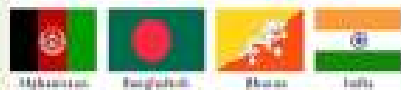


LNG BUSINESS STRATEGIES : TRAINING FOR PARTICIPANTS FROM SAARC COUNTRIES

SAARC ENERGY CENTRE,
ISLAMABAD, 15-19TH NOVEMBER , 2021



Swami Dayal Prasad
Rajeev Mathur
R K Garg
Dr A K Balyan



Gas Supply and Distribution



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- ▶ Global Environment & Energy Transition Outlook
- ▶ Growing Energy needs & Infrastructure requirement
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- ▶ Transnational Pipelines
- ▶ Small Scale LNG – Virtual pipelines

Global Environment & Energy Transition Outlook - IEA Scenario forecast for a 2050 net zero carbon future

- ▶ According to an IEA Scenario all the **LNG projects under construction and planned currently will not be required** ,if the target is a net zero carbon by 2050
- ▶ IEA forecasts current **LNG trade in 2020 at 420 BCM and by 2050 it will fall to 160 BCM by 2050**
- ▶ **Gas pipeline trade** is expected to **fall by 65%** globally
- ▶ By 2050, all **LNG supply will come from low cost and low carbon emission producers**
- ▶ The **annual investment** from 2030 onwards in new oil and gas projects will **fall to \$170 Billion**
- ▶ The projection for **investment** in new oil and gas projects from 2021 to 2030 is about **\$350 Billion**
- ▶ **Gas demand** is expected to fall from **3.9 TCM in 2020 to 1.7 TCM in 2050**
- ▶ In 2050 more than **50% of the gas will be used for hydrogen production**

Energy transition Scenario - clouds oil-gas outlook

- ▶ Global energy transition is creating **uncertainty for an estimated \$14 trillion worth of oil and gas assets**
- ▶ Post COVID oil demand recovery will see **demand rise higher than 160 MBOE per day** levels seen in 2019
- ▶ Due to the 2014 oil price crash, **upstream was now for cost efficient**
- ▶ Oil & Gas sector will generate **as much cash flow in 2021 \$60/bbl as it did at \$100** prior to 2014 oil price crash
- ▶ The **outlook** for oil and gas sector **becomes uncertain** with pressure for energy transition to cleaner fuels
- ▶ Two Scenarios of **Wood-Mac**
 - ▶ A. **Gradual Energy Transition**
 - ▶ Energy transition would see **oil demand staying above 90 million BPD till 2050**
 - ▶ Wood Mac projects **oil prices at just above \$80 a barrel** by 2030
 - ▶ **LNG price** projected to **between \$8-9/mmbtu**
 - ▶ B. **Temperature rise to be limited to 2°C by 2050**
 - ▶ If the world decides to limit global warming to 2°C by 2050, **oil demand would peak before 2025**
 - ▶ From there it **will fall to 35 million bpd by 2050**, 70% below peak levels
 - ▶ **Brent would average \$40 a barrel by 2030** and decline after that
- ▶ In both scenarios, **gas demand and prices would remain resilient**, supported by coal displacement in Asia
- ▶ Wood-Mac expects **more investments toward gas production rather than oil**
- ▶ **LNG price projected to be between \$8-9/mmbtu** and start to decline from 2040 onwards

Gas Infrastructure

Natural Gas Pipeline Infrastructure

Major infrastructure for natural gas transmission includes pipelines, compressor stations, storage areas, and facilities for liquefied natural gas. Gas transmission lines are distinguished from gas distribution lines in that the latter consist of smaller, lower-pressure gas transmission lines to households and companies



Pipelines

- Transport natural gas from source to market across the landscape
- Include small-diameter, low-pressure pipelines to wide diameter, high-pressure interstate or intrastate transmission pipelines that cross state boundaries
- In the case of interstate facilities, they are generally installed in a 50-foot right of way at a minimum of 30-36 inches underground



Compressor Stations

- Pressurize natural gas to move it through the pipeline
- House natural gas fired engines, turbines, or electric motors to pump natural gas through the pipeline
- Vary in size and are strategically situated along a pipeline route, generally on parcels ranging from 10 to 40 acres



Storage Fields

- Store natural gas for use during a period of high demand
- Area used to balance the demand on gas users (e.g. between seasons)
- Are primarily underground facilities determined by geology and proximity to natural gas production



