

## Table of Contents

» Editorial

» Hydrogen

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## EDITORIAL

### OGEL Special Issue on The Hydrogen Economy - Introduction

*Dr. Cameron Kelly*  
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#### Introduction

Despite being the most common element in the known universe, realising the true value of hydrogen remains problematic. To be used as a fuel, heat source or feedstock, hydrogen must typically be synthesised from a chemical reaction - these include greenhouse gas emitting processes to produce "brown" (gasification of brown coal) or "grey" (steam reformation of natural gas) hydrogen, capturing and storing carbon dioxide from grey or brown hydrogen to produce "blue" hydrogen and creating "green" hydrogen through electrolysis powered by renewable energy sources.

When burned, hydrogen produces zero carbon emissions - this characteristic makes the element an obvious choice in the global fight against climate change, prompting many commentators to label it the key missing ingredient to a credible net zero pathway. It is this same characteristic which make hydrogen an obvious candidate for reducing or even eliminating emissions in the world's fossil fuel - intensive industries, and in so doing create a new 'hydrogen economy'.

Despite recent and rising global interest in hydrogen, the concept of a hydrogen economy is not new. Hydrogen was promoted as a replacement for hydrocarbons like oil and gas following the oil crisis in the 1970s, and again in the 1990s and early 2000s as global awareness of climate change and the urgent need to reduce greenhouse gas emissions has grown. Versions of what might constitute the ideal hydrogen economy vary, but all feature the significant scaling up of green hydrogen as a substitute for fossil fuel use. Such scenarios show real promise for hard-to-abate industrial sectors historically dominated by fossil fuels usage.

If hydrogen is to play a key role in the global clean energy transition, its most attractive uses lie in sectors for which the abatement of greenhouse gases has (at least historically) proven to be difficult - these include industrial manufacturing (such as steel fabrication, cement production and ammonia synthesis), heavy transport and fuel cells (as an evolving alternative to battery - powered electric vehicles) and power generation (as a feedstock for hydrogen-fired turbine power stations, and when combined with large-scale geological storage and renewable energy to produce green hydrogen).

Gas industry stakeholders argue that a staged approach to developing the hydrogen economy is appropriate, beginning with carbon capture and storage (CCS) to enable blue hydrogen production. Similarly, resources companies advocate that there are significant synergies with hydrogen to be explored before a full transition to green hydrogen, given their existing reserves of gas, evolving CCS and CCUS (carbon capture, utilization and storage) capabilities, together with opportunities to repurpose existing technology and facilities to accommodate blue hydrogen.

A fully formed and functioning hydrogen economy is undoubtedly still some way off. The International Energy Agency has estimated the number of electrolyser projects and installed capacity for green hydrogen projects has increased from less than 1 MW in 2010 to over 25 MW in 2019. Renewable energy prices and the cost of electrolyzers have declined significantly over the same period. Inevitably, the high costs of scaling up hydrogen infrastructure means that governments have a critical role in supporting industry investment and in creating a supporting regulatory framework. Early signs show real promise: energy hungry but resource poor jurisdictions like Japan have made hydrogen a cornerstone of their long-term energy strategies and have issued well-publicised invitations to overseas hydrogen production bases (like Australia) which can service their import requirements. Germany has announced a €130 billion pandemic recovery budget dominated by green initiatives, including a fully-funded target of 5GW of electrolyzers by 2030. Australia, with its abundant natural and renewable resources, is poised to become a key global player in hydrogen export markets over the long term.

On the supply side, significant demand already exists for hydrogen producing projects. Nonetheless, current costs mean that if blue and green hydrogen projects are to be deployed and accelerated, large-scale investment and other fiscal support from governments will be crucial. Australia provides a useful example: in April 2020, the Australian Renewable Energy Agency (ARENA) announced a funding round of up to \$70 million to support the nascent green hydrogen market in Australia. Following an oversubscribed initial stage, seven companies were shortlisted for further consideration. However, ARENA received over 30 expressions of interest for the available \$70 million, totalling over \$3 billion in value.

