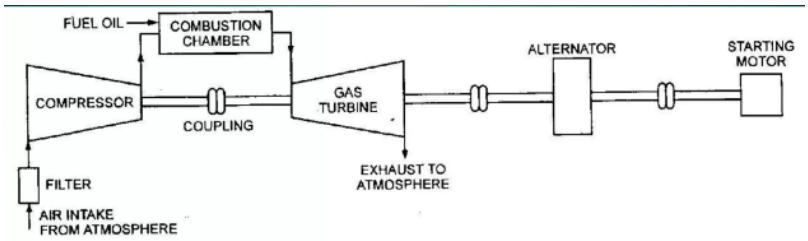
Gas Based Power Plants

Why in news?

Heat waves push gas-based power plants capacity to a five-year high in May 2024.

What is Gas Based Power Plants?

- **Gas-based power plant** – They generate electricity by burning gas as their fuel and thus it is also known as a gas-fired power plant.
- **Sources** - Natural gas or methane gas primarily while sometimes other gases like propane or butane.
- **Power generation** – These plants generate almost 25% of world electricity.
- **Working principle**– They use gas turbines or gas engines to convert the energy from burning gas into mechanical energy, which is then used to generate electricity through an alternator or generator.
- **Components** – Air, gas fuel, compressor, combustion chamber, gas turbine, alternator and starting motor.



- **Working** – It takes in air from the atmosphere through air filter which is compressed to very high pressure.
- *Fuel and compressed air is fed to combustion chamber* and burned inside.
- Compressed air expands inside gas turbine chamber and the *turbine rotates the generator coupled to it*.
- *Alternator* connected to gas turbine *produces electricity*.

Advantages of Gas Based Power Plants
• **Less emissions**- It contributes to cleaner air and reduced environmental impact. • **Higher efficiency**- It can achieve high efficiency rates, making them cost-effective for electricity generation. • **Reliability**- Gas supply networks are generally more reliable than other fossil fuels, ensuring consistent power generation. • **Less space requirement**- They typically require less physical space compared to coal plants, making them easier to site.
Disadvantages of Gas Based Power Plants

• **Dependence on fuel**- Gas availability and price fluctuations can affect operational costs and stability.
• **Infrastructure costs**- Initial setup costs can be high, especially for combined cycle plants that require additional equipment.
• **Environmental Impact**- While cleaner than some alternatives, they still produce greenhouse gases & contribute to global warming.
• **Higher water use**- Some gas plants require significant water for cooling purposes, impacting local water resources.
• **Noise Pollution**- Gas turbines can produce significant noise during operation, affecting nearby communities.

How gas based power plants differ from coal based plants?

	Gas-Based Plants	Coal-Based Plants
Fuel Source	Gas	Coal
Fuel Supply	Generally, more stable supply	Susceptible to supply chain disruptions
Efficiency	Higher efficiency in converting fuel to electricity	Lower efficiency compared to gas-based plants
Emissions	Lower emissions (CO2, SOx, NOx)	Higher emissions, especially CO2
Environmental Impact	Generally considered cleaner	Higher environmental impact due to emissions and mining
Flexibility	More flexible for rapid startup and shutdown	Less flexible, longer startup and shutdown times
Power Output	Typically, lower power output per unit compared to coal	Higher power output per unit

What is the status of gas based plants in India?

The International Energy Agency forecasts India's gas demand to grow by 7% in 2024, while the Gas Exporting Countries Forum predicts a 6% increase.

- **Needs** – India faces a surge in electricity demand, especially during the upcoming summer season.
- It can be an ideal transition fuel for the shift from coal-based generation to renewable energy in the Indian power sector.
- It helps India in achieving the target of increasing the share of non-fossil fuel, especially renewables, in power generation to 50% by 2030.
- **Rules** – These plants are mandated by the Government under the Electricity Act to operate as directed in exceptional circumstances.
- **Monitoring authority** - The Central Electricity Authority under Ministry of Power.
- It monitors 62 gas based power stations, with a total capacity of 23,845 MW using gas as primary fuel.

- Generation - Gas-based power generation spiked significantly, up 83% year-on-year and 39% month-on-month, totalling 2.8 billion units (BU) in June 2024.

Gas-based power generation

May	PLF (%)	Power generation (MU)	Gas consumed / supplied (MSCMD
2024	28.7	5,053.41	36.35
2023	15.9	2,818.90	21.20
2022	13.9	2,457.18	18.44
2021	20.4	3,446.45	24.86
2020	28.9	5,152.02	35.36
2019	25.0	4,439.81	31.68

- **Concerns** - A significant portion of the ***Gas-Based Generating Stations (GBSs)*** is currently unutilized, primarily due to commercial considerations.

What are challenges in implementing it in India?

- **Higher dependence on imports -** Dependence on imported liquefied natural gas (LNG) makes the cost of power generation vulnerable to global price fluctuations and supply chain disruptions.
- **Limited infrastructure-** India's current pipeline infrastructure is limited and needs expansion.
- **Environmental Concerns-** While cleaner than coal, gas-based plants still emit greenhouse gases.
- Meeting stringent emission norms adds to costs and operational complexities.
- **Policy & regulatory challenges-** Inconsistent policies, including pricing mechanisms, subsidies, and regulatory approvals, can deter investments and project viability.
- **Lack of technology and expertise-** Advanced technology is needed for efficient gas ***turbine operations and integrating renewable*** energy sources.
- There is also lag in significant expertise and investment.

What are the steps taken by India?

- India aims to attach all Indian states with the trunk natural gas pipeline network by 2027.
- **Policy reforms** – Regulations like New Domestic Gas Pricing Guidelines (2014) and the Hydrocarbon Exploration and Licensing Policy (HELP) aims to to offer pricing incentives for home fuel producers at the same time as balancing the pursuits of purchasers.
- **Infrastructure development** – Pradhan Mantri Urja Ganga (PMUG), launched in 2016 aims to increase the natural fuel pipeline infrastructure.
- **Funding** – Created Natural Gas Infrastructure Development Fund (NGIDF) to offer financial aid for the improvement of natural gas infrastructure in India.
- **Distribution network** – Measures taken to expand City Gas Distribution (CGD) network throughout India to increase access to piped natural gas (PNG) for families, industries, and business institutions.
- **Developing gas terminals** – Promoting of LNG imports terminals to diversify gas

supply resources and decorate energy security.
    - Natural gas is imported across ***3 main hubs*** located at Dahej and Hazira in Gujarat, and Kakinada in Andhra Pradesh.
- **Indian gas exchange (IGX)** – It is India's first gas exchange, a digital platform allowing to buy and sell natural gas in the market.
- **Gas Index of India (GIXI)** – It is the first ever, nationwide price index to reflect benchmark natural gas price for India which is launched by IGX.

What lies ahead?

- Encourage the exploration and development of domestic gas reserves to reduce reliance on imported gas and mitigate price volatility.
- Develop infrastructure for transporting gas efficiently across the country to ensure a steady and reliable supply to power plants.
- Provide long-term policy certainty and incentives for investment in gas-based power generation, including tax breaks, subsidies, and assured purchase agreements

References

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