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Critical communications for oil and gas

The oil and gas industry is turning to digitalization to develop more efficient ways to reach and transform hydrocarbons. For energy operators, a move to the digital era will bring new opportunities to reduce the cost and risk involved in developing hydrocarbon sources in remote and hazardous environments. To seize these opportunities, energy operators need communications solutions that can enhance operations and safety, reduce costs, and manage risk more effectively.

Nokia's communication solutions provide Oil and Gas networks, platforms and applications for the critical connection to reach natural resources more efficiently and safely. Backed by our advanced technical expertise in all-IP, ultra-broadband networks, and LTE connectivity, this secure and reliable network solution transforms your existing environment into a foundation for re-invention and innovation. With Nokia critical connections, you can adhere to stringent regulations, keep workers safe, and stand out in a highly competitive marketplace.

Energy consumption on the rise

The United States Energy Information Administration (EIA) projects that global energy consumption will grow 48 percent between 2012 and 2040. It also projects dramatic increases in the consumption of liquid fuels (34 percent more) and natural gas (69 percent more), spurred on by demand in developing countries such as China and India.

The world's relentless thirst for energy represents an immense business opportunity. But the opportunity comes in an increasingly difficult business environment. Regulators are closely scrutinizing deep-sea drilling, long-distance pipeline, and tar sands mining operations. At the same time, political unrest, expanding refinery capacity, volatile commodity markets, and the end of "easy oil" are inspiring fierce competition and driving costs higher. All of these factors are pushing hydrocarbon exploration into remote and hostile environments that prevent easy extraction and make it harder to control costs, and maintain security and safety.

The challenge intensifies with remote projects that have to be managed locally and supervised centrally. Use of sensors, SCADA, and other distributed control systems can support remote monitoring and automate critical processes. But the skills required to identify, develop, and manage new reservoirs remain scarce and need to be shared more extensively.

How can you maximize production and meet booming demand in this complex climate? The key is to develop new business and operational models that can minimize risk and safeguard your personnel and operations. Solutions that simplify communications can remove cost and complexity and clear your path to greater efficiency, safety, and geographic reach.

Figure ES-1. World energy consumption by country grouping, 2012-40
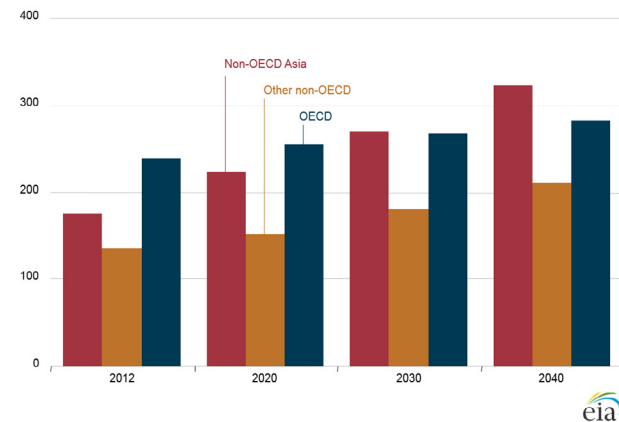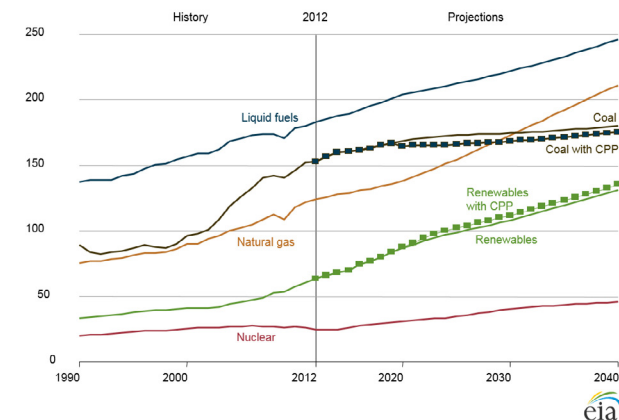quadrillion Btu

