سمینار تخصصی

توسعه ظرفیت‌های بازیابی گاز فلر

با رویکرد مدیریت ناترازی، مزیت‌های اقتصادی و هوای پاک

۱۶ بهمن ماه ۱۴۰۳ | تهران - مرکز همایش‌های صداوسیما

خانه صنعت، معدن و تجارت جوانان ایران

انجمن سازندگان تجهیزات صنعتی ایران (ستما)

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شرکت ملی پالایش و پخش فرآورده‌های نفتی ایران

شرکت ملی نفت ایران
شرکت نفت مناطق مرکزی ایران

شرکت ملی نفت ایران

شرکت صنایع پتروشیمی خلیج فارس
Persian Gulf Petrochemical Industrial Co.
PGPIC
شرکت پالایش گاز بیدبلند خلیج فارس

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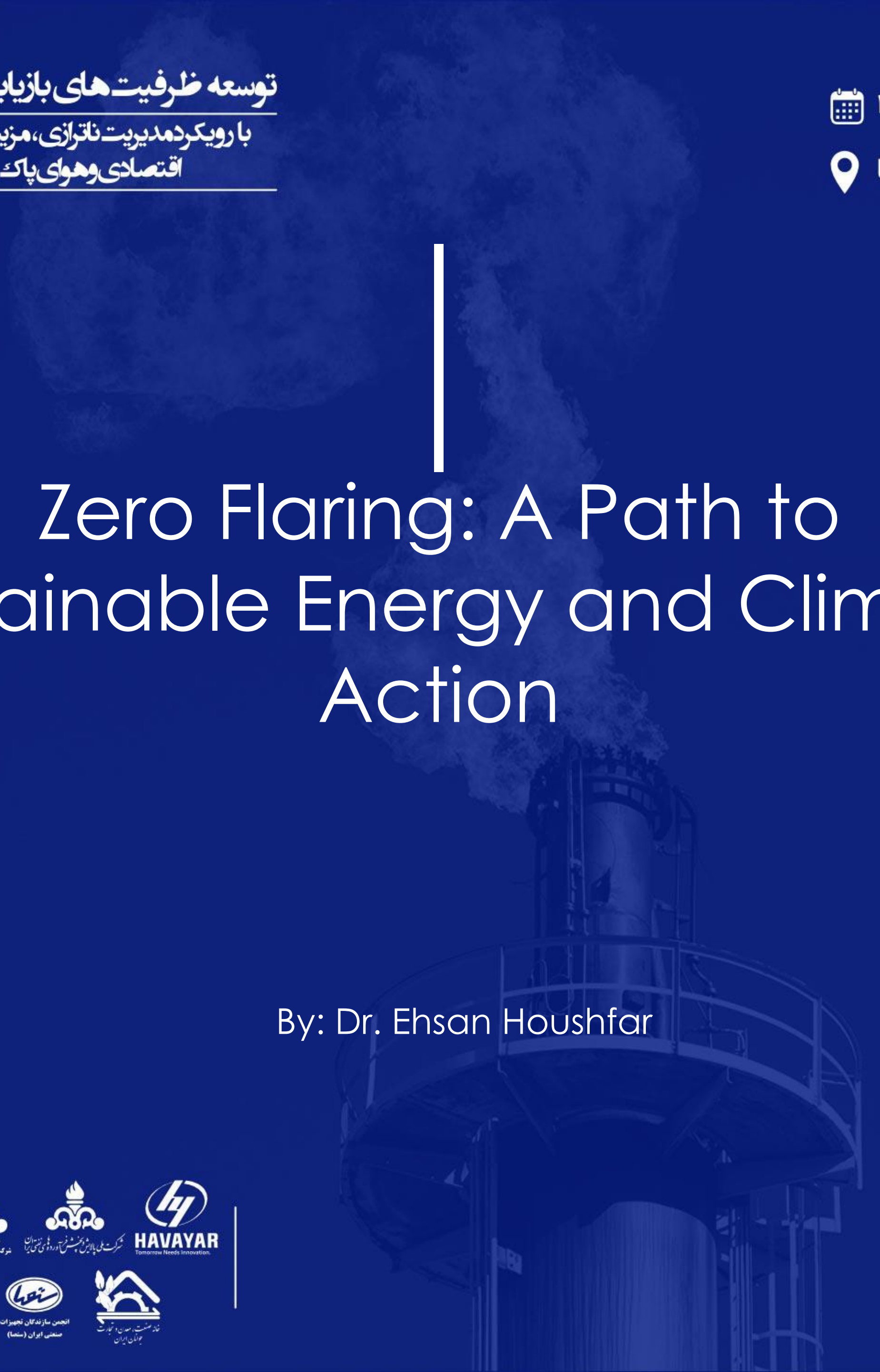


Zero Flaring: A Path to Sustainable Energy and Climate Action

By: Dr. Ehsan Houshfar

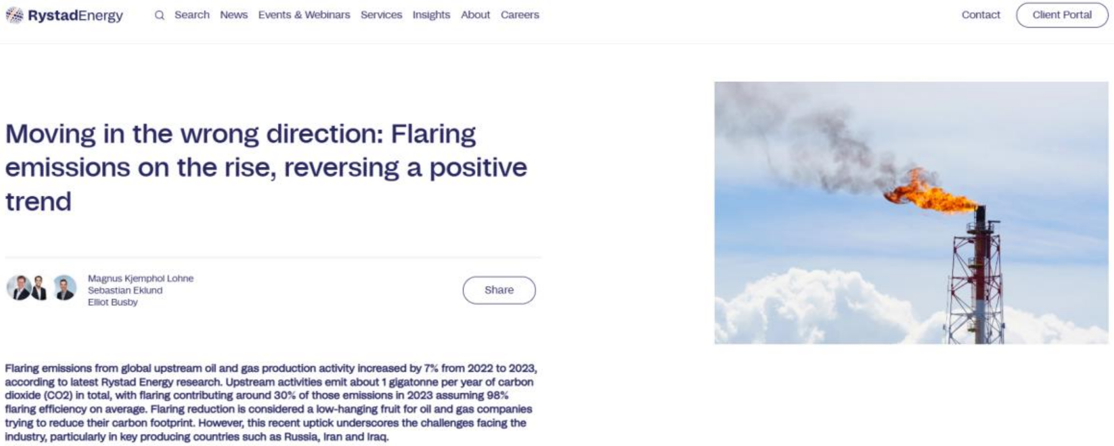
TotalEnergies moves to slash flaring at Iraqi oilfields as part of $10 billion integrated project

Construction starts at ArtawiGas25 facility to handle associated gas from Ratawi field

Iraq to stop 78% of flared gas by the end of 2025

• IRAQ **Amr Salem** February 3, 2025 340 2 min

Gas flare burning
Photo: AFP



Moving in the wrong direction: Flaring emissions on the rise, reversing a positive trend

Magnus Kjemphol Lohne
Sebastian Eklund
Elliot Busby

Flaring emissions from global upstream oil and gas production activity increased by 7% from 2022 to 2023, according to latest Rystad Energy research. Upstream activities emit about 1 gigatonne per year of carbon dioxide (CO2) in total, with flaring contributing around 30% of those emissions in 2023 assuming 98% flaring efficiency on average. Flaring reduction is considered a low-hanging fruit for oil and gas companies trying to reduce their carbon footprint. However, this recent uptick underscores the challenges facing the industry, particularly in key producing countries such as Russia, Iran and Iraq.