The move to a viable global hydrogen economy is likely to involve synergies between the renewable energy and gas industries, with projects involving an international group of sponsors, lenders, and offtakers. To materialise, any version of the hydrogen economy must realise and more importantly take advantage of the increasing connectivity between and across international energy markets. This Special Issue on the Hydrogen Economy attempts to address this opportunity by presenting a detailed discussion of the hydrogen opportunity (from both demand and supply - side perspectives) across several jurisdictions, including

the European Union, Germany, the United Kingdom, Russia, Australia, Japan, Canada and the United States. Given the nascent stage of the global hydrogen economy together with unprecedented interest in the sector, the Issue is a timely addition to a globally significant topic in international energy markets.

[Full article here](#)

## HYDROGEN

### How Will EU Policies Shape the Clean Hydrogen Funding Landscape?

*Christopher Jones  
William-James Kettlewell*

*Baker McKenzie*

#### Executive summary

European policy makers have recently acknowledged the major role that hydrogen will have to play in the EU energy system.

Acting on this recognition, the Commission adopted a Hydrogen Strategy in which it addresses various levers for growing the clean hydrogen economy. According to this strategy, although both low carbon and renewable hydrogen will be allowed to be supported in various ways, subject to meeting certain standards, the Commission favors (i) R&D and production support and (ii) renewable hydrogen. On the demand side, the Strategy provides few concrete details regarding the measures that are likely to be implemented, but the Commission's immediate priority is to replace the carbon-intensive hydrogen in existing end-use sectors with clean hydrogen. Support for innovative use of clean hydrogen in other sectors seems to be a second and midterm priority. In terms of the effect of this Strategy at the Member States' level, the functioning of the biggest fund of the European Recovery Plan will likely enable the Commission to influence, to some extent, Member States' hydrogen-related policies and subsidies, aligning them to some extent on its Hydrogen Strategy. Lastly, the EU Taxonomy is highly likely to disincentivize private capital flows towards inefficient electrolyzers and CCUS apparatus.

Overall, the EU Hydrogen Strategy, complemented by the upcoming European Recovery Plan and the EU Taxonomy, provides a regulatory framework well tailored to rapidly grow low carbon and especially renewable hydrogen production and to incentivize Member States and the private sector to align on its objectives.

One will have to see whether and how these expectations will now turn into actual legislation.

[Full article here](#)

## Blue Hydrogen as an Enabler of Green Hydrogen - The Case of Germany

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### Introduction

The German government is pursuing phasing out lignite and hard coal-fired power by 2038 and a policy of strong support for renewables as major instruments to reach its 2050 decarbonization targets. At the same time, it has published a hydrogen strategy, promoting the use of hydrogen, but with reference solely to green hydrogen (hydrogen produced by electrolysis from renewable electricity), ignoring the role of blue hydrogen (hydrogen produced by a process of steam reforming of pyrolysis from natural gas).

Many papers compare blue and green hydrogen on a cost basis, concluding that blue hydrogen has the potential of large-scale CO<sub>2</sub> reduction. Here it is argued - using the case of Germany - that in addition to the cost argument in its favour developing blue hydrogen is a must for any realistic decarbonization pathway, as green hydrogen will not be available in substantial volumes until the power sector is fully decarbonised by renewable electricity, i.e., not before 2040, more likely 2050. Therefore, to decarbonise the non-electric sector expediently, a market switch to hydrogen must be developed based on blue hydrogen with the use of existing technology of steam methane reforming (SMR) and auto-thermal reforming (ATR), as well as CO<sub>2</sub> sequestration complemented by pyrolysis as soon as available. Starting with blue hydrogen will be essential for timely and deep decarbonisation and will pave the way for green hydrogen to enter the market as soon as it becomes possible based on competition.

*Footnotes omitted from this introduction.*

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### Lessons Learnt? What Hydrogen Policymaking Can Learn From The Regulation of GB Electricity and Gas Sectors

*Dalia Majumder-Russell  
CMS Cameron McKenna Nabarro Olswang LLP*

### Executive Summary

Hydrogen developments are proliferating across Asia, Europe and parts of North America. Many of the projects are still in research and development stage but if hydrogen use is to be scaled up to meet the Paris Agreement climate change ambitions, commercial scale hydrogen projects will need to be developed within this decade. This requires the

development of bankable commercial structures underpinned by clear laws and policy frameworks.

Few jurisdictions currently have distinct regulation in this field. Without the right policy and legislation in place, investors will struggle to provide the high capital sums needed to ensure the success of hydrogen projects. Policymakers and regulators therefore need to look to existing legal standards to create a framework fit for the hydrogen powered future.