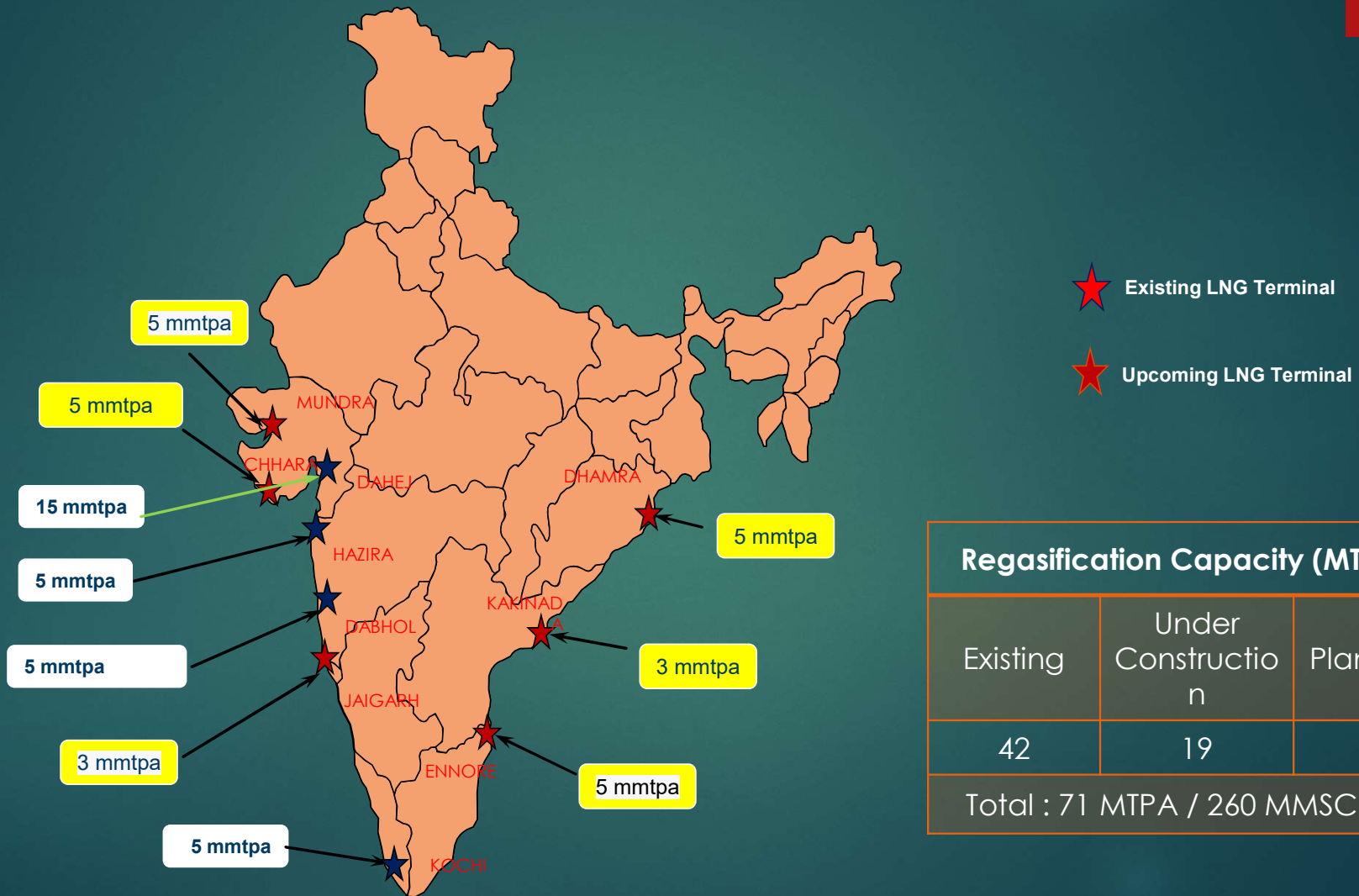
Liquefied Natural Gas (LNG) facilities

- Convert natural gas to a liquid for more convenient and efficient storage and transportation.
- Include above-ground tanks used primarily by distribution companies.
- Can include large terminals utilized for both importing or exporting natural gas



Re-gasification Terminals in India – Growing Requirements

18-11-2021



Regasification Capacity (MTPA)

Existing	Under Construction	Planned
42	19	9
Total : 71 MTPA / 260 MMSCMD		



Construction of Gas Pipelines

- ▶ Building a major oil and gas pipeline is among the most complex projects that any organization can undertake.
- ▶ It is filled with many different potential external bottlenecks that can cause delays, excessive costs, and various other problems.
- ▶ In order to keep a major pipeline construction project on schedule and under budget, it needs planning ahead, adapting the right technology and right kinds of partners to execute the project

Construction of Gas Pipelines

- **Advantages**

- The pipelines can be laid over difficult terrain as well as under water
- Their operation and maintenance cost is lower
- It involves very low energy consumption
- It ensures steady and constant supply of natural gas to the places at long distances.

- ▶ **Challenges encountered in Pipeline Construction**

- Right of Way Issues
- Difficult Terrain
- Geopolitical Issues- local, regional, national, international
- Infrastructure Shortfall- capacity constraints as demand grows

Stages in pipeline Project life cycle

Conceptualization:

1. Market surveys for deriving basic assumption for demand.
2. Initiation of feasibility study for Commercial / Technical viability.

Feasibility Report

1. Route selection & surveys
2. Hydraulic/simulations
3. Estimation of the project cost
4. Market demand assessment
5. Project Report Approval

Engineering & Planning

1. Design & sizing
2. Specification & tender document preparation
3. Material procurement/Release of work order & contracts
4. Acquire RoU/Permissions

Project Execution & Commissioning

► Other details

1. Pipeline length
2. Type of Terrain
3. No. of crossings/type of crossings
4. No. of valves, compression, Terminals, IPS etc.
5. Obstruction/limitation
6. Identification for Authorities for permission

Stages in Pipeline Project life cycle

▶ **Type of surveys**

1. Topographical
2. Population density index
3. Soil resistivity

▶ **Design/Hydraulic & simulation process**

▶ Simulation for network hydraulics

- ▶ software derives - diameter of the pipeline, required pressure at all locations, future flow/ load projections

▶ **Constructional Stages**

1. Pre-constructional activities
2. Construction activities
3. Testing & Commissioning
4. Handover to Operation & Maintenance Department

Pre-constructional activities :It include the following,

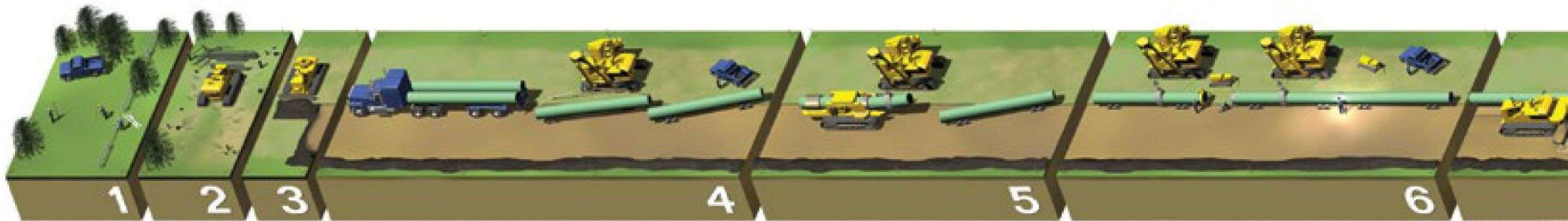
Pipelines- Pre Construction and Construction Process

Pre Construction activity	Steps
Planning	Resource & Equipment
Scheduling	Scheduling of activity & material ordering & delivery schedule
Mobilization	Mobilization of manpower & equipment
Procedure/Qualification	Approval for a procedure for various activities & following welding testing & Qualification
Training	Safety Training & Site briefing

- **Natural gas pipeline construction steps:**
1. Actual Route approval
 2. Surveying and construction right-of-way
 3. Clearing the ground
 4. Grading the area
 5. Trenching
 6. Stringing the pipeline
 7. Bending pipes to fit ground contours
 8. Welding the pipeline segments together
 9. Coating the joints
 10. Lowering the pipeline into place
 11. Installing valves
 12. Backfilling the trench
 13. Hydrostatic testing to ensure the pipeline can handle pressure
 14. Commissioning of the pipeline
 15. Restoration to return the land to its original condition

PIPELINE CONSTRUCTION

Pipeline construction is a multi-step process. Many months prior to construction, field surveys are conducted along the proposed route.



© Natural Resource Group, LLC

(1) Based on the information gathered during surveying, a final route is developed, and the route is then marked with stakes.

(2) Crews begin to prepare for construction by grading the right-of-way, removing trees and preparing the working space.

(3) In cultivated areas, the topsoil along the right-of-way is stripped and stored in piles for

careful replacement following the installation of the pipeline.

(4) Crews then re-stake the center of the trench area, lay out, or “string,” sections of the pipe along the right-of-way.

(5) Crews bend and weld the sections of pipe into a longer piece that follows the contours of the land.

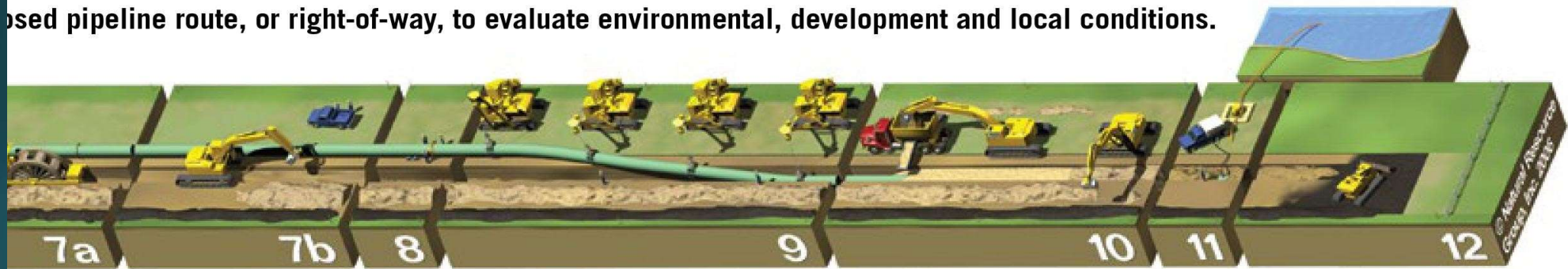
(6) Individual sections are already coated to prevent corrosion. Each weld is inspected by X-ray and then coated.