Figure ES-2. Total world energy consumption by energy source, 1990-2040
quadrillion Btu

Source: eia

The crucial role of communications in oil and gas

A new era has dawned in the oil and gas industry. Many companies are transforming their operations with digital communications technologies that bring sophisticated automation, remote monitoring, and real-time asset management to the oil field. These technologies offer the potential to accelerate productivity and reservoir recovery, improve operational efficiency, and provide superior protection for physical sites, computer systems, and workers.

To take advantage of these technologies, you need an advanced communications infrastructure that can:

- **Converge** network silos to create one resilient, cost-effective, multi-service, and QoS-enabled network. A converged network can significantly reduce your capital and operating expenses. It can also help you prioritize critical applications and ensure that they are always available.

- **Enhance** performance by providing a multipath diverse network topology and hardware proven in harsh environments

- **Enable** you to reduce onsite staff and speed up decision-making processes by facilitating collaboration between remote front-line workers and central office experts

- **Safeguard** your staff, facilities and network by integrating systems that support capabilities such as IP-based video surveillance (CCTV), perimeter intrusion detection, access control / personnel on board, public address and general alarm (PAGA), emergency communications and message broadcasting, and environmental monitoring

Nokia communications solutions for Oil and Gas gives you these capabilities. It enables you to support onshore & offshore upstream operations as well as downstream operations that include mobile communications with next generation operational systems and real-time applications that run on a single secure end-to-end private LTE and IP/MPLS network. Offering performance proven in multivendor environments, Nokia communication solutions enable the critical connection for you to reach natural resources more efficiently and safely.

More efficiently
Enhancing hydrocarbons delivery and quality

Efficiency is critical to success when you are working to manage engineering challenges, market pressures, and operations in demanding locations. Your success will grow if you can increase the speed at which you identify, access, and transport hydrocarbons.

Production efficiency, energy management, and standards compliance will become even more important as you move production to remote and hazardous locations. As you expand your operations, you will rely more on automation achieved through sensors, SCADA, and other distributed control systems. These systems must support your critical processes and allow you to deploy fewer staff on site and shift decision making to the central control room.

Nokia communication solutions for Oil and Gas lets you drive this shift by deploying real-time data collection, management, and analytics capabilities at the front line. It enables you to facilitate employee collaboration and speed critical decision-making processes by extending high-quality video communications and seamless high-data-rate connectivity across dispersed field and central office sites. It also helps you empower remote workers with wireless technologies that bring office tools and secure corporate data server access to the field.

With Nokia communication solutions, you get resilient real-time solutions that maximize availability for all critical applications. These solutions can preserve connectivity in multi-fault or disaster scenarios by providing multi-task and multi-path diversity in the network topology. Together, they offer an end-to-end infrastructure that supports powerful and flexible IP-based fixed and mobile applications, including SCADA for pipelines and wellheads, VoIP, and full 4G broadband radio network convergence. This infrastructure is built on highly disciplined systems engineering methodologies. It can be customized to address your unique needs and clear your path to future upgrades.

