

Global Renewable and Low-Carbon Gas Report

2021 edition

About IGU

The International Gas Union is the global voice of the gas industry. With more than 160 members in over 80 countries, covering 95% of the global gas market: from exploration and production of natural gas, low and zero carbon gas and technologies, to transit, pipelines, and LNG, and through distribution and use of gas, the IGU is the only international association covering the entire supply chain across all continents.

Contents

Message from the President	5
Message from the Oxford Institute for Energy Studies	6
Executive Summary	7
1. Introduction	9
2. Methodology	15
3. Analysis and conclusions	16
4. Country Focus Section	19
4.1 China	19
4.2 Malaysia	24
4.3 Netherlands	27
4.4 Denmark	29
4.5 Germany	31
4.6 South Korea	35
4.7 United States	38
4.8 Canada	42
4.9 Brazil	45
5. Appendix	48
5.1 Types of Renewable Gases	48
5.2 Details of Methodology	49

Figures

Figure 1: Share of Primary Energy by Fuel	11
Figure 2: Natural Gas Production by region 2001-2020	12
Figure 3: Shares of Primary Energy of renewable gases	13
Figure 4: Renewable Gas Production Cost Comparison	14
Figure 5: Number of Hydrogen and Biomethane Plants reported in database	16

Figure 6: Map of global coverage of IGU's Renewable Gas Database	17
Figure 7: Energy consumption by source in China	18
Figure 8: Number of biomethane plants in China by status	20
Figure 9: Estimated output of biomethane plants in China by status	20
Figure 10: Number of hydrogen projects in China by status	21
Figure 11: Estimated output of hydrogen plants in China by status	21
Figure 12: Power generation by source in Malaysia	24
Figure 13: Biogas production in Malaysia	25
Figure 14: Cumulative growth in number of biogas plants in Malaysia	26
Figure 15: Cumulative growth in capacity of biogas plants in Malaysia	26
Figure 16: Netherlands biomethane Plants and estimated output by stage of development	28
Figure 17: Electricity generation by source 1990-2019	29
Figure 18: Denmark Electricity generation from biofuels and waste by source 1990-2019	29
Figure 19: German greenhouse gas emissions by year	31
Figure 20: German Energy system by fuel and sector 2018	32
Figure 21: Germany Biomethane plants by source of feedstock	33
Figure 22: Germany Hydrogen Plants by stage of development	33
Figure 23: South Korea Primary Energy Supply	35
Figure 24: US Primary Energy Consumption 1950-2020	37
Figure 25: US Electricity Generation 1950-2020	38
Figure 26: US Hydrogen projects by stage of development	38
Figure 27: US biomethane projects by stage of development	39
Figure 28: US Renewable Gas projects by State	40
Figure 29: Existing Hydrogen infrastructure in US Gulf Coast region	41
Figure 30: Canada Biogas use and potential	42
Figure 31: Canada Hydrogen Projects by stage of development	43
Figure 32: Biomethane Projects in Canada by State	44
Figure 33: Brazil Biomethane project by status	45
Figure 34: Brazil Biomethane project by size and status	46
Figure 35: Location of Brazil biomethane projects by status	46
Table 1: Properties of biogas and natural gas	48

Message from the President

Welcome to the inaugural edition of the International Gas Union's *World Renewable and Low-Carbon Gas Report*.

This is the first report in what is to become a new series. We made the choice to launch this report to demonstrate our support and appetite for the accelerated growth of the global renewable and low-carbon gas sector. Developing effective growth strategies, requires an understanding of the baseline, and that is what we aim to establish with this series. It will track the industry's progress, as it grows and develops over time.

Renewable gas and low-carbon hydrogen are two vital elements in an achievable energy transition. They will be critical for the global energy system to achieve the required levels of decarbonisation, fast enough to avoid irreversible climate change.

The clear message is that scale of projected supply is going to be more and more challenging to attain, without a rapid and significant increase in production. The current level of planned and installed production capacity for renewable and low-carbon gases appears negligible compared to the stated plans, and that must be changed.

As such, this report is a call to action on all fronts – policy, industry, and the financial community. We all need to play our part if there really will be a practicable gaseous energy revolution.

The IGU aspires for this report to develop into authoritative source of information on global renewable and low-carbon hydrogen gas, as our other flagship reports are on natural gas. We will tap into the IGU's wide-reaching global network and one of the most extensive gas industry knowledge bases in the world to make that possible. Over a thousand professionals participate in IGU's Committees and Task Forces. They produce insightful reports and design the Technical Program of one of the biggest global energy events, the World Gas Conference with the next edition in Daegu, Korea, in May of 2022.

I also take the opportunity to call on all IGU members and partners with renewable gas and low-carbon hydrogen projects to participate in the next year's edition of this survey. For more information, you can reach out to the IGU report study group leader or IGU Public Affairs.

I hope this report will be informative and inspire action in the global energy community to accelerate the production scale-up of the key renewable and low-carbon gas technologies.

Joe. M. Kang
President, IGU

Message from the Oxford Institute for Energy Studies

The Oxford Institute for Energy Studies (OIES), together with its partners in this project from the Sustainable Gas Institute, Imperial College, London and the Bureau of Economic Geology, University of Texas, Austin, has been delighted to work with the International Gas Union on the production of this renewable gas database report. While we recognise that this first edition has only be based on limited data, it has already produced some valuable insights, and we expect this to grow further as the data coverage increases in future editions.

We felt it particularly valuable to look at both biomethane and hydrogen in one report, as we see them playing complementary roles in decarbonisation of the global energy system and both are very relevant to the natural gas industry.

We look forward to continuing the co-operation with the International Gas Union over the coming years.

Martin Lambert

Senior Research Fellow, Oxford Institute for Energy Studies

IGU Innovation and R&D Committee Study Group

Gerard Martinus (Project Lead)	GasTerra, The Netherlands
Vladislav Karasevich	Russian Gas Society, Russia
Greg Caldwell	ATCO Gas, Canada
Marco Sanjuan	Promigas, Colombia
Philippe Buchet	ENGIE, France
Pierluigi Ionavale	Resgas, Italy
Rod Rinholm	Gas Technology Institute, USA

OIES Project Team members

Martin Lambert	Oxford Institute for Energy Studies
Ning Lin	Bureau of Economic Geology, University of Texas, Austin
Robert Brooks	RBAC
Yayun Chen	RBAC
Meiyan Chen	RBAC
Gbemi Oluleye	Centre for Environmental Policy, Imperial College, London

Supported by: **Tatiana Khanberg**, IGU Senior Manager of Public Affairs

Also available as part of the eCourse

[2022 Renewable Energy Law eConference](#)

First appeared as part of the conference materials for the
17th Annual Renewable Energy Law Institute session

"Texas is an energy state — does that include Hydrogen? "