Agenda

- Introduction to Flaring
- Where Flaring Occurs
- Environmental Impact
- Economic and Social Impact
- Why Zero Flaring Matters
- Challenges to Achieving Zero Flaring
- Solutions and Technologies
- Case Studies
- Global Initiatives
- Economic and Environmental Benefits
- Call to Action

What is Flaring?

gas combustion in places such as petroleum refineries, chemical plants and natural gas processing plants, oil or gas extraction sites having oil wells, gas wells, offshore oil and gas rigs and landfills.

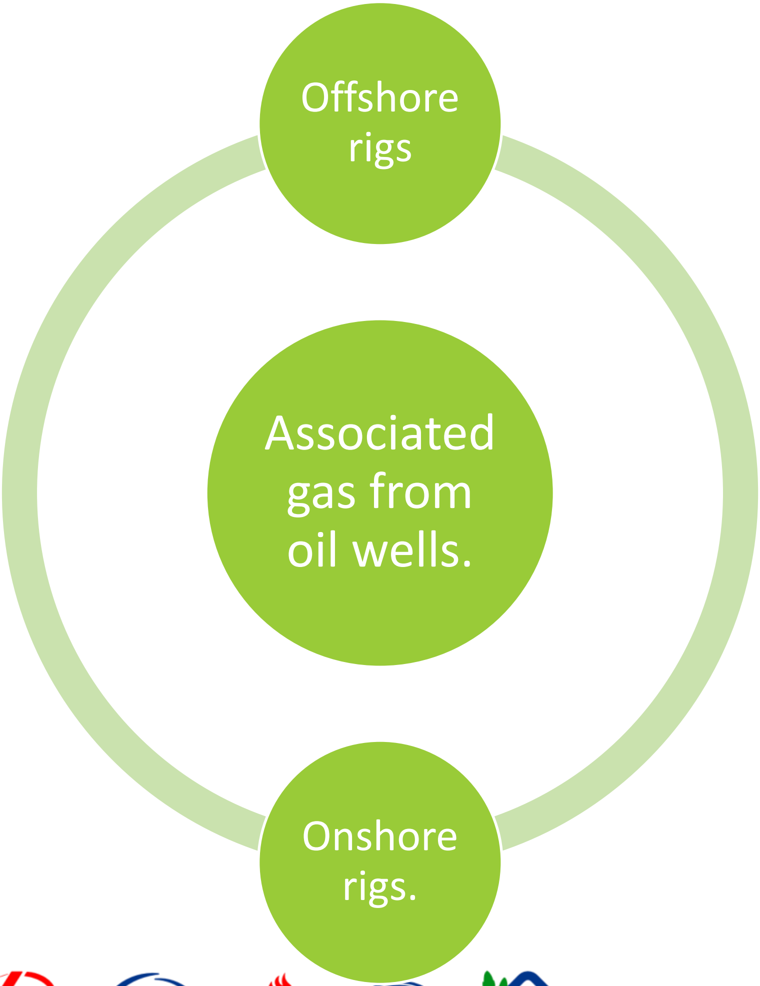
Where Flaring Occurs?

Oil and Gas Production: Wellheads, offshore rigs.

Landfills: Burning methane from waste decomposition.

Refineries and Chemical Plants: Processing and safety flaring.

Flaring in Oil and Gas Production



Offshore rigs

Associated gas from oil wells.

Onshore rigs.

Flaring in Refineries and Chemical Plants

Used during maintenance, startups, and emergencies.

Burns off excess gases from chemical processes.

Flaring in Natural Gas Processing Plants

Burns off impurities or excess gas.

Ensures safe operation during processing.

Flaring in Landfills

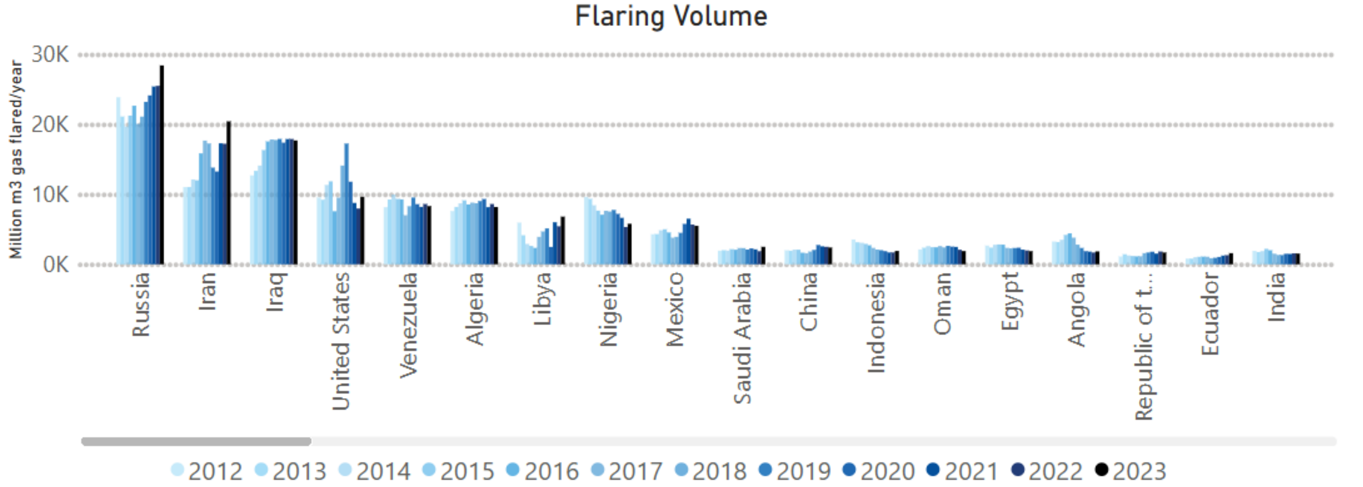
- Alternative to venting methane directly.
- Burns methane produced by decomposing waste.