Dynamic bandwidth adjustment (QoS) is a key feature of critical connections with a Nokia communication solutions. It enables you to maximize the value of assets and prioritize real-time data streams for critical safety applications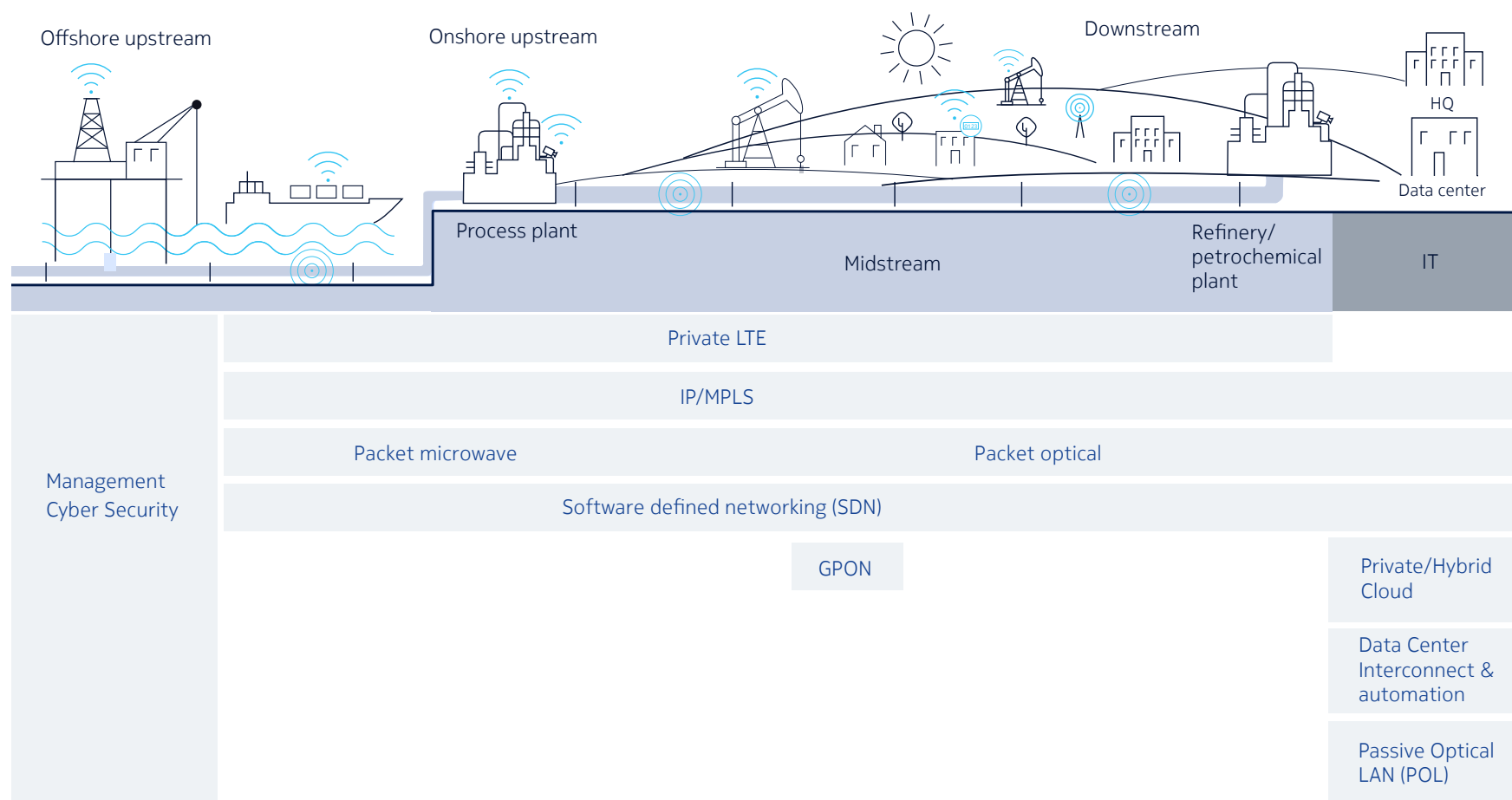. It can also enable you to address anomalies relating to pressure gradients, earthquakes, tsunamis, severe weather events, or leaks and spills in far-flung well and pipeline environments. Using dynamic bandwidth adjustment, you can recover hydrocarbons and reduce downtime more efficiently.

Nokia solution critical connections increases your speed and efficiency by extending ubiquitous, end-to-end real-time monitoring and supervision capabilities across all your operations. These capabilities reduce diagnostic time and allow you to respond to safety, security, and critical operational events more quickly and effectively.