(7a) Once this process is complete, a trench is dug to accept the pipe.

(7b) In agricultural areas, careful attention is paid to properly separate and store the topsoil and subsoil so they do not mix.

PIPELINE CONSTRUCTION

posed pipeline route, or right-of-way, to evaluate environmental, development and local conditions.



(8) The pipe coating is inspected one more time before the pipe is lowered into the trench.

(9) The pipe is lowered into the trench and laid within the prepared trench bottom.

(10) The trench is then carefully backfilled with subsoil and topsoil.

(11) Before operation, pressurized water is used to test the pipeline and verify the structural integrity of the pipe and welds.

(12) The right-of-way and workspace is regraded and vegetated according to agency requirements and landowner agreements.

The construction process usually takes less than two to three months to complete on an individual

landowner's property, depending on weather conditions. Throughout the many phases of pre-planning and construction, Enbridge representatives work closely with communities and individuals along the route to provide information, seek input and answer questions.

NOTE: These illustrations are conceptual and general in nature; specific construction and restoration techniques could vary depending on circumstances.

PIPELINE CONSTRUCTION



Technological norms for Safety of Pipelines

- ▶ ASME B 31.8 - Design, material & equipment, welding, fabrication, installation, testing, commissioning, O & M, corrosion etc.
- ▶ PNGRB - **T4S Regulations , 2009**
 - ▶ Technical Standards & Specs, safety standards for - **material and equipment,welding,pipeline system components and fabrication details,design installation & testing,operation & maintenance procedure,corrosion control, sour gas service requirements etc.**
 - ▶ List of critical activities in Natural Gas Pipelines defined along with periodicity, time period for reporting compliance – **Test record for Radiography/ultrasonic/NDT,Hydrotests before commissioning, Cathodic protection , as built records, intelligent pigging,HSE/Fire protection system,gas detectors,vents,HAZOP,Fire extinguishing, flooding system**

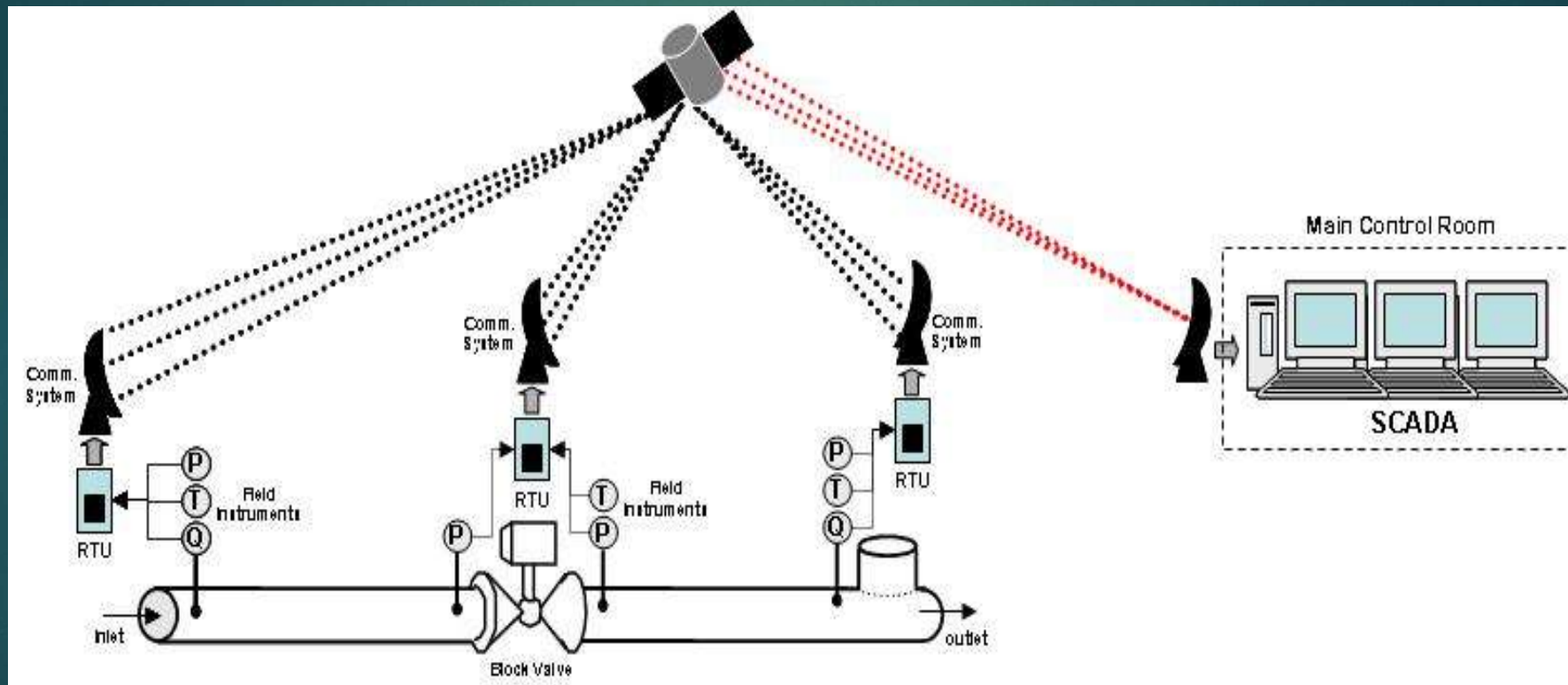
Operation of Pipelines

- ▶ Pipelines are **controlled and operated remotely**, from what is usually known as the "**Main Control Room**". In this center, all the data related to field measurement is consolidated in one central database. The data is received from multiple RTUs along the pipeline. It is common to find RTUs installed at every station along the pipeline.
- ▶ Field devices are instrumentation, data gathering units and communication systems. The **field instrumentation** includes flow, pressure, and temperature gauges/transmitters, and other devices to measure the relevant data required. These instruments are **installed along the pipeline** on some specific locations, such as injection or delivery stations, pump stations (liquid pipelines) or compressor stations (gas pipelines), and block valve stations.
- ▶ The **information measured** by these field instruments is then gathered in local remote terminal units (RTU) that **transfer the field data to a central location** in real time using communication systems, such as satellite channels, microwave links, or cellular phone connections.

