Piloting Hydrogen Injection into Natural Gas Distribution Networks

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ERRA HYDROGEN WEBINAR

Mehmet Şerif SARIKAYA

GAZBİR – GAZMER

Project and International Manager

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SAFER, SMARTER, GREENER

Electrolysis → Green Hydrogen

SMR or Gasification (CCS) → Blue Hydrogen

SMR or Gasification → Gray Hydrogen

Pyrolysis → Turquoise Hydrogen

COP21

Use of Hydrogen;

Zero Carbon Emissions
Energy Storage and Carrier

Calorific Value of Unit Mass of Gas Hydrogen ,

2.1 times of Natural Gas

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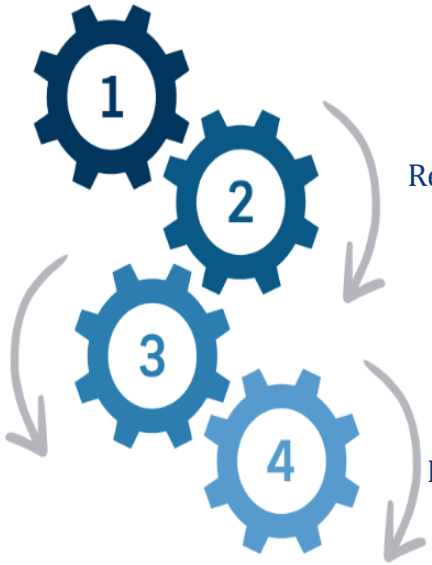
Natural Gas Sector in Transition to Hydrogen

Priority investments and issues for the transition from natural gas to hydrogen

Political Support and Public Investment Partnership

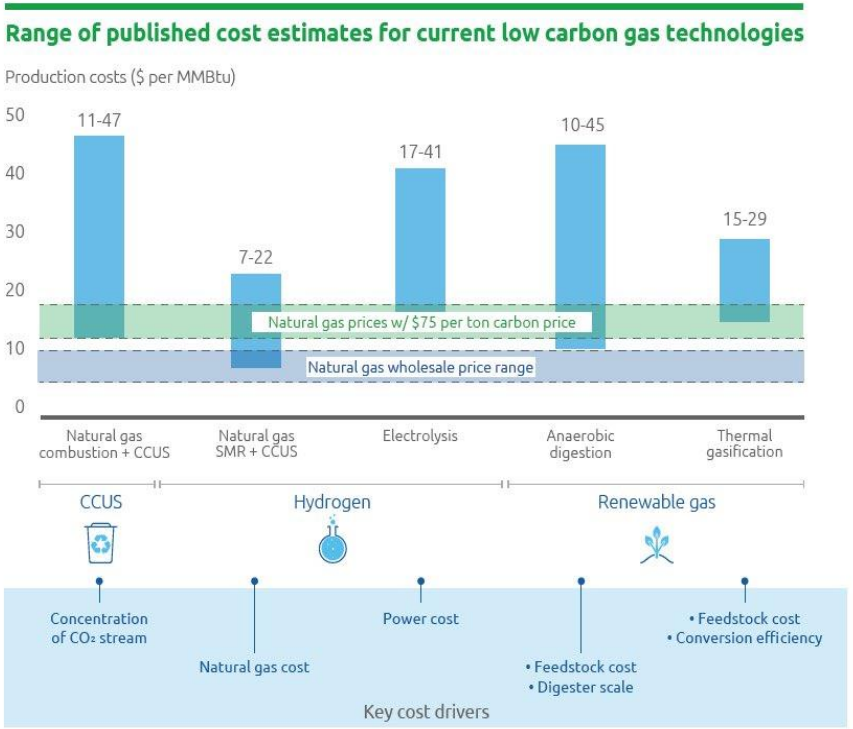


Regulations

Development of Hydrogen Pipeline Infrastructure

Converting Domestic Devices

Cost of using hydrogen in natural gas systems



Source: Imperial College London, Navigant, IEA, BCG analysis.

