure 4** below applies the 7 characteristics of environment monitoring

to 4 types of common connectivity options and illustrates that environment monitoring is best served by NB-IoT in terms of cost, performance and expected benefit. Reading the heatmap vertically, NB-IoT fulfils environment monitoring requirements that the connectivity is suited to handle mission critical communications, the actual data transmitted, in relative cost of environment monitoring solution, be used both indoors vs. outdoors and over and underground, communicate over long distances, to last more than 10 years, and to low power consumption. The heatmap can also be read horizontally. For example, environment monitoring, despite not being a core operational process, has mission critical requirements in certain industry vertical. As such, NB-IoT, 2G and 3G fulfil this requirement by virtue of being offered on a licensed spectrum.

Figure 4: Heatmap of Environmental Monitoring Connectivity Options
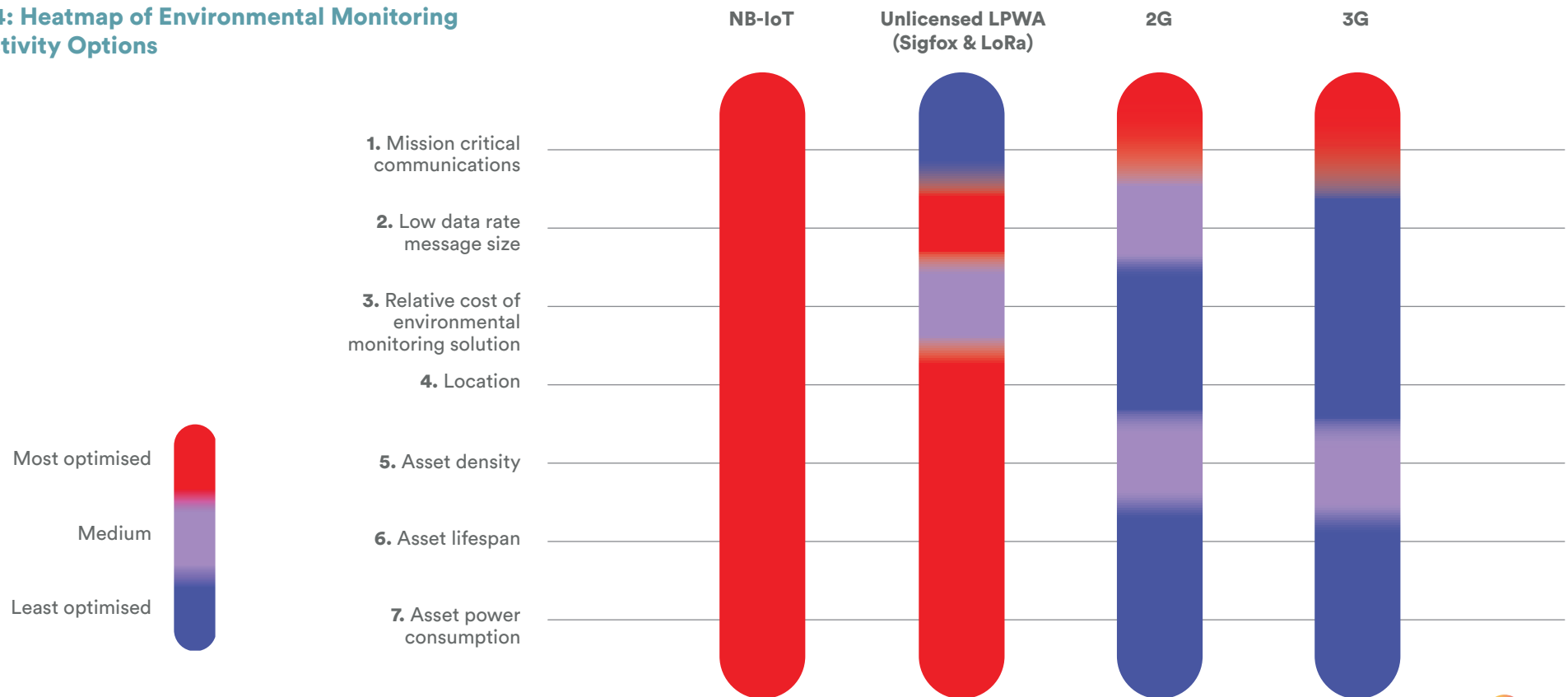
1NCE offers simplicity to the value chain.

1NCE is the first dedicated Tier 1 MVNO providing fast, secure and reliable IoT network connectivity for low data B2B applications. As a native IoT company, 1NCE offers a "connect and forget" connectivity service that is well suited for environment monitoring solution. This convenience gives sensor manufacturers, OEMs, solution providers, system integrators and application service providers an easy addition to their solutions to quickly build the needed revenue stream from their customers. 1NCE offers a predictable cost of connectivity to the value chain via its 1NCE Lifetime fee that covers all relevant costs that occur within the lifespan of the solution; costs such as SIM card, data volume, monthly fees, activation fees, roaming charges and licence fees for using the connectivity management platform to manage and control IoT devices.

Most importantly, 1NCE offers simplicity in terms of making the optimal connectivity decision. It is positioned as expert in low data rate connectivity for IoT, with a simple and compelling commercial offer that applies not only to NB-IoT but also to 2G and 3G technologies, and which assists in the transition from these older technologies to NB-IoT as required.

Check list for making connectivity decision.

Environment monitoring has its unique characteristics that make the selection of connectivity skewed towards LPWA networks. NB-IoT is optimal in terms of function, cost and benefit, especially as it is optimised to connect stationary or slow-moving things on reliable and secure licensed networks. 1NCE recommends making these 7 connectivity characteristics as a check list to guide you in making the right connectivity decision.

Figure 5: Checklist for Choosing Connectivity Access

5

Asset density

Will the asset be located within a high or low density area?

6

Asset lifespan

What is the asset lifespan? Less than 2 years, 2-5 years, 5-10 years, more than 10 years.

7

Asset power consumption

Does the asset have an independent power source that makes power consumption relative to the asset's lifespan critical?

4

Location

Where will the asset be located; indoor vs. outdoor, rural vs. city, above vs. underground.

1

2

3

Mission critical Communications

Does the application have mission critical requirements that require licensed and standardised connectivity assurances?

Low data rate message size

How big is the message expected to be?

Relative cost of environment monitoring solution

Is the connectivity cost a negligible proportion of the total application solution?

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Learn more about 1NCE Connectivity Solutions. Get in touch! info@1nce.com

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