Operation of Pipelines- SCADA

- ▶ The **SCADA system** at the Main Control Room receives all the field data and presents it to the pipeline operator through a set of screens or Human Machine Interface, showing the operational conditions of the pipeline.
- ▶ The operator can **monitor the hydraulic conditions** of the line, as well as send operational commands (open/close valves, turn on/off compressors or pumps, change setpoints, etc.) through the SCADA system to the field.
- ▶ To optimize and secure the operation of these assets, some pipeline companies are using softwares' called "**Advanced Pipeline Applications**".
- ▶ The software tools installed on top of the SCADA system, that provide extended functionality to perform leak detection, leak location, batch tracking (liquid lines), pig tracking, composition tracking, predictive modeling, look ahead modeling, and operator training.

Operation of Pipelines- SCADA



Contract Carrier Gas Pipelines

- ▶ A contract carrier system implies that the capacity in a natural gas pipeline, over and above the entity's own requirements, shall be available to any other entity subject to the latter entering into a firm **contract for transportation of a volume of natural gas for a specified period of not less than one year**, on such other terms and conditions as may be mutually agreed, on payment of natural gas pipeline tariff
- ▶ The contract for transportation of natural gas is for transportation of natural gas and without any obligation as to the sourcing of the natural gas.

Common Carrier Gas Pipelines

- ▶ Natural gas pipeline is widely accepted mode of bulk transportation of natural gas from a source to a delivery point over a particular route
 - ▶ The concept of **natural monopoly** in transportation of natural gas is universally accepted in view of its capital intensiveness, safety factors and the need for protecting consumer's interests.
 - ▶ **Consumer interest** is best served by promoting competition, avoiding infructuous investments by optimum utilization of infrastructure of natural gas pipelines.
- ▶ The concept of allowing capacity in natural gas pipeline to be utilized by any entity on a non-discriminatory basis incentivizes emergence of independent shippers of natural gas
 - ▶ Shippers enter into contract carrier or common carrier arrangements with entities owning such infrastructure for transportations of natural gas
 - ▶ leads to development of competitive natural gas markets.

Common Carrier Gas Pipelines

- ▶ A **common carrier system** implies that the capacity in a natural gas pipeline, over and above the entity's own requirement and capacity allocated on a contract carrier basis, shall be available to any other entity subject to the latter entering into a **contract for transporting volume of natural gas normally for a period of less than one year**, on such other terms and conditions as may be mutually agreed
- ▶ The **contract for transportation of natural gas** shall be only for transportation of natural gas and without any obligation as to the sourcing of the natural gas.
- ▶ Common carrier capacity available in natural gas pipeline at any given point of time shall be allocated to any entity seeking booking of the same on a **non-discriminatory 'first-come-first served' basis**.
- ▶ **In case common carrier capacity is not available** in a natural gas pipeline at any given point of time and another entity seeks booking of the same for a period of less than one year, the request shall be accommodated by following the **procedure set out in regulations**
- ▶ When the **extra capacity** in a natural gas pipeline to be provided on a common carrier basis is less than thirty three per cent of the sum of the capacity requirements of the entity and the firm up contracted capacity with other entities, the same will be made available- (i) **on expiry of firm contracts. Or (ii) by way of expansion of capacity in the natural gas pipeline:**

GAS TRANSPORTATION CONTRACTS

- ▶ DEFINITIONS
- ▶ RIGHTS AND OBLIGATIONS
- ▶ CONDITIONS PRECEDENT AND OPERATING CODE
- ▶ CAPACITY TRANCHES
- ▶ TERM
- ▶ TRANSMISSION CHARGES
- ▶ LIQUIDATED DAMAGES
- ▶ BILLING AND PAYMENT
- ▶ REPRESENTATIONS, WARRANTIES AND COVENANTS
- ▶ PLANNED WORKS
- ▶ FORCE MAJEURE
- ▶ CHANGE IN LAW
- ▶ TERMINATION
- ▶ LIABILITIES AND INDEMNITIES

MISCELLANEOUS PROVISIONS -

DISPUTE RESOLUTION EXPERT

- NORMAL TRANSMISSION RATES
- GAS SPECIFICATION
- SCHEMATIC OF TRANSPORTER FACILITIES
- TERMS & CONDITIONS OF LETTER OF CREDIT
- FORMAT OF CAPACITY TRANCHE #

Pipeline Tariff Models

- ▶ Natural gas pipeline tariff - unit rate of tariff for a natural gas pipeline (excluding statutory taxes and levies) in **Dollars per million British Thermal Units (\$/MMBTU)** for transport of natural gas;
- ▶ **DCF Methodology**
 - ▶ Discounted Cash Flow methodology refers to **equating the inflows from the projected revenue earnings out of natural gas pipeline tariff with the outflows of capital and operating expenditures over the economic life of the project** by discounting these flows at the project's **reasonable rate of return**. The volumes and outflows are estimated over the economic life which results in the determination of the natural gas pipeline tariff required to be earned by the project to achieve the internal rate of return
 - ▶ **Models – Postalised for a pipeline, Zonal tariffs, Unified for a set of pipelines, Entry/Exit for a network of pipelines, Telescopic, bid out tariffs etc.**

Tariff Models

▶ Postalised

- ▶ A **single tariff for an entire pipeline or network** (Say, from Km 1 to Km 1000 or more) based on a predetermined rate of return calculated on the Capacity, Capex & operating costs, spread over the entire volume transported through the pipeline.
- ▶ **Customer fairness is a key driver** in using postage stamp rates. This approach to rate-making provides equal opportunity to obtain the transportation service regardless of whether customers are existing or new or where they are located in the system

▶ Entry Exit

- ▶ In an entry-exit system, **tariffs** for gas transportation networks must be **set separately for every entry and exit point** (and may therefore differ at each point). Ideally, the calculated tariffs for the individual entry and exit points should reflect the underlying costs the transportation system operator has to incur in order to make transportation services available at these points
- ▶ Gas is brought into the system either at cross-border entry points (pipeline entry or where applicable via an LNG terminal) or at entry points from domestic production. Gas exits the system either at crossborder exits or different market areas, to directly connected customers at TSO level or at exit points to distribution networks.

▶ Zonal Tariffs

- ▶ Once a single levelized transportation tariff has been determined based on **the DCF method**, it is recovered on the **basis of zonal structure** i.e. broken up into 2 or more distance limited zones

▶ Cost of Service

- ▶ Cost-of-service may be defined as the amount of revenue a regulated gas pipeline must collect, from rates charged consumers, **to recover the cost of doing business**.

▶ Unified

- ▶ A system where buyers of gas instead of being charged for every pipeline they use in the system, are required to **pay a single charge across all pipeline networks**

▶ Telescopic tariff

- ▶ tariff rates are fixed based **on per unit of distance travelled from source** / injection point (e.g. per km/per unit of gas).