Legislation studies on the use of hydrogen in natural gas systems

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HYDROGEN INJECTION PROJECTS in NATURAL GAS SYSTEMS

HYDROGEN INJECTION PROJECTS BY COUNTRY

United Kingdom

USA

Russia

Ukraine

Japan

Netherlands

Germany

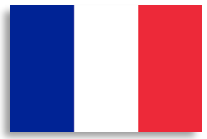
Portugal

South Korea

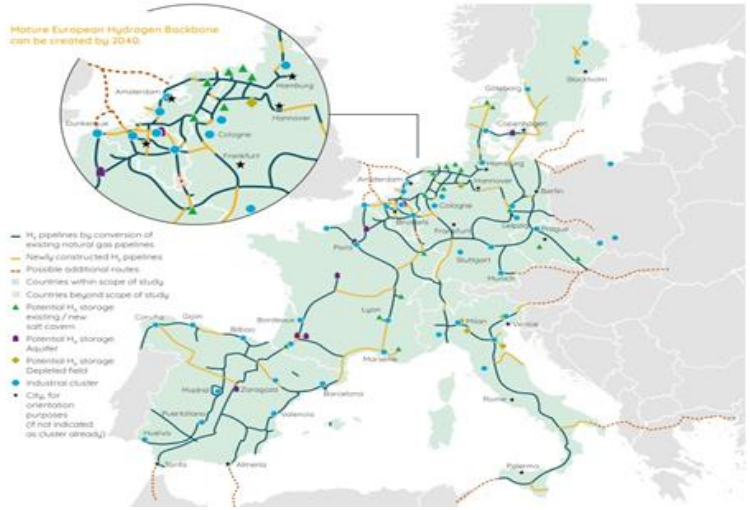
Canada

Australia

France

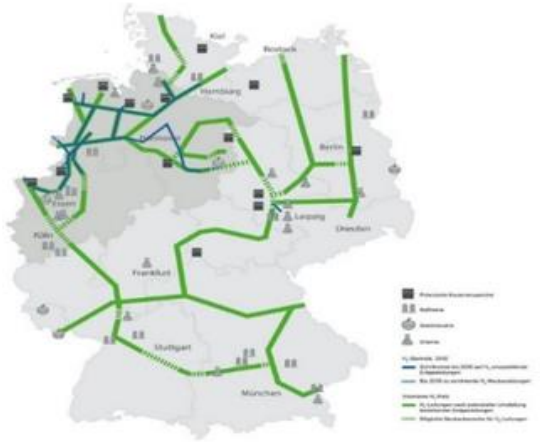


2040 European Hydrogen Backbone



Source: GuideHouse

Germany National Hydrogen Infrastructure



Source: OGE

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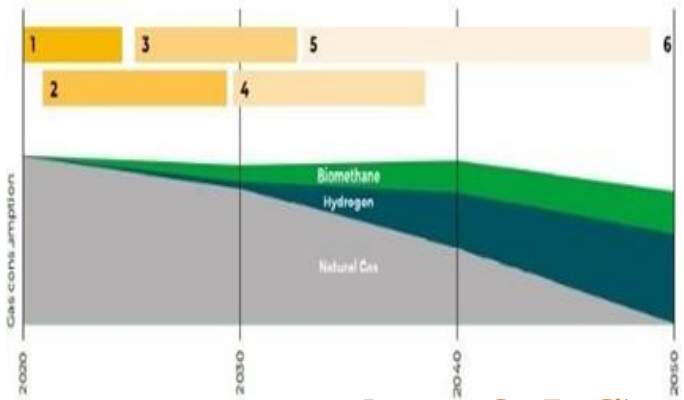
HYDROGEN FUTURE PERSPECTIVE

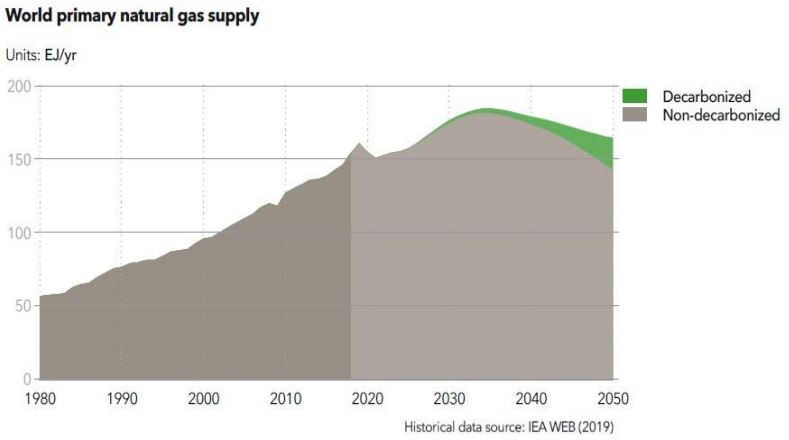
Exchange of Gas in Network



Resource: Gas For Climate

Decarbonization

2050 **Target** Decarbonization of 13% of Natural Gas



Saving

Annual Savings of 140 Billion Euros Up to 2050 with the Use of Renewable Gas

Employment

600,000 new jobs by 2050 as renewable gas production increases and uses in Europe