In common with many other jurisdictions, the United Kingdom ("UK") does not yet have a well-defined legislative framework for regulating hydrogen projects across the various sectors, though a Hydrogen Strategy is expected to be unveiled in 2021. Nevertheless, the UK does have a well-established and highly competitive gas and electricity market, particularly that of Great Britain ("GB"). Having led the way in market reforms in electricity across the globe, the UK offers a blueprint for how a coherent hydrogen regulatory policy can be developed.

🔗 [Full article here](#)

### Forthcoming Russian Hydrogen Strategy and its Implications for the Arctic Development

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### Abstract

In July 2020 the EU published its Hydrogen Strategy intending to create cumulative investments in renewable hydrogen in Europe of up to €180-470 billion by 2050, and creating more than one million jobs across the supply chain. On a global scale, more and more countries are beginning to reveal their hydrogen strategies. Russia is one of the major energy exporters in the world and according to the 2035 Russian Energy Strategy by the Ministry of Energy, hydrogen can become a new energy carrier, and Russia - one of its main exporters. In October 2020 an Action Plan for the development of the Russian hydrogen energy industry for the period up to 2020-2024 was adopted, and forthcoming Russian hydrogen strategy is expected to be adopted in 2021.

The priorities of the upcoming Russian hydrogen strategy are Russia's entry into international export markets and the corresponding development of hydrogen production and consumption. Experts note that Russia's competitive advantages are the availability of reserves of production capacities, proximity to potential consumers (EU, Asian countries), and the presence of operating

transportation infrastructure. Arctic regions contribute to about 15% of the Russian GDP. It is important to understand the role of hydrogen for the future of Arctic development in Russia. This article reviews the current situation by discussing the legal framework and market and development initiatives by focusing on the Russian Hydrogen Energy Action Plan until 2024 and the forthcoming Russian Hydrogen Strategy, considering its implication for Arctic development.

🔗 [Full article here](#)

## **Gas Decarbonisation in Europe: Clean Hydrogen as the New Prospective Area for Russia-EU Cooperation**

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### **Introduction**

Active decarbonization of the EU economy, including decarbonization of the gas industry, creates new opportunities for Russia-EU cooperation in gas. This can also be a new type of cooperation - based not only on Russian gas supplies to the EU destined for energy end-use of natural gas in industry, power generation, and households, but as well as a feedstock for the chemical industry, on the joint participation of the parties in developing a new technological pathway based on, inter alia, clean hydrogen from natural gas.

Achieving EU carbon neutrality by 2050 is a priority under the New Green Deal of the European Commission. Significant EU resources are aimed at achieving this goal. The stake is placed on electricity from renewable energy sources (RES) and decarbonized gases, primarily hydrogen (H<sub>2</sub>). Moreover, the EU considers hydrogen both as an energy carrier and a means of storing excess RES-electricity.

It is clear that post-pandemic EU economic recovery will not return to the old energy supply-demand structure, but will be based on the new low-carbon energy model, even more "green" than was planned in the pre-pandemic time.

Thus the market niche for fossil fuels, even for natural gas as the lowest-carbon among them all, including Russian gas, can narrow (in relative terms) in some traditional sectors of their consumption. But it can be expanded within the new sectors of prospective gas demand, in particular, as a feedstock for hydrogen production, especially if the latter is produced from natural gas without CO<sub>2</sub> emissions (clean H<sub>2</sub> from natural gas).

In this context, Russia has a potential competitive niche for export-oriented decarbonization of the gas sector on the joint with the EU basis which will be mutually beneficial for both parties. Since 80% of the GHG (green-house-gases) emissions through Russia-EU cross-border gas supply chain took place downstream of this chain (in the EU end-use), such decarbonization based on clean hydrogen production shall be first organized downstream the EU.

*Footnotes omitted from this introduction.*

🔗 [Full article here](#)

## **Hydrogen Stake as a Guarantee of Natural Gas Future in Europe After 2050**

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### **Abstract**

The EU energy strategy provides for a significant reduction in emissions and greenhouse gases (GHG) by increasing the share of renewable energy sources in the energy balance and increasing energy efficiency. However, despite the fact that the direction of the European economy towards a low carbon economy is clear, discussions and disputes continue to arise concerning the methods of reaching this goal. On one side, various radical groups are calling for a complete refusal from fossil fuels by 2050.