"Migrating to all-IP is a significant part of our next-generation network, which will enable us to better manage our piping infrastructure to ensure more reliability, safety, and cost efficiency.

The Nokia IP/MPLS solution plays a key role in our strategy, which includes continued service delivery improvement as well as support for critical applications such as Supervisory Control and Data Acquisition (SCADA)."

Orlando Spencer, Project Manager and Communications Architect for Washington Gas

Reducing OPEX to speed profits

Like all oil and gas companies, you face considerable pressure to deliver fuel and shareholder returns as quickly as possible. You have to make sure your operations run at peak speed and efficiency at all times.

Traffic generated by SCADA, Terrestrial Trunk Radio (TETRA) /LMR, IT, and security applications is carried over separate TDM networks, each of which has a static bandwidth allocation. This separation requires you to support multiple types of cabling and platforms for each new project, keep a variety of spare systems, and ensure that engineers are trained to use them. What's more, your legacy TDM and SDH/SONET solutions are nearing end-of-life. To remain profitable, you need a network architecture that can help you simplify cabling and platform requirements, support legacy applications, and be ready for new IP- and Ethernet-based applications for digitalization.

Nokia communication solutions helps you reduce CAPEX and OPEX by minimizing the types of cabling and platforms you need for new projects. It offers a converged architecture that

makes it easy to migrate aging and diverse networks to a single cost-effective, multi-service, QoS-enabled network. You can further extend this network to remote sites and workers with industry standard broadband wireless to form the communications foundation for digitalization. In addition, it offers an integrated service-aware management solution that can enable you to efficiently monitor and control all network systems in real time. With Nokia communication solutions you can:

- Integrate legacy communication applications on layer 1 and layer 2 and move to a converged all-IP multi-service network

- Migrate TDM- and IP-based process control traffic — for example, traffic from SCADA, sensors, and monitors — to a QoS-enabled network

- Get a comprehensive view of the network and take control of key network components in real time

- Effectively extend secure, reliable broadband communications for real-time information flow to remote sites and workers for greater automation

Private LTE + IP/MPLS Network

Long Term Evolution (LTE) enables oil and gas operators to build an industry standards-based broadband, non-line of sight (LOS) wireless networks that extend the reach of communications for exploration, transportation, and production. LTE provides broadband speeds with QoS management capabilities that enable real-time communications for critical monitoring, control and automation. It offers a reliable broadband radio access network that can support the bandwidth intensive video and data applications needed to improve the efficiency of upstream, midstream, and downstream operations, and mobile edge computing for low latency data processing at edge for automation.

IP/MPLS enables gas and oil operators to build versatile, service-aware networks for individual applications with assured privacy, security, and reliability with its virtual private network (VPN) capabilities. It consolidates all applications into a single converged architecture that provides the high QoS needed for critical applications, such as SCADA, land mobile radio (LMR), and video surveillance. IP/MPLS is the ideal complement to LTE since it VPN capabilities can be extended over an LTE wireless broadband network while preserving its QoS, security and management capabilities. This consistent service and management environment across the entire network simplifies operations and optimizes cost.

Improve operations and living conditions

Oil and gas companies are reaching farther than ever before in the quest for hydrocarbons. To keep up with demand, you may have to manage new risk created by construction, drilling, and pipeline operations that span thousands of kilometers or miles. No matter how far you reach, you need to ensure that you provide comfortable and convenient working and living conditions for your valued remote-site workers.

Enhance remote operations capabilities

Critical applications become even more important when operations span great distances and reach into remote and challenging locations. Reliability and 24/7 real-time supervision are essential. To maintain productivity and control operating costs you need the ability to monitor and manage remote equipment, alarms, events, and field personnel.