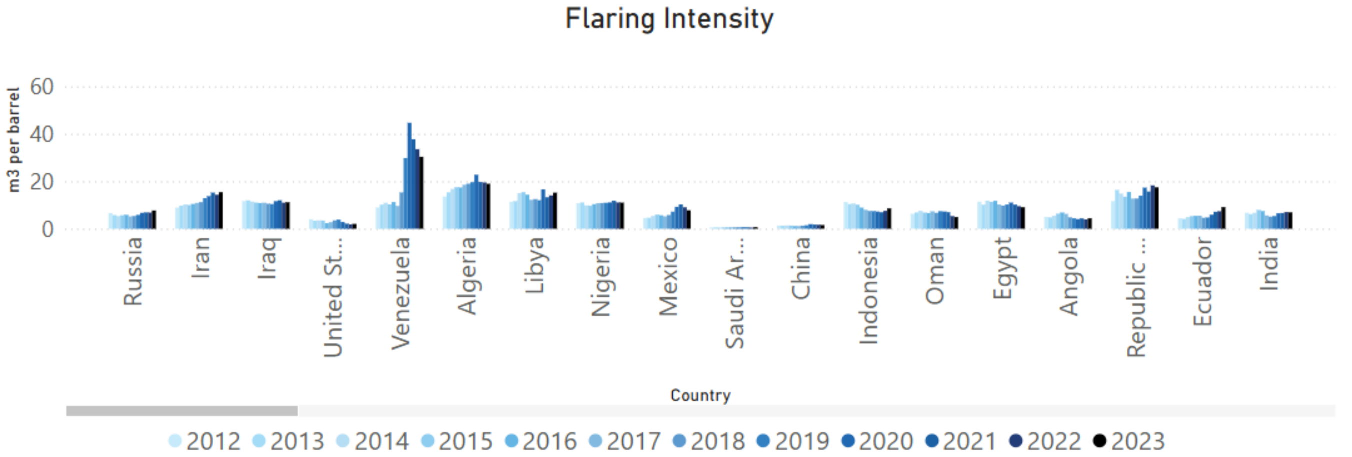
Environmental Impact of Flaring

Impacts

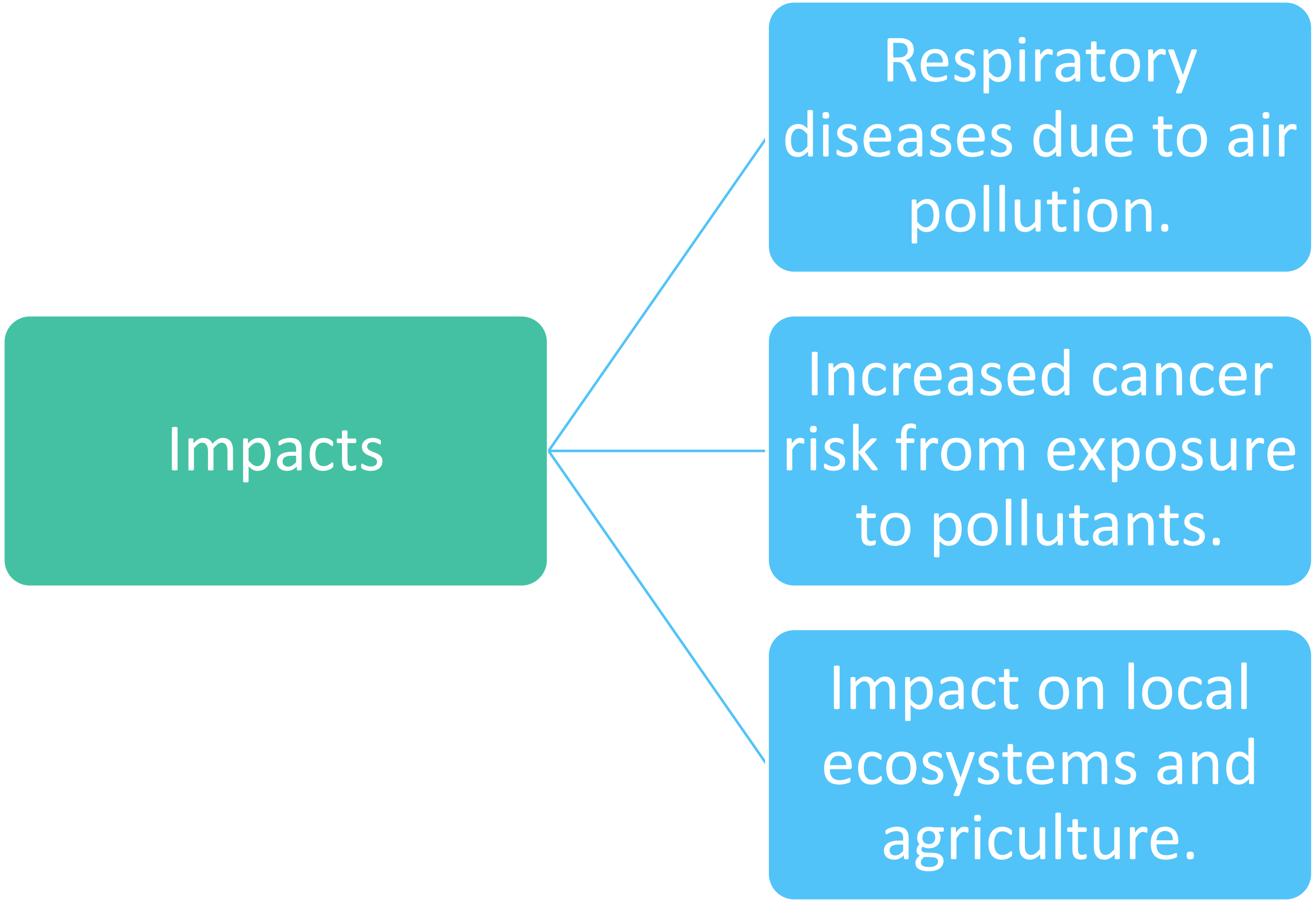
- CO_2 emissions contributing to climate change.
- Methane leaks (potent greenhouse gas).
- Air pollution: black carbon, sulfur dioxide, and nitrogen oxides.

Flaring in the World


Flaring Volume


Flaring Intensity

Health Impact on Communities



Impacts

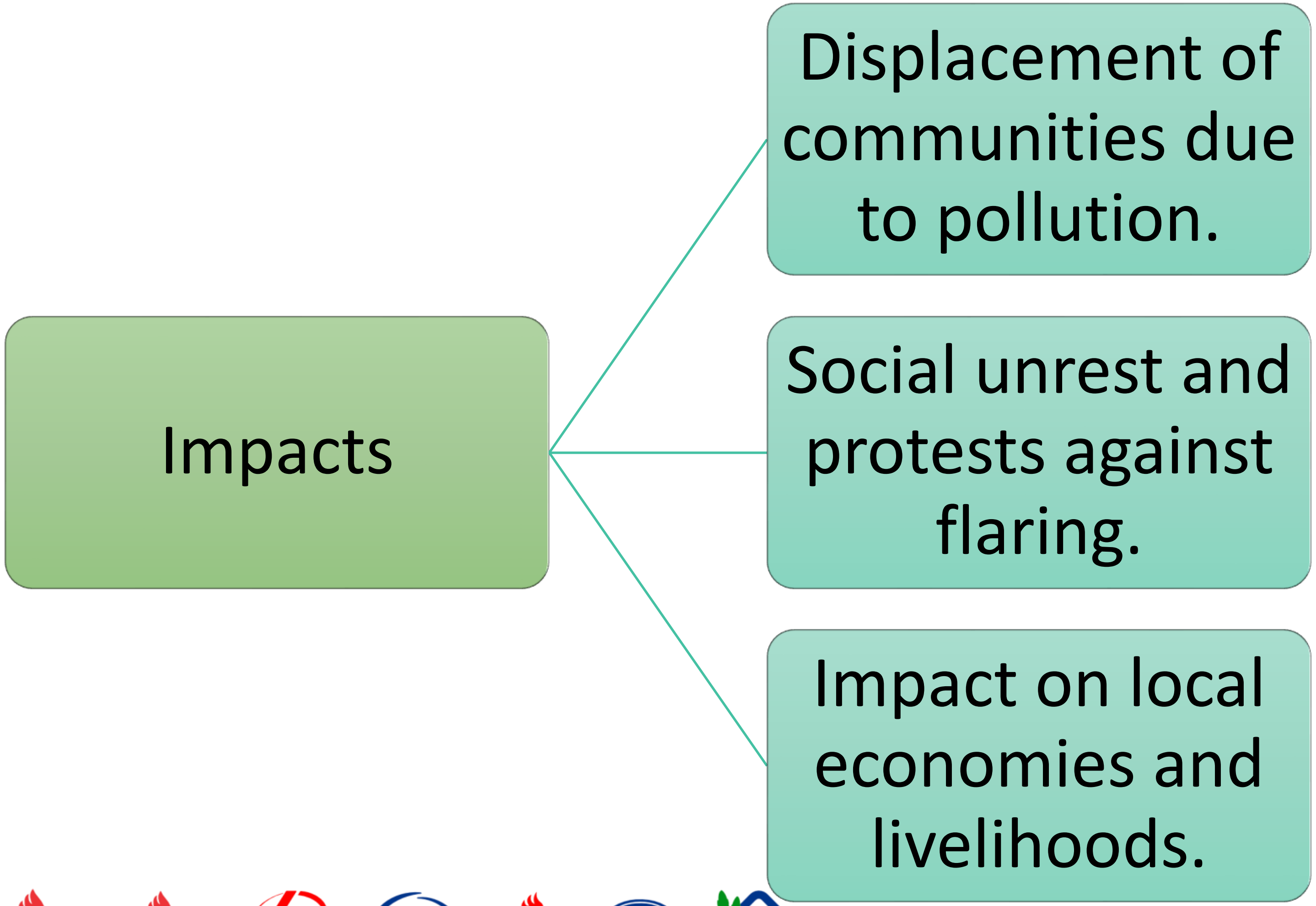
- Respiratory diseases due to air pollution.
- Increased cancer risk from exposure to pollutants.
- Impact on local ecosystems and agriculture.