On another side, opponents of total electrification offer a combination of renewable energy and natural gas, even after 2050 - as a raw material for the production of hydrogen. Symbolically, this group may be called the supporters of the "hydrogen strategy". They promote hydrogen as a way to resolve key problem of stable operation of the power system based on renewable energy sources, which should act as a repository of unclaimed renewable energy. Herewith, "blue" hydrogen, produced from natural gas, will compensate for the lack of "green" hydrogen obtained by water electrolysis.

This article is devoted to the prospects of natural gas in Europe in the light of the "hydrogen strategy".

🔗 [Full article here](#)

## Comparing the Hydrogen Strategies of the EU, Germany, and Australia: Legal and Policy Issues

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*Jordie P.J. Pettit  
HWL Ebsworth Lawyers*

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### Abstract

For hydrogen to assist in meeting ambitious decarbonisation goals, national law and policy has a central role. This article presents a critical analysis of Australian law and policy for hydrogen energy, by comparison with selected European jurisdictions.

Existing energy policy literature describes divergent paradigms and pathways to hydrogen futures. Australia is a case study of policy conflict over competing methods of hydrogen production and their differing climate change implications.

We compare the recently published national hydrogen strategies of Australia, Germany, and the European Union. Selected reference is made to the strategies of France and Spain. One of the purposes of our comparative approach with Europe is to identify points of contrast and to derive ideas and inspiration for alternative energy pathways for Australia, and other nations similarly reliant on fossil fuels. We critique the problematic ambiguity in Australia's Strategy and its use of the phrase 'clean hydrogen' in preference to 'green hydrogen'.

Our review of the text of national strategies reveals three fundamental differences. These involve: (i) targets for hydrogen production capacity and hydrogen production, (ii) budgets for grants and incentives to encourage the hydrogen sector, (iii) and the definition of 'clean' hydrogen and positions on hydrogen production from fossil fuels.

We also locate each strategy within existing climate and energy law in each jurisdiction. Analysis of relevant legislation in Australia and Europe reveals the differing implications for the hydrogen sector of low versus high ambition in domestic climate and energy law. We argue that higher climate ambition is likely to encourage faster growth in the hydrogen sector.

Our paper elaborates upon some of the main legal barriers to hydrogen sector growth, providing a preliminary comparative review for Australia. Despite our critique of its present national-level position, in Australia we also find supportive hydrogen policies in several sub-national jurisdictions, innovative research and pilot projects combined with several extremely ambitious large-scale private sector projects. Based on our review,

we suggest that law reform to promote hydrogen will require detailed review of existing national and sub-national electricity, gas, and transport law.

[Full article here](#)

## The Hydrogen Hope? Challenges and Opportunities for an Australian Hydrogen Industry

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*Dr. Madeline Taylor  
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### Introduction

Given Australia's desire to develop hydrogen both for the national energy targets and as an export commodity, this paper analyses and reviews the current policy settings in Australia to encourage the development of a clean hydrogen industry. In so doing, the paper examines the challenges and opportunities current policies will present as Australia seeks to stimulate clean hydrogen export industry. In analysing current hydrogen policies in Australia, this paper first examines the national hydrogen strategy, and the issues of hydrogen pricing, fuel security for Australia, and current developments. It then examines the emerging hydrogen governance framework. Drawing upon lessons in the development of the coal seam gas sector, this paper also considers the issues in regulation and governance, particularly in relation to gas-hydrogen blending. It concludes with an assessment of the needs of the regulatory framework to develop a competitive hydrogen sector.

[Full article here](#)

## Hydrogen and CCUS Compatible Gas Networks: Identifying Legal Principles for Gas Market Re-Design

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### Abstract

(Will be added shortly) In the view of achieving carbon neutrality and energy system integration, technologies like carbon capture and storage (CCS and, with re-utilisation, CCUS) are expected to play a strategic role, enabling notably the production of low carbon forms of gas like hydrogen (H<sub>2</sub>). Other forms of sustainable gases, like biogas, are also planned to take a higher share in what will be a more diverse energy mix. However, to play their role in the transition to a low carbon energy system, those new energy solutions and forms of sustainable gases will depend on a sound infrastructure regulation. Many industrial actors have advanced



their views, but legislators and regulators now need to decide how to develop an enabling and consistent legal framework for the gas infrastructure market, balancing climate ambitions, flexibility, security of supply, cost effectiveness and fairness for final customers. This article aims to identify the legal principles for a new market design for gas infrastructures under the combined objectives of carbon neutrality and energy system integration.