Investment

A cost of 27 - 64 Billion € is predicted in Europe by 2040

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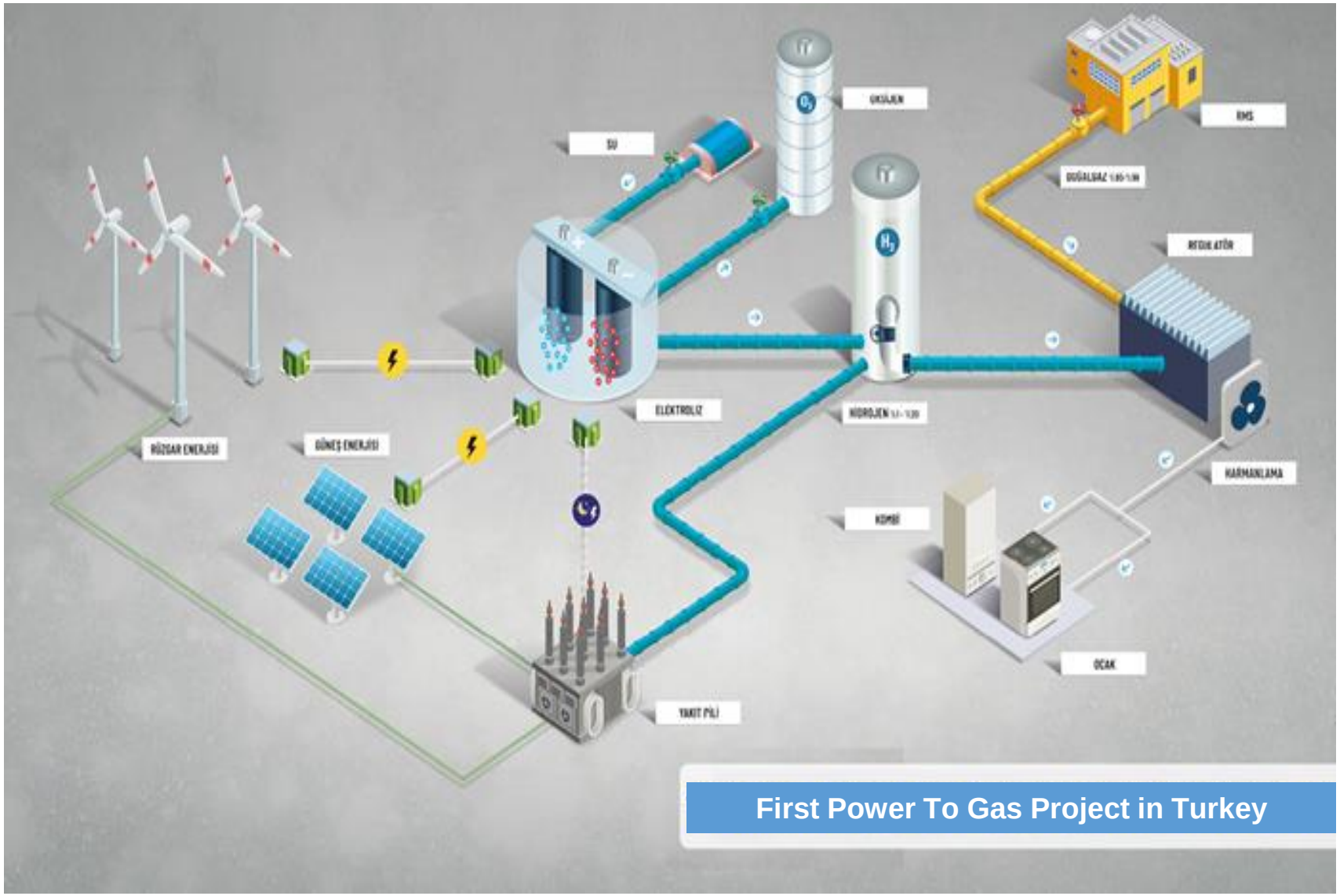
CLEAN GAS CENTER PROJECT