Economic Impact of Flaring

Impacts

- Wasted energy resource: equivalent to billions of dollars annually.
- Lost revenue from gas that could be sold or used.
- Regulatory fines and reputational risks for companies.

Social Impact of Flaring



Impacts

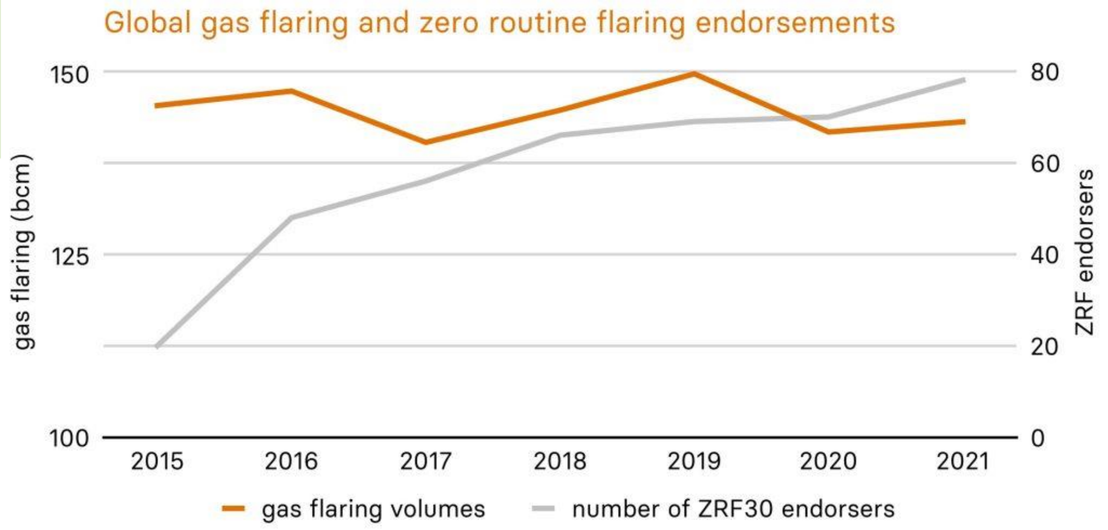
- Displacement of communities due to pollution.
- Social unrest and protests against flaring.
- Impact on local economies and livelihoods.

Why Zero Flaring?

Aligns with global climate goals (e.g., Paris Agreement).

Improves energy efficiency and resource utilization.

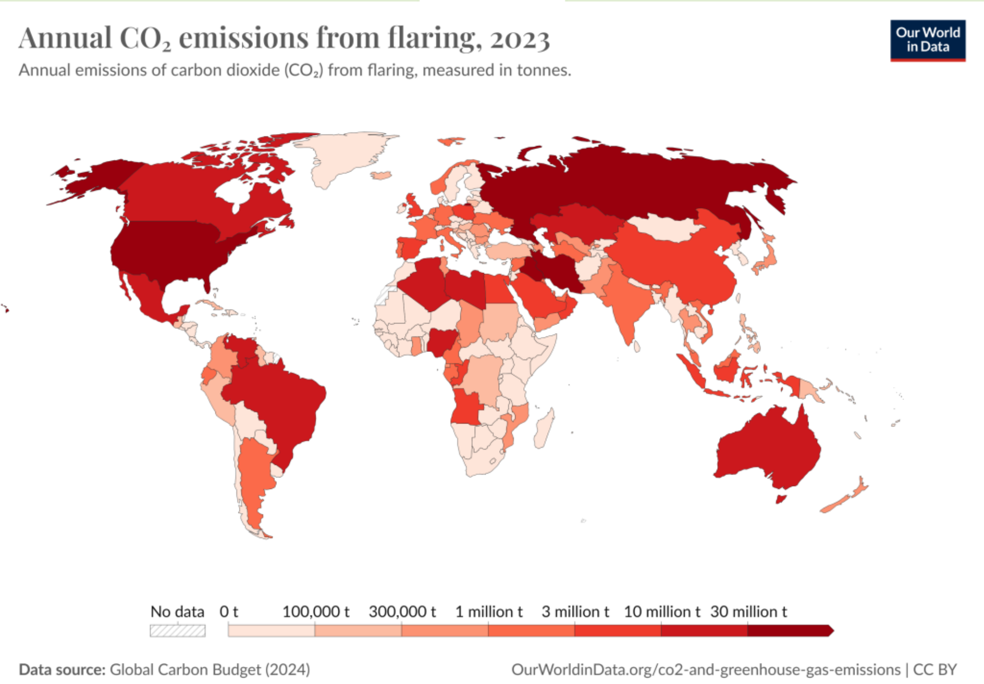
Enhances corporate social responsibility (CSR) and compliance.


Global gas flaring and zero routine flaring endorsements

Global Climate Goals

Paris Agreement targets for reducing greenhouse gas emissions.

Role of zero flaring in achieving these targets.



Annual CO₂ emissions from flaring, 2023

Annual emissions of carbon dioxide (CO₂) from flaring, measured in tonnes.

Data source: Global Carbon Budget (2024)

OurWorldinData.org/co2-and-greenhouse-gas-emissions | CC BY

Challenges to Achieving Zero Flaring

High costs of infrastructure in remote areas.

Weak regulatory frameworks in some regions.

Technical limitations for small or aging fields.

Year
2023

Flare Size
Large (>50 mmscfd)
☐ Select all
■ Large (>50 mmscfd)
☐ Medium (5 - 50 mmscfd)
☐ Small (<5 mmscfd)

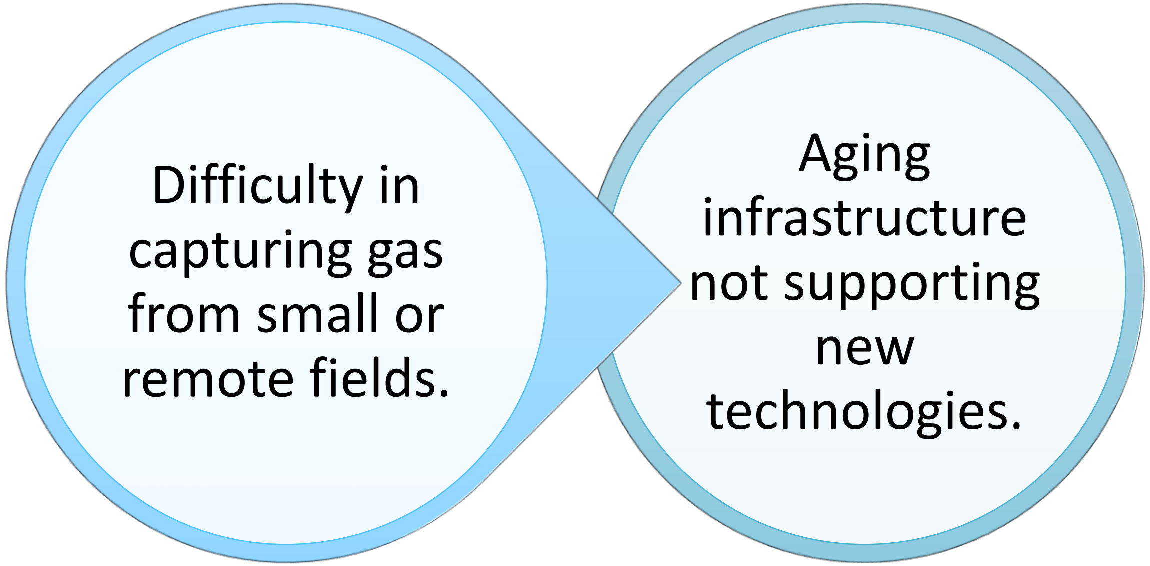
Location
All

Economic Barriers

Low gas prices making capture uneconomical.