▶ Bid out Tariffs

- ▶ Tariffs charge based on what is **bid out** while proposing to set up a pipeline with the regulator

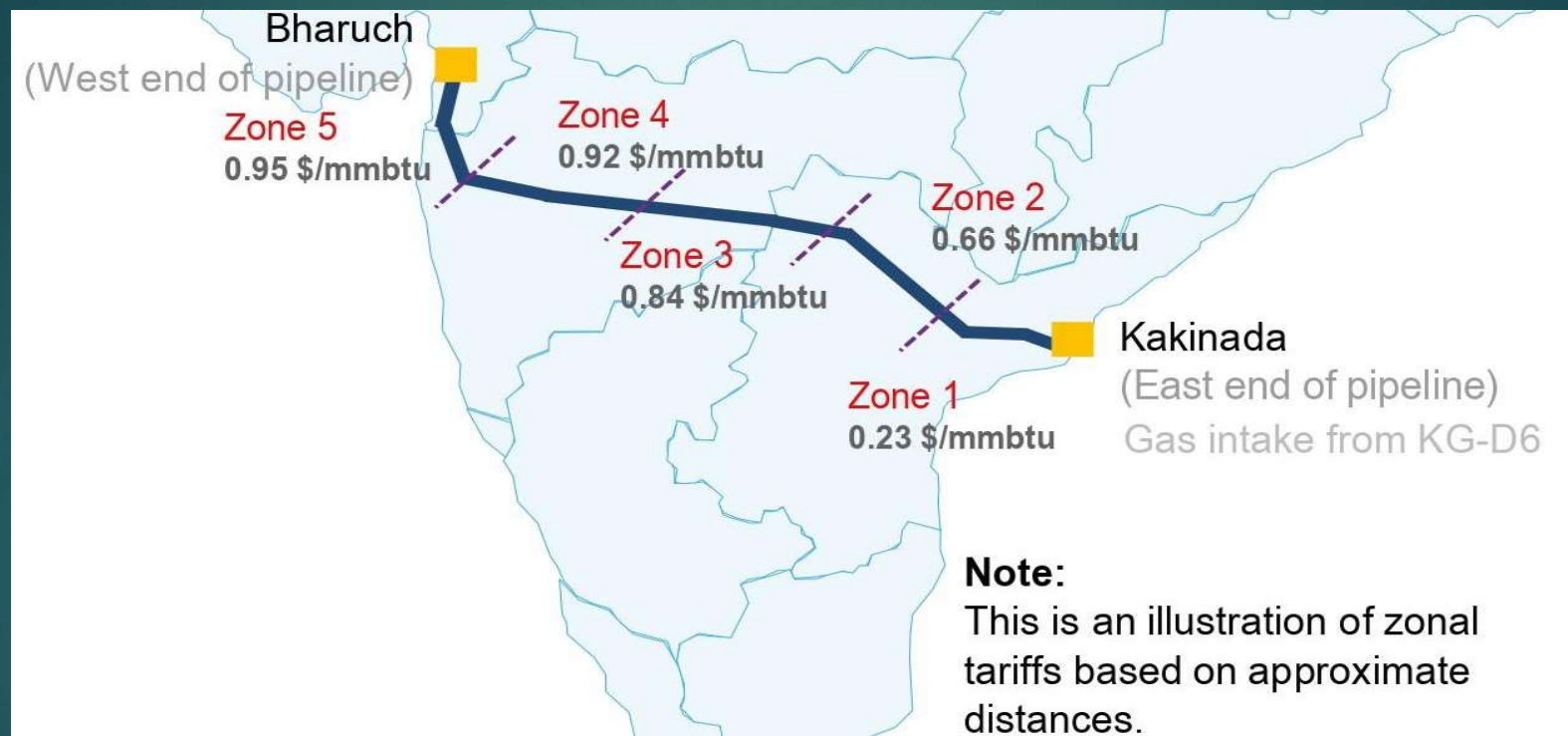
Pipeline Tariff Models- Europe

- ▶ Two basic approaches used
 - ▶ Rate of-return regulation
 - ▶ Incentive regulation
- ▶ Rate-of-return or 'cost plus' regulation
 - ▶ Regulator sets the allowed revenue to cover the reasonable costs of the service, based on the **costs of the fixed investment in pipeline networks, financing and operational costs as well as a reasonable return** on the assets necessary to provide the service. The total cost base is usually set by a regulator or negotiated with the transmission system operator (TSO).
- ▶ Incentive, or 'cap regulation'
 - ▶ **prices or revenues are set in advance** (in most cases for a regulatory period of 3-5 years), inducing the TSO to cut costs by **allowing it to retain additional profits gained through efficiency savings**.
 - ▶ At the end of the regulatory period, prices and revenues are then recalculated for the next period. Revenues exceeding the allowed revenues will be corrected, and so will normally be revenues less than the allowed revenues, e.g. in the case of under-utilisation of the pipeline.
 - ▶ Cap regulation is today quite common. Most countries which chose this approach apply revenue caps, while only a few apply price caps (e.g., Slovakia, Lithuania).

Pipeline Tariff Models- USA

- ▶ In US an interstate transmission pipeline operator's rates are established using one of the following methodologies:
- ▶ The **cost-of-service method** requires that a pipeline operator submit cost and revenue data supporting a requested rate. The operator is allowed an opportunity to recover its cost of providing service and earn a reasonable return on its investment.
- ▶ The **negotiated rate method** allows an operator to charge a rate that is agreed upon by the pipeline operator and a shipper. To safeguard against unequal bargaining power, the shipper must have the option to select service under the pipeline operator's "recourse rate" that is based on the pipeline's cost of service.
- ▶ The **market-based rate method** may be employed when an operator can demonstrate that it lacks market power. In these circumstances, an operator is authorized to charge rates consistent with market conditions. Some interstate pipeline operators have market-based storage rates.

Zonal Tariff - illustration





Session 4 (Extension)

CROSS BORDER OR TRANSNATIONAL PIPELINES AND THEIR
IMPACT ON LNG MARKET LIQUIDITY AND TRADE

Cross-border Natural Gas Pipelines

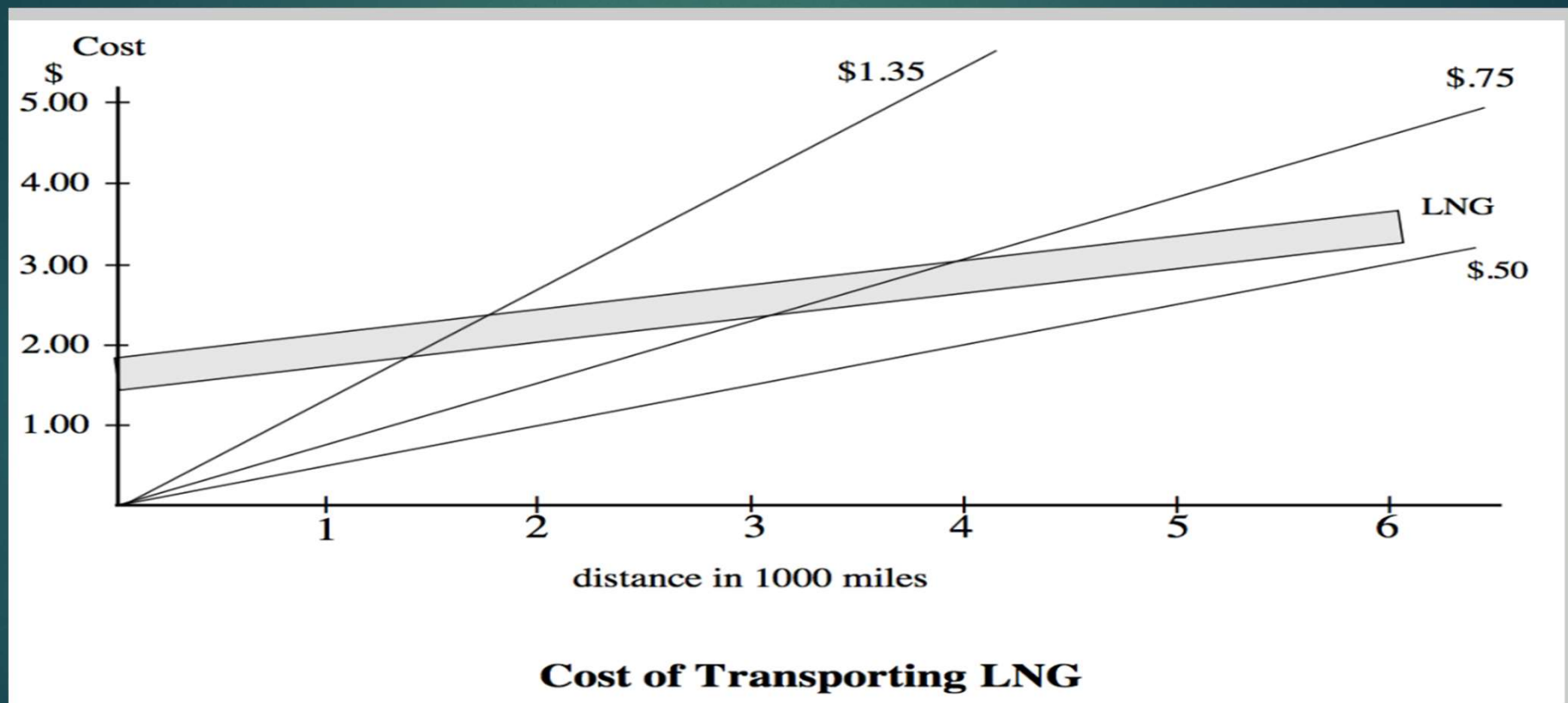
Trans National Pipelines

- ▶ Transnational pipelines create long term economic relations between nations for meeting energy needs
- ▶ Transnational pipelines are point to point and have limited flexibility in terms of capacity, supply volumes and destination
- ▶ Transnational pipeline projects and LNG Import Projects are complimentary with each other in order to meet the energy needs of the nations

Trans National Pipelines V/S LNG

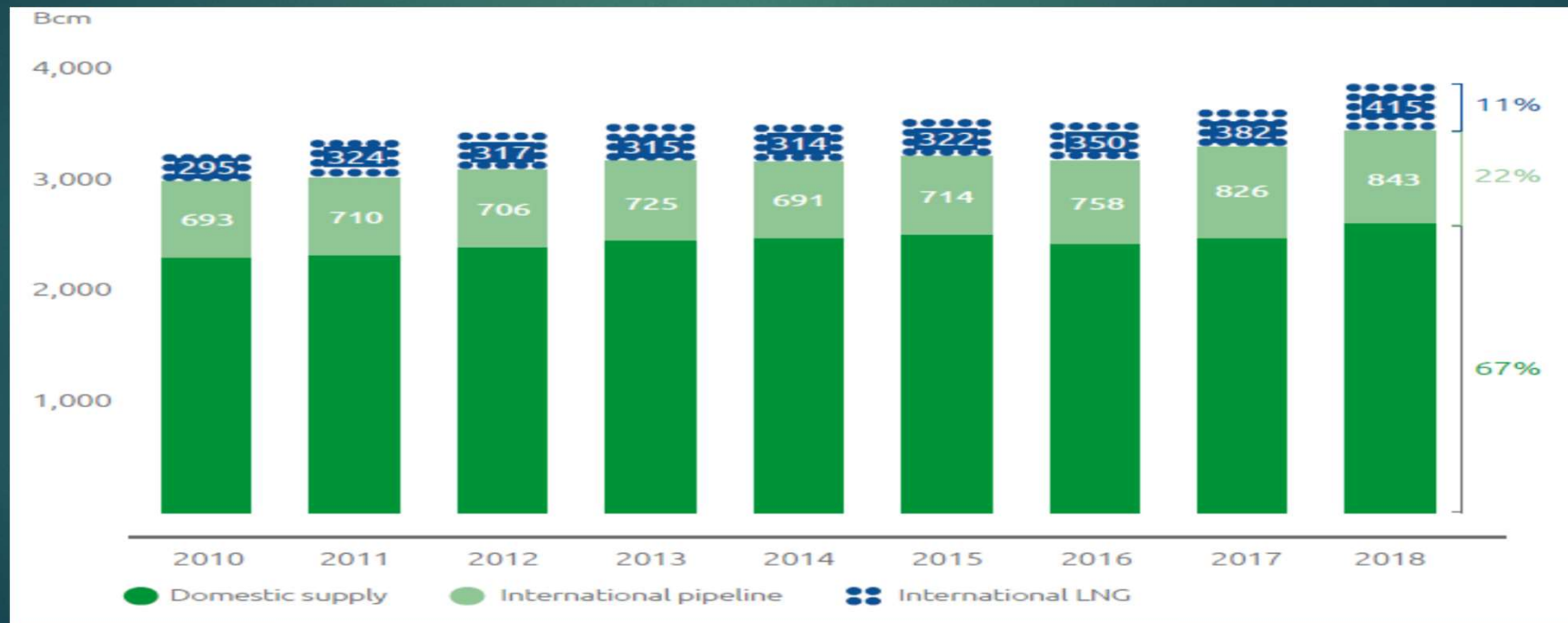
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Break even point for LNG at different pipeline transportation costs



SHARE OF PIPELINES AND INTERNATIONAL PIPELINES

- In 2010, out of 988 bcm of international trade, a little over 70% was by pipelines, and in 2018, out of 1256 bcm of trade, about 841 bcm or approx 67% was by pipeline as in the figure below .
- As per EIA / World Energy Outlook 2019, the LNG trade would overtake the Pipeline supplies



Gas Pipelines and their impact on LNG

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- ▶ It is imperative that in any market that imports gas, **Transnational Pipelines compete with LNG**.
- ▶ Following Trans-national pipeline projects are expected to significantly contribute to gas exports and are likely to affect future LNG trade for
 - ▶ **Europe and China.**
 - ▶ **Nord Stream II (Russia – Germany, 1222 kms)**
- ▶ **Nord Stream I**
 - ▶ is the existing longest sub-sea twin pipeline of 48 inches connecting Russian gas fields to mainland Europe, from Vyborg, Russia to Greifswald, Germany.
 - ▶ The capacity of Nord Stream I twin pipelines is about 55 bcm (approx 150mmcmd) and became operational from Nov 2011 & Oct 2012 respectively.
- ▶ **Nord Stream II (Ust-Luga to Greifswald)** also has 48-inch twin pipelines. The project started in 2018-19.
 - ▶ The project cost was estimated at about 14.8 Bn Euros (6 Bn Euros for On-shore pipelines and 8.8 Bn Euros for Off-shore pipelines).
 - ▶ Target completion was middle of 2020. Gazprom holds 51% equity and the rest is with Uniper (Germany), Engie (France), Gasunie (Dutch gas company) & others. Gazprom has financed 50% of the cost and the rest is as loans from Banks/FIs/Project Stakeholders.
 - ▶ However, with only laying of the last 150-200 kms of pipeline remaining, the US has imposed sanctions in Dec 2019, aimed to marginalize the increased dominance of Russia over European gas supplies. Both, Russia & Germany have strongly criticised the sanctions.
 - ▶ The EU divided and a sizeable lobby supports completion of this project as many of the contracting agencies are from Europe. Ukraine, Poland and some Central & Eastern European countries support the sanctions.
 - ▶ Russia deployed its own resources including its own special Vessel (earlier deployed on the Pacific coast in East Russia) for laying sub-sea pipelines. The testing has commenced. Pipeline commissioning likely to be delayed beyond 2022.
 - ▶ This pipeline would ease European supplies by 30-40 MTPA equivalent of LNG.