Nokia private LTE and IP/MPLS communication solution for Oil and Gas simplifies remote operations by enabling you to:

- Monitor and troubleshoot remote and hard-to-access wellheads, pipelines, and other collection points with high-definition network-based video monitoring applications

- Interpret and correlate the constant flow of data coming from numerous sources

- Gather logs and respond effectively to alarms and events generated by systems in different locations

With Nokia communication solutions, you get expertise and technologies that can take your operations farther and into more remote environments. You get best-in-class planning, deployment and management services supported by experts in critical applications, QoS requirements, and carrier-grade network design. And you get an easily and rapidly deployable network that combines products packaged for long-term operation in the field. The result is a powerful, intelligent solution that extends your on- and off-shore reach while allowing you to operate with greater reliability and lower risk.

To rapidly and securely extend communications to new sites that are not reachable with your current network, software defined networking (SDN) is utilized. This simplifies and automates service turn-up while adhering to a consistent policy and operation model regardless of the site access method – carrier commercial service, Internet, satellite, etc.

Employee satisfaction and productivity

You make extraordinary demands of your onsite workers and put critical operations in their hands. It's important to ensure that these workers remain comfortable and productive. Good working and living conditions are crucial to stable production and supply from distant locations. They can also help you recruit and retain highly skilled employees.

Cutting-edge communications, information, and entertainment services can make workers' jobs and lives simpler. Nokia communication solutions lets you bring the broadband experience to the oil field by combining the speed and flexibility of an IP/MPLS network with solutions that support commercial-grade triple-play (video, Internet, telephony) and customized multimedia services. This combination ensures that workers in even the most remote locations can work more efficiently, enjoy higher-quality entertainment, and stay in touch with friends and family. The end result is a more satisfied and productive workforce.

Superior connectivity and communications make it easier for field personnel to share data. These information exchanges link remote oil and gas sites to the outside world. They also streamline processes, maintenance, and operations, all of which help you save time and cost. Broadband access helps you extend home-quality entertainment and convenience to workers through applications such as video on demand, personal video communications, and telemedicine capabilities. These capabilities can be supported using Gigabit Passive Optical Network (GPON) technology and a single fiber that extends from the main facility to the accommodation village.

The local area network (LAN) within a building or campus is the central nervous system of the organization that speeds decision making, connects employees and supports access to systems and business processes. Nokia Passive Optical LAN (POL) solution brings your LAN up to light speed. It uses fiber-optic cable instead of copper and the GPON transmission protocol.

POL out performs Ethernet in all the key criteria: capacity, military-grade security, carrier-grade reliability, and longevity with solutions up to 50% cheaper. It effortlessly supports the growing number of large files and data-heavy applications with increasing digitalization such video conferencing, 3D design and digital image processing.

Good working and living conditions are crucial to stable production and supply from distant locations.

More safely
Guaranteeing safety and security

Safety and security are top concerns for oil and gas companies with assets spread around the world. The concern is especially great for facilities in geographically challenging or politically unstable locations. You may worry about human threats like cyber attacks, theft, and vandalism. You may worry about environment- or product-related risks that threaten the health and safety of your field personnel. Or you may be concerned about a host of other geographical, economic, or political issues that could put your operations at risk.

To protect against these threats, you need a service-aware communications network that can safeguard your people, assets, and data. The network must support legacy and new applications while preserving availability and security. It must be reliable and resistant to cyber attacks and support control and surveillance subsystems. It must ensure interoperability and compliance with industry and regulatory standards. And it must offer dependable and secure voice and data communications to support security systems that protect your workforce and assets.

Cyber threats are causing companies in all sectors to re-examine the security of their data and operations. The oil and gas industry faces additional risks: a devastating cyber attack could result in physical damage or even loss of life. Oil and gas companies responding to the PWC global state of information security survey 2017 reported an average of 7,432 security incidents per year. Oil field services reported more than double this sum.