High initial investment required for infrastructure.

Technical Limitations



Difficulty in capturing gas from small or remote fields.

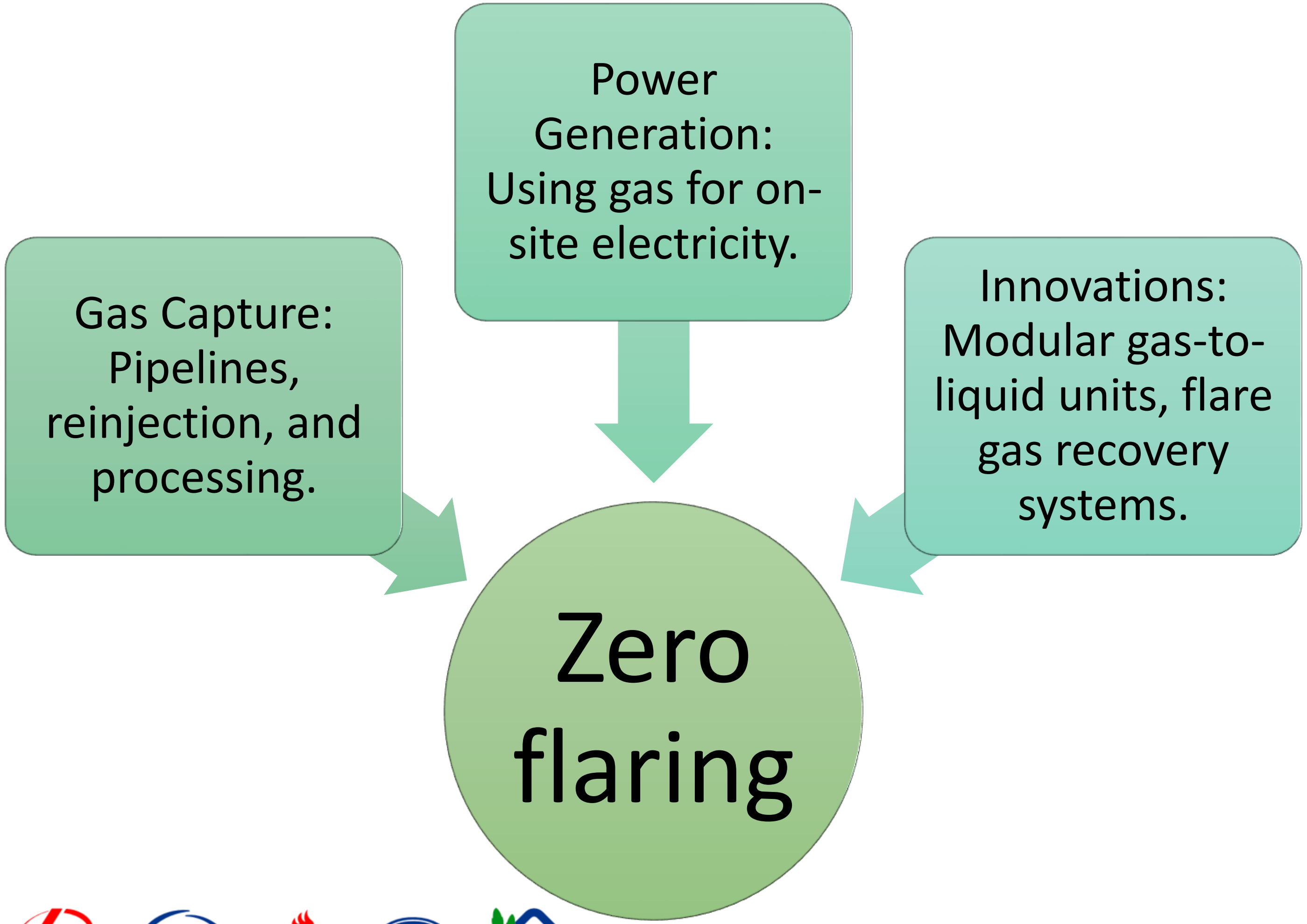
Aging infrastructure not supporting new technologies.

Regulatory Gaps

Need for stronger international cooperation.

Lack of enforcement in some regions.

Solutions and Technologies



Power Generation: Using gas for on-site electricity.

Gas Capture: Pipelines, reinjection, and processing.

Innovations: Modular gas-to-liquid units, flare gas recovery systems.

Zero flaring

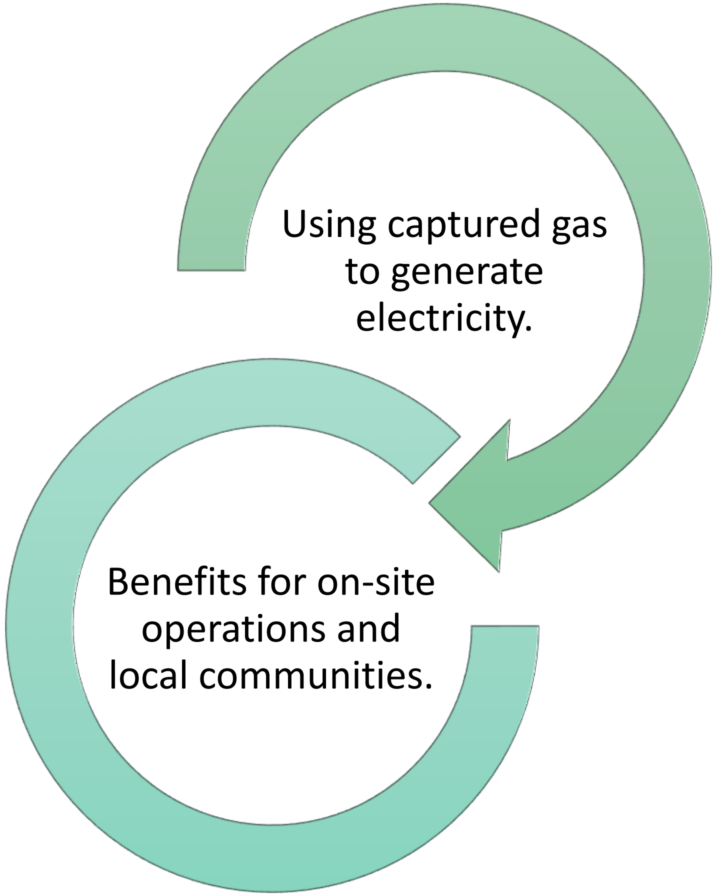
Gas Capture and Utilization

Capturing gas for use in power generation or processing.

Reinjecting gas into oil fields to enhance recovery.

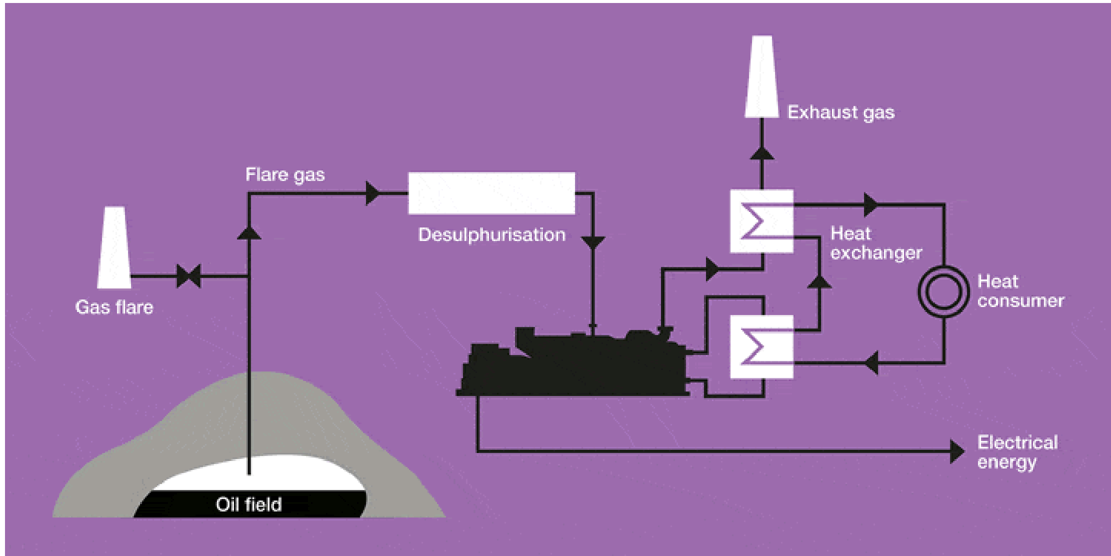

shutterstock.com · 147957095

Power Generation



Using captured gas to generate electricity.

Benefits for on-site operations and local communities.

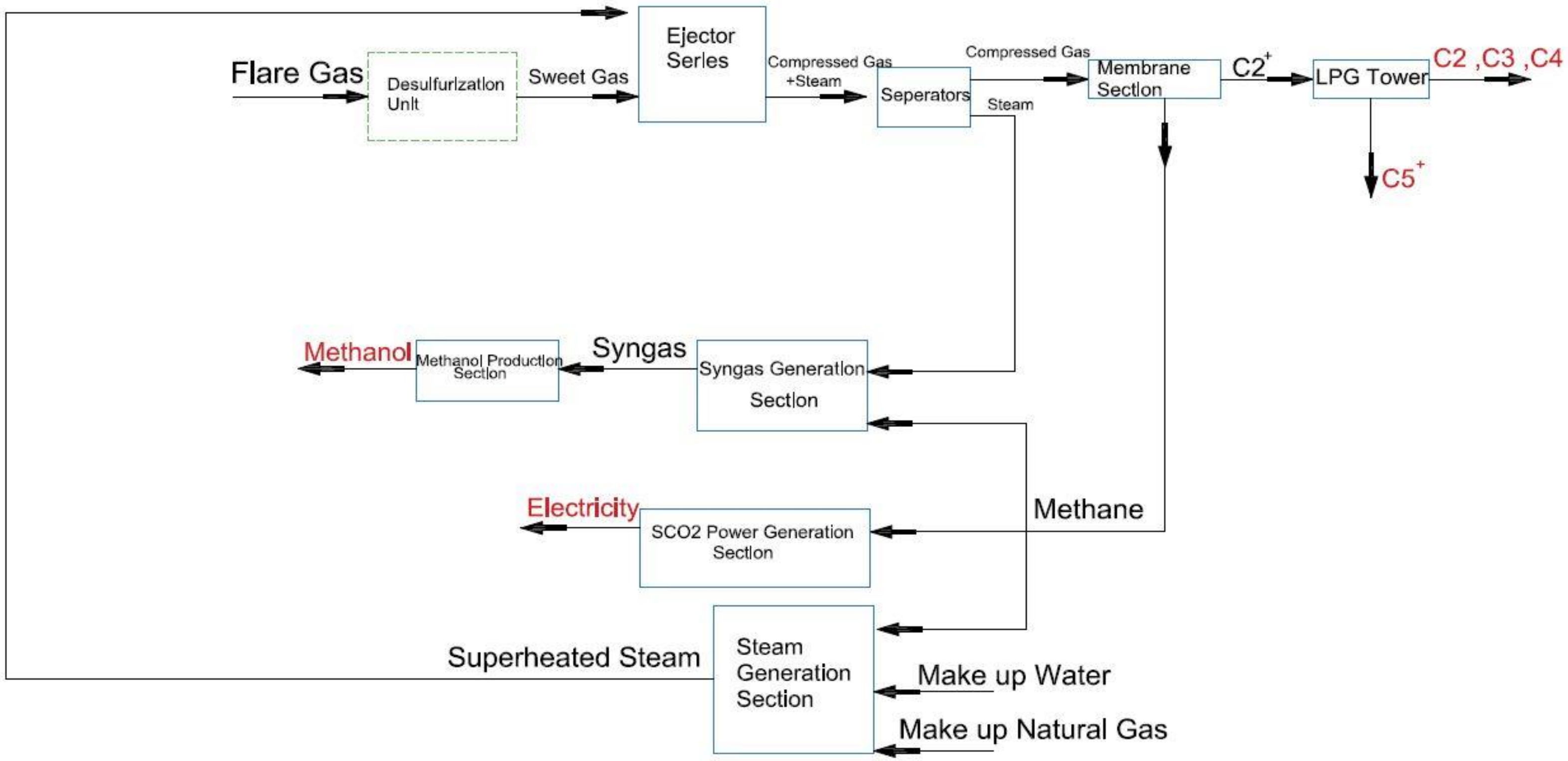


Technological Innovations

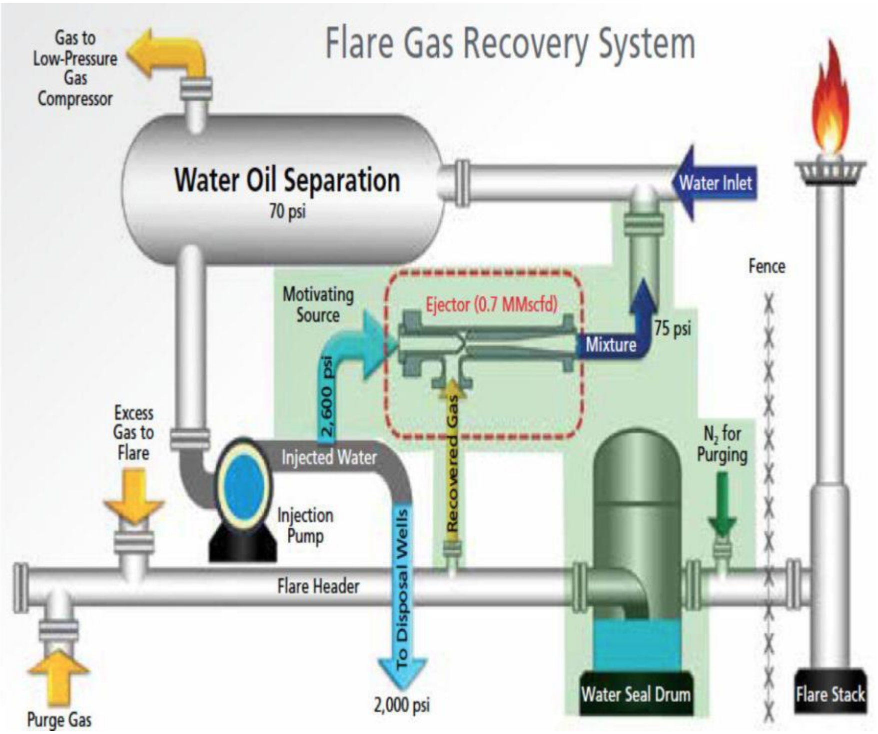
Technologies			
Flare Gas Recovery Systems: Capturing and compressing flare gas for reuse.	Modular Gas-to-Liquid (GTL) Units: Small-scale units to convert gas into liquid fuels.	Leak Detection and Repair (LDAR): Advanced sensors and drones to detect methane leaks.	Digital Monitoring: Real-time data analytics to optimize gas capture.

مطالعه موردی: ایران

سامانه یکپارچهٔ تولید متانول، الکتریسیته، گاز مایع و میعانات گازی (+C۵) با خوراک ورودی گاز فلر



- بازیابی گاز فلر
  - فشرده سازی گاز فلر
    - استفاده به عنوان سوخت در فرایندهای پتروپالایشی
    - تزریق به چاه با هدف ازدیاد برداشت
    - تزریق به شبکه سراسری گاز
  - جداسازی اجزای سازنده گاز فلر
  - تولید ترکیبات شیمیایی
    - آمونیاک
    - اتیلن
    - متانول
    - دی متیل اتر
  - تولید الکتریسیته

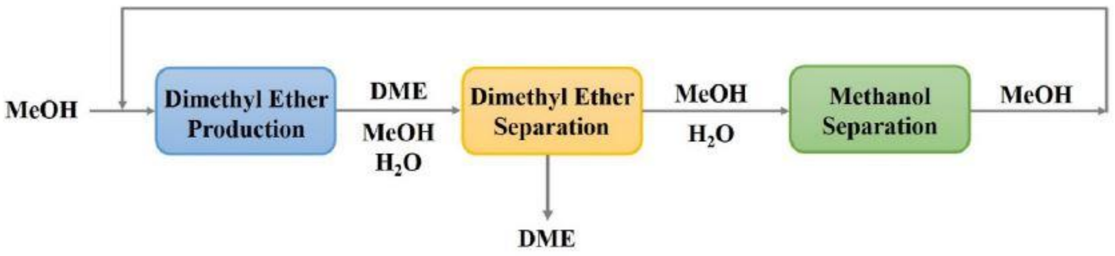


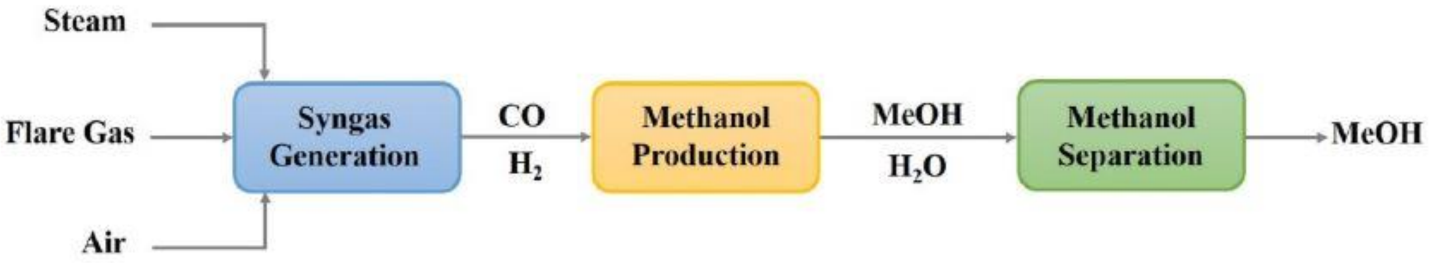
متغیرهای تأثیرگذار در شناسایی و انتخاب بهترین فناوری ممکن بازیابی گاز فلر:

1) ترکیب مولی اجزای سازندهٔ گاز فلر
2) هزینه‌های سرمایه‌گذاری و جاری
3) پیچیدگی فنی تکنولوژی مورداستفاده
4) انتقال محصول نهایی به بازار
5) میزان مصرف انرژی و انتشار گازهای گلخانه‌ای

تولید محصولات شیمیایی از گاز فلر

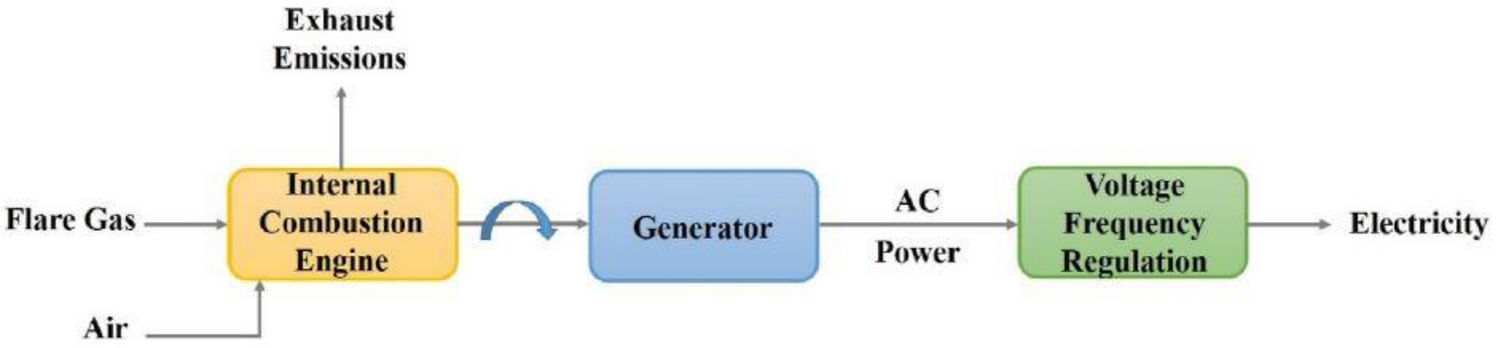
- تولید محصولات شیمیایی از گاز فلر
  - متانول
    - متانول به اولفین
    - متانول به پروپیلن
    - متانول به بنزین
  - دی متیل اتر
  - آمونیاک
  - اتیلن





تولید توان از گاز فلر

- تولید توان از گاز فلر
  - موتورهای گازسوز
    - محدوده وسیع توان نامی تا ۳۰MW
    - بازده الکتریکی قابل‌قبول ۴۰-۵۰٪
    - هزینه‌های جاری پایین
    - تعمیرات و نگهداری ساده‌تر
  - توربین گاز
  - توربین بخار
  - سیکل های ترکیبی
  - پیل سوختی

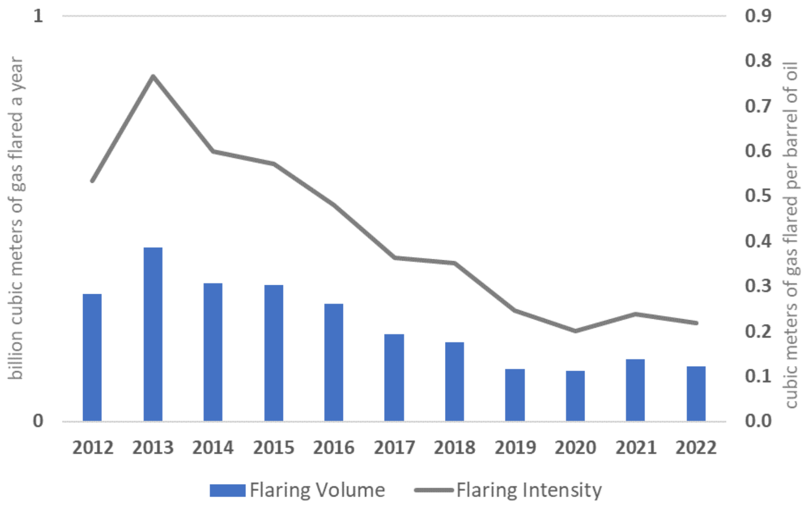


Case Study: Norway

Strict Regulations: Norway imposes a carbon tax and bans routine flaring. above EUR 60 per tonne of CO2

Advanced Technology: Use of reinjection and gas processing.

Results: Norway has reduced flaring to near-zero levels.

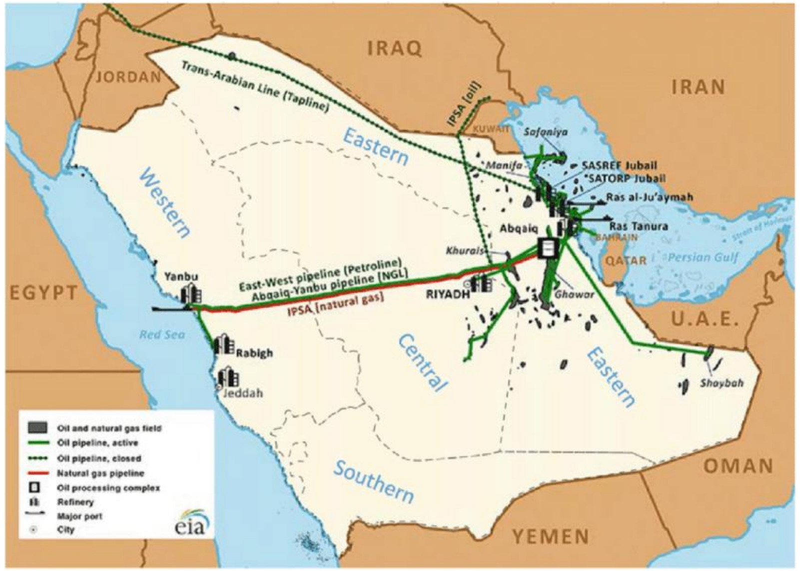


Case Study: Saudi Arabia

Master Gas System: A nationwide network to capture and process associated gas.

Investment in Infrastructure: Billions spent on gas processing plants and pipelines.

Results: Significant reduction in flaring and increased gas utilization.



Case Study: BP, Shell, and Equinor

BP: Committed to zero routine flaring by 2030; uses advanced flare gas recovery systems.

Shell: Invests in modular GTL units and digital monitoring.

Equinor: Achieved near-zero flaring in Norway through reinjection and gas processing.

Case Study: Qatar

Gas-to-Liquids (GTL) Plant: Converts flare gas into liquid fuels and chemicals.

Results: Significant reduction in flaring and economic benefits.

Case Study: Nigeria

Nigerian Gas Flare Commercialization Program: Aims to eliminate flaring by 2030.

Challenges: Infrastructure gaps and regulatory issues.

Progress: Some success with gas capture projects.

Global Initiatives

World Bank's Zero Routine Flaring by 2030: Encourages governments and companies to eliminate routine flaring.

Global Gas Flaring Reduction Partnership (GGFR): Provides technical assistance and funding.

Regional and National Policies: Examples include Norway's carbon tax and Nigeria's flaring regulations.

Economic Benefits of Zero Flaring

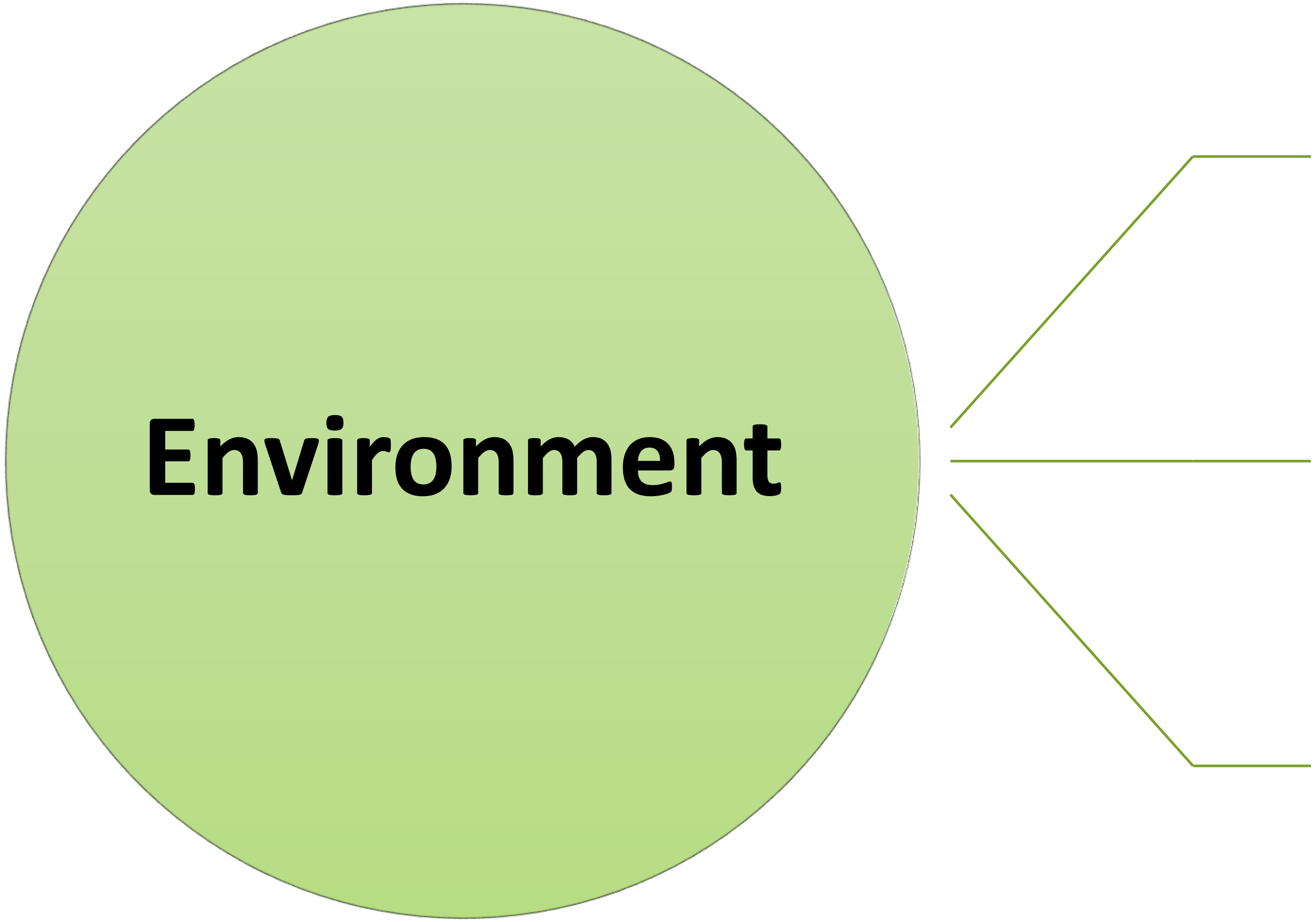
Economic

Increased Revenue: Selling captured gas instead of flaring it.

Reduced Fines: Avoiding regulatory penalties.

Improved Reputation: Enhancing corporate social responsibility (CSR).

Environmental Benefits of Zero Flaring



Environment

Reduced Emissions: Lower CO_2 and methane emissions.

Improved Air Quality: Less black carbon and pollutants.

Resource Conservation: Efficient use of natural gas.

Call to Action

Action

Governments: Strengthen regulations and provide incentives.

Companies: Invest in technologies and commit to zero flaring.

Individuals: Advocate for sustainable energy practices.

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