Gas Pipelines and their impact on LNG

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- ▶ **TANAP** (1841 kms) (Trans-Anatolian Natural Gas Pipeline)
 - ▶ This pipeline supplies gas from Azerbaijan to Turkey and Europe. The pipeline was commissioned on 30th Nov 2019.
 - ▶ The existing through-put is about 16 BCM (or 44 MCMD, 28 for Europe and 16 for Turkey).
 - ▶ Backed up by future supplies from Turkmenistan, the pipeline shall be scaled upto 23 BCM by 2023, 31 BCM by 2026 and 60 BCM by 2030.
 - ▶ This is likely to ease the gas supplies for Turkey, Greece, Albania and Italy, and reduce their dependence on gas imports from Russia and LNG

- ▶ **TurkStream** (930 kms, set of two 32 inch pipelines, Final capacity 31.5 bcma)
 - ▶ It is a twin 32-inch pipeline project for supplies from Russia across the Black sea in two legs, one for Turkey, and the second one for Bulgaria, Serbia, Hungary, Slovakia & Austria.
 - ▶ It can carry about 44 MMCMD in each stream. This pipeline also faced US Sanctions imposed in Dec 2019 under PEEPSA. However, the first part of the pipeline upto Turkey has been commissioned in Jan 2020.
 - ▶ The gas flows from Turkey to Bulgaria and from there to Romania, Ukraine, Greece and North Macedonia via the Trans-Balkan Pipeline.

New Route to Asia

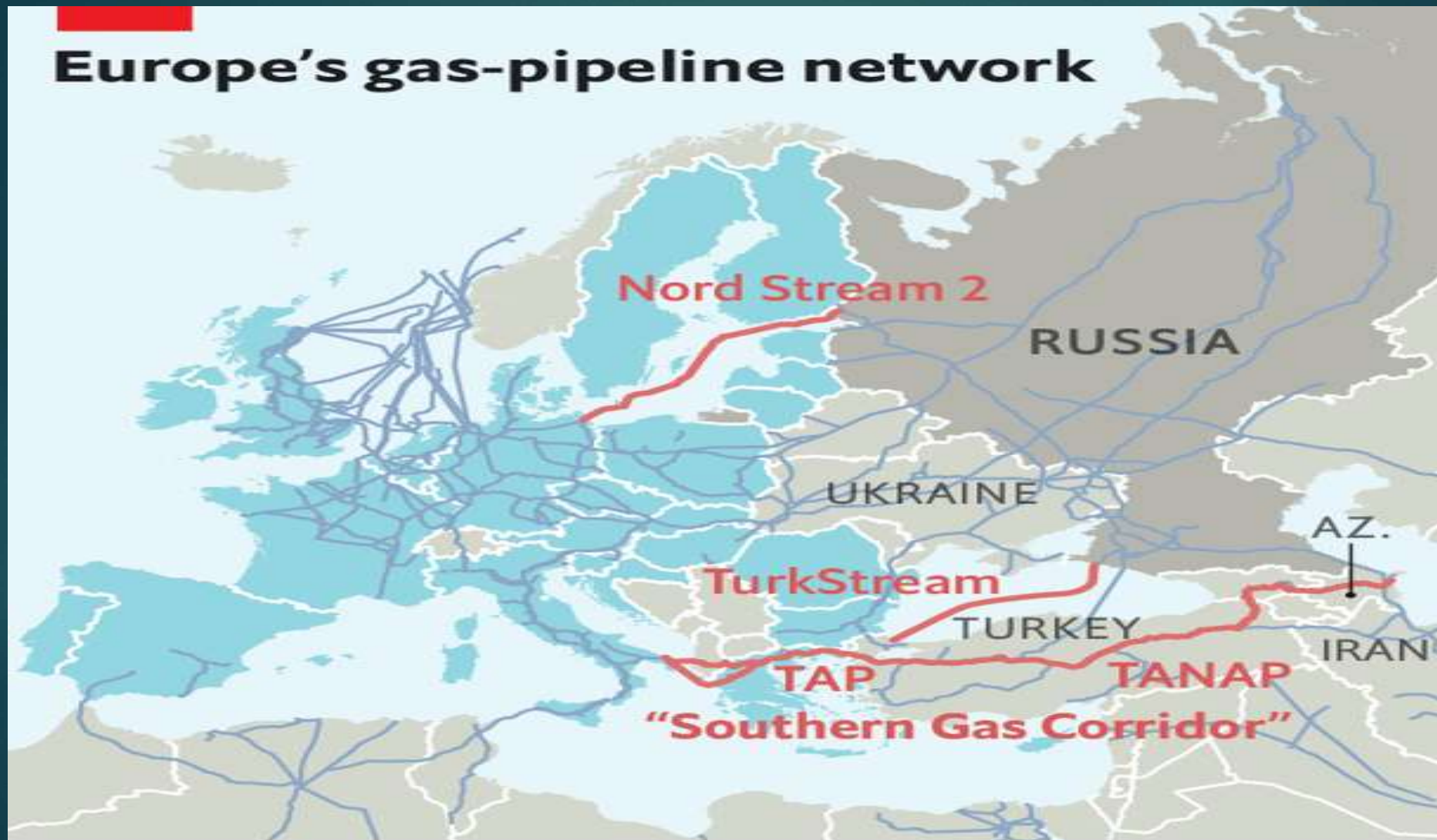
Russia prepares for first gas pipeline supplies to China

✓ Operational pipeline ✗ Prospective pipeline ⚡ Gas field 🏭 Gas production center



Sources: Gazprom; Xinhua News Agency and Sinolink Securities Co. **BloombergQuickTake**

Europe's gas-pipeline network



Gas pipelines and LNG carriers

- European Union in 2019
- Gas producer supplying EU

Alliances and bypasses

- Three Seas Initiative country
- Country bypassed by Russia
- Country with gas pipeline agreement with Russia

Major gas pipelines supplying EU

- Existing
- Under construction
- Planned
- Ukraine bypass system

Transport capacity in Gm³/year

- Over 50
- 20 to 50
- 5 to 20

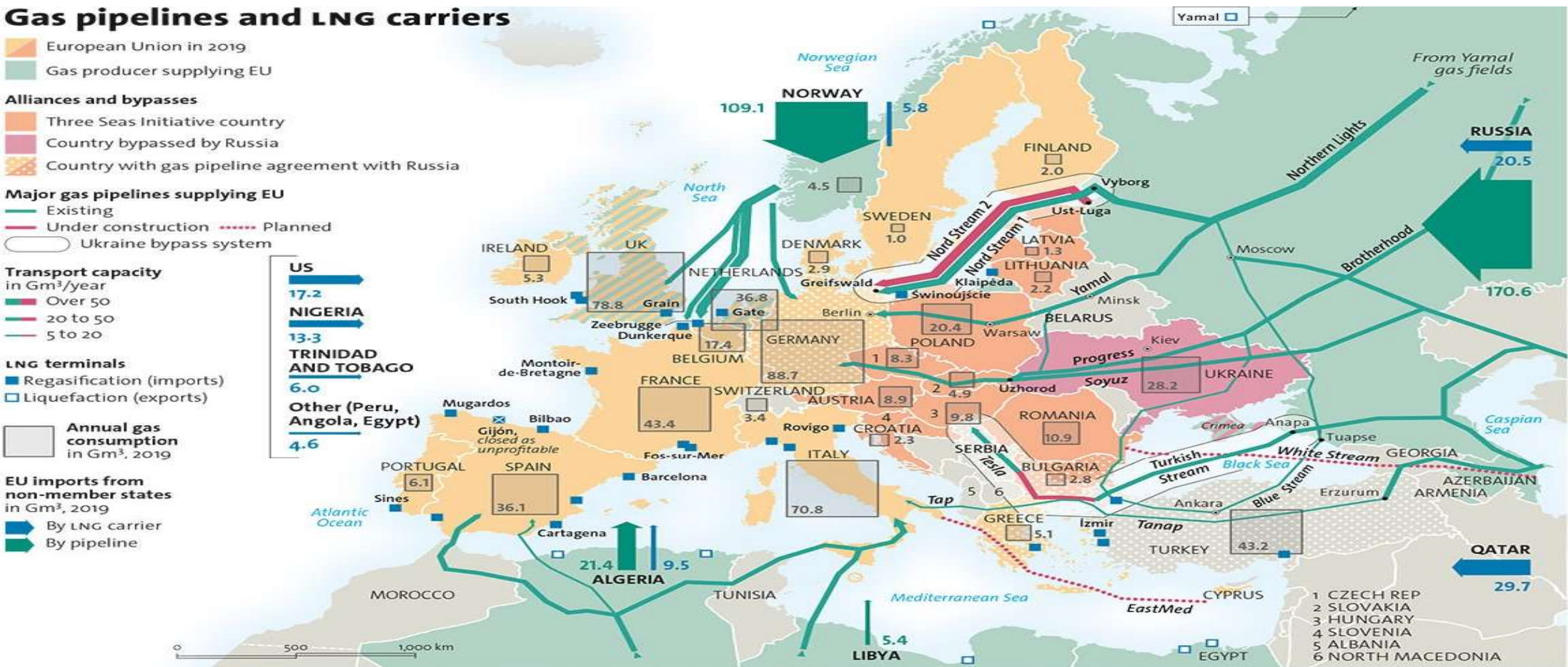
LNG terminals

- Regasification (imports)
- Liquefaction (exports)

Annual gas consumption in Gm³, 2019

EU imports from non-member states in Gm³, 2019

- By LNG carrier
- By pipeline



Top 10 of gas in Gm³, 2019



Distribution of primary energy consumption in the EU 2019



EU monthly imports of Russian natural gas via main supply routes



Regional Accessibility: Pipeline projects

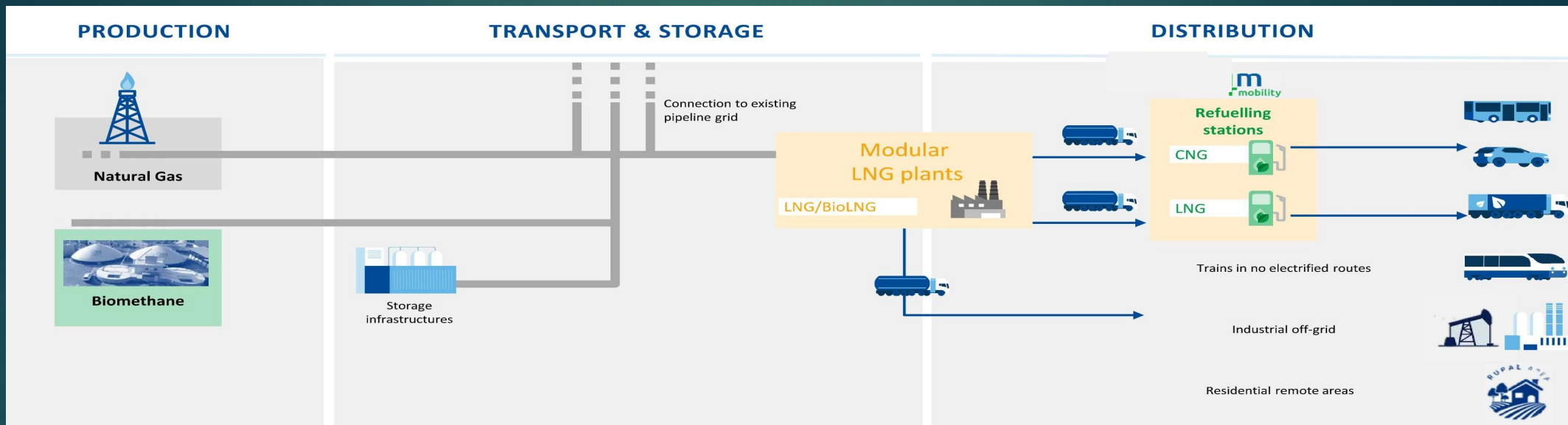
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Small Scale LNG

- ▶ Small-scale liquefaction plants are usually developed to serve specific markets and have a **production capacity of less than 500,000 tons per year** (by contrast, a large industrial-scale LNG plant like the Gorgon facility has an export capacity of approximately 16 million tons per year).
- ▶ These plants provide supply to end-users in places where traditional infrastructure does not reach, or to consumers requiring liquid fuel
- ▶ major end uses for ssLNG:
 - ▶ marine fuel (bunkering),
 - ▶ fuel for heavy road transport,
 - ▶ power generation in off-grid locations.
- ▶ The market is growing and several major energy companies are already involved in ssLNG, including Shell, Engie, ENI, Gasum, and Gazprom. The size of the market is expected to grow to approximately 100 million tons per year by 2030.

SSLNG – PRODUCTION TO DISTRIBUTION



Upstream

Monetize valuable natural gas to markets

- Stranded gas
- Flaring gas
- Biogas (with no outlook for pipeline distribution)

Midstream

Staged LNG development:

- Establish scalable supply alongside with local market development
- **Reduce and optimize the logistic cost of NG**

Downstream & Retail

Low cost alternative to diesel/propane/heating oil

- **Reduce mobility emissions and costs** by switching trains, heavy duty vehicles, ships,...
- **Serve industrial and commercial off-grid customers displacing LPG diesel**



- ▶ Thanks
- ▶ Q & A