Schematic view of the project

- Duration of Project : 2 Years
- Green Hydrogen Production
- Hydrogen up to 5-10-15-20% and Natural Gas up to 95-90-85-80% were Mixed
- Natural Gas Hydrogen Mixture was be Performed and Burned in Domestic Appliances Such as a Gas Stove, Boiler and Interior Installation
- Clean Gas Center was Planned as an Renewable Gas R&D Center in the Long Term

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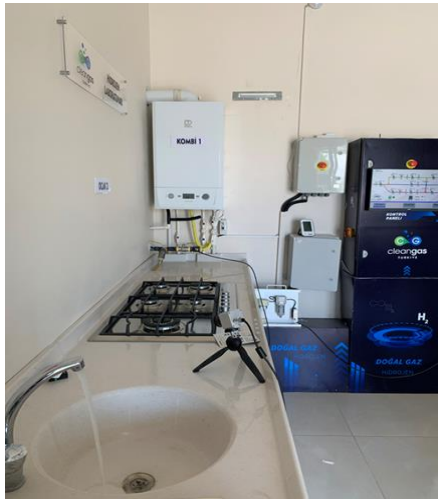
CLEAN GAS CENTER PROJECT



- Leak Tests
- Tightness and Durability Test
- Chemical Analysis
- Bending Test
- Pressure Test
- Carbon Emission Tests
- Flash Back
- Gas Flow Rate
- Gas Quality

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PRIORITY ISSUES FOR THE TRANSITION TO SAFE AND SECURE HYDROGEN

- Setting a Working Group
- Gas Quality and Safety
- Technical Compliance Studies
- Transition and Integration Process
- Natural Gas Users
- Human Resource
- R&D and Investment
- Regulation Studies
- Market Creation

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ROAD MAP OF TURKEY IN TRANSITION TO HYDROGEN IN NATURAL GAS SECTOR

- **2021-2025:** R&D studies
- **2025-2030:** Minor-scale integration - Low hydrogen concentration
- **2030-2040:** New infrastructures - Increase in hydrogen concentration
- **2040-2050:** Gas infrastructure which is 100% compatible with hydrogen

Targets

2021 – 2025	2025 – 2030	2030 – 2040	2040 – 2050
Safety Studies in Residences, Distribution and Transmission Networks	Hydrogen Injection to Networks on a Regional Basis (up to 10%)	Creating Hydrogen Lines	Extensive Use of Hydrogen in Housing and Industry
Pilot Studies for Hydrogen Uses in Housing and Industry	Creating a Renewable and Low Carbon Gas Market	Increasing Hydrogen Generation	100% Hydrogen Compliance of Distribution Lines
Tests for Domestic Devices	Allowing Renewable and Low Carbon Gas Mixture to Current Networks	Accelerating the Transformation in Industrial and Domestic Devices and Increasing Domestic Production	Initiating the Hydrogen Export
Supporting the Hydrogen Innovation and Demonstration Projects	Establishing Small Scale Facilities for Hydrogen Generation, Storage and Transportation	Increasing Hydrogen Injection to Networks on a Regional Basis (min 20%)	Creating Sufficient Hydrogen Generation and Storage Capacity
R&D Studies on Hydrogen Generation and Storage	Initiating the 100% Hydrogen Usage Tests	Determining Pilot Sites with 100% Hydrogen Use	
Creating Blending and Technology Targets	Increasing Industry Incentives for the Production of Convertible Devices	Creating Special Hydrogen Storage Areas	
Initiating the Legislation Studies Determining Hydrogen Incentive Policies Initiating the Hydrogen Awareness Studied for Consumers	Continuing Improvement in Industrial and Domestic Devices Completing the Human Resources Practices2 Determining Legislation Regarding Transport, Transmission, Storage, Distribution and Consumption of Hydrogen	Connecting Industrial Clusters to Hydrogen Storage and Production Facilities with Hydrogen Lines	
Determining Human Resources Strategy and Policy	Initiating the Government Incentive for Hydrogen Market Formation		

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CONCLUSION

- Moving to a fully hydrogen-based supply system is a distant future and will require significant government support.
- Initial steps in the transition to hydrogen may include temporary demonstration projects or small-to-medium scale projects. These projects can inject hydrogen into existing distribution networks to mix with natural gas to a safe limit.
- The current regulatory and commercial framework for the gas supply system will need to be adapted in these early stages of the hydrogen transition.
- Establishing competitive of hydrogen and natural gas, balancing energy and pricing transportation
- The need for the use of new generation devices and gas meters
- Initiation of preliminary studies for regulation
- Developing a Hydrogen Roadmap in the Natural Gas Sector

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THANK YOU

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