Nokia communication solutions for Oil and Gas secures and protects your operations connectivity that spans pipelines, onshore plants, and off-shore assets to support capabilities including:

- IP-based video surveillance (CCTV) with intelligent video analysis

- Perimeter intrusion detection

- Access control and personnel on board

- Public address and general alarm (PAGA)

- Emergency communication and message broadcast

- Environmental monitoring

- Comprehensive physical security systems

To protect the network and data, Nokia communication solutions offer a flexible and robust network architecture with a multi-layered approach to security management spanning multi-vendor & multi-technology IT and OT environments. This solution includes:

- Single sign-on capabilities for network wide attribute and role based identity management

- Multi-layer encryption solution to maintain data confidentiality and authentication

- Network based anti-malware solution that actively monitors and detects malware, and then minimizes its impact

- Centralized configuration, monitoring and analysis for multi-vendor networks

- Ability to audit and analyze all parameters in physical and virtual networks to preserve data integrity

This solution is designed to work with deployed security point products.

Nokia communication solutions for oil and gas

Emerging Internet of Things (IoT) technologies and applications offer oil and gas companies new capabilities to extract hydrocarbons more efficiently and safely. This is accompanied by a growing number of IP-based mobile IoT devices that drive a new set of communications needs.

You need a trusted partner to bring advanced digital communications to the oil field. As a global leader in all-IP and ultra-broadband, Nokia offers end-to-end expertise that spans all aspects of transformation, from feasibility studies, conception, and design to engineering, procurement, supply, implementation, operation, and maintenance. Our solutions are proven to work with products from leading manufacturers. We provide a broad range of best-of-breed offerings, including:

- An end-to-end private broadband wireless LTE network for data and video along with industry standard 3GPP voice features for converge of TETRA/LMR traffic. Mobile Edge Computing (MEC) is used for low latency data processing at network edge and MulteFire and Wi-Fi technologies for solutions using unlicensed spectrum in areas with a low risk of interference.

- A converged, multiservice, critical wide area network (WAN) composed of IP/MPLS, packet microwave, and packet optical equipment

- Software defined networking (SDN) for automated, dynamic and secure service turn-up

- Comprehensive security management spanning multi-vendor & multi-technology IT and OT environments

- Network management with end-to-end visibility to optimize network performance and simplify daily operations

- Next generation secure, high capacity LAN based on POL technology for buildings and campus

- Broadband network based on GPON, IP/MPLS and fiber for information and entertainment services at village accommodations

Our offerings are ready to be integrated with the following subsystems:

- SCADA

- CCTV and physical security

- Navigational aids, meteorological instruments and entertainment systems

- Operations control center, including network operations center, integrated network management system, security management, tailored application server, and production and transmission control center capabilities

- New IoT devices and applications

- Corporate communications that span the LAN, mobility, unified communications, telephony, and multimedia conferencing technologies

Nokia communication solutions for Oil and Gas combines our extensive local knowledge with our strategic global presence. We augment its technology base with rigorous detailed documentation and proven engineering and management to ensure alignment with corporate best practices, monitoring and quality standards, and approved equipment lists. We comply with local, regional, and national regulatory requirements and provide comprehensive security and reliability auditing.

Nokia is a trusted digital transformation partner to oil and gas operators, engineering, procurement and construction companies (EPCs), and telecom system integrators around the world. To date, we have managed more than 2,300 network migration projects across multi-vendor platforms. With a global presence and a history of successful deployments in highly challenging critical environments, we leverage the unrivalled technical and scientific expertise of Bell Labs, one of the largest innovation powerhouses in the communications industry. Its knowledge of the stringent requirements and demanding conditions that characterize the oil and gas industry enables us to deliver communications solutions suitable for any oil and gas company or EPC.

Nokia's communication solutions provide Oil and Gas the critical connections to reach natural resources more efficiently and safely.

Digitalization of oil field operations will improve productivity by an estimated 1 percent to 5 percent and staff efficiency by up to 15 percent.

Global energy & petrochemical company

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