The article identifies four key principles on which the re-design of the gas market should be based on: (1) integrated energy system planning with accompanying governance tools; (2) efficient and coordinated infrastructures permitting procedures; (3) transparent and enabling regime for access to the grid and gas grid conversion; (4) safe, effective and smart operation of transport networks and related infrastructures.

### **Developing a Canadian Clean Hydrogen Economy: Maximising the Export Potential**

*Dr. Rudiger Tscherning  
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#### **Abstract**

This article examines the feasibility of developing a Canadian "hydrogen economy", involving, in the first instance, the production of hydrogen for domestic application in key energy-intensive sectors. In developing the legal and policy framework for hydrogen, decision makers and industry must also recognise Canada's longer-term export potential to supply a growing global demand in "clean hydrogen". Emerging hydrogen markets in the USA, the European Union, as well as in Japan and South Korea are all strategically located within a competitive distance advantage from Canada. With a diverse energy mix of abundant natural gas resources along with vast renewable energy potential (predominantly in the form of hydroelectricity) and nuclear energy generation to produce hydrogen, Canada could become a clean hydrogen superpower. Decision makers must therefore ensure that industry will be in a position to compete in growing global hydrogen markets.

Canada benefits from a number of strategic hydrogen economy advantages, not least in Western Canada's oil and gas sector which has extensive expertise in the production of hydrogen for upgrading of bitumen from oil sands. How can this be leveraged to scale-up blue hydrogen production using natural gas and the storage of carbon in a growing carbon capture and storage industry in Alberta and Saskatchewan? What potential is there to produce pink hydrogen using nuclear energy, and, in the longer term, to produce green hydrogen from Canada's vast freshwater and renewable energy resources? Capitalising on Canada's clean hydrogen potential will depend on the development of infrastructure to supply both domestic and export markets. Canada's long-term export potential, in particular, is dependent on a

hydrogen-focused governance model to secure regulatory approval and social acceptance of infrastructure to supply international markets. This article therefore examines policy and regulatory hurdles in the build-out of critical hydrogen infrastructure and identifies that scaling-up a clean hydrogen economy will require truly concerted and strategic infrastructure investment, as well as the coordinated build-out of infrastructure, to maximise Canada's promising export potential.

[Full article here](#)

### **Hydrogen in the United States - Developmental Perspective**

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#### **Introduction**

The US federal government has supported increased hydrogen usage for over forty years, but it wasn't until 1990 that it created a research plan for hydrogen outside of the Space program. The United States first formulated a hydrogen policy in the Energy Policy Act of 1992, which promulgated large-scale hydrogen research. It aimed to reduce U.S. dependence on petroleum and concomitantly encourage the use of alternative fuels via the Department of Energy; hydrogen was one such source. The second Bush administration demonstrated a deeper interest in developing hydrogen as an alternative fuel source and is mentioned in the State of the Union Address in 2003 by former President Bush. This announcement was followed by the Energy Policy Act of 2005, and a Hydrogen Posture Plan. Since then, hydrogen policy in the United States has remained essentially unchanged for almost twenty years. While former President Barak Obama greatly reduced funding for many of the hydrogen policy initiatives, since 2017, funding for hydrogen research and development ("R&D") has steadily increased. The official policy is still guided by the Energy Policy Act of 2005, however. The only change has been the funding of the policy, and initiatives started due to the availability of funding under it.

It remains to be seen what policy direction president Biden will pursue, but his initial actions suggest a very different approach to energy policy than during the Trump administration. The United States is hesitant to go "all in" on hydrogen and funding it along the lines of a "Manhattan Project", so it remains largely in the R&D stage while other countries have begun to commercially utilize hydrogen as a clean energy source.

*Footnotes omitted from this introduction.*

[Full article here](#)

## Japan's Hydrogen Energy Development

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### Introduction

Japan's policy and specific strategy for hydrogen energy development has proceeded by both public and private sectors closely working together in accordance with the "Basic Strategy for Hydrogen", as formulated at the "Ministerial Conference on Renewable Energy and Hydrogen" of the Japanese government on December 26, 2017 (the "Basic Strategy") and the "Road Map of Hydrogen and Fuel Cell Strategy", as formulated in June 2014 by the Hydrogen and Fuel Cell Strategy Council, which is a meeting of experts in industrial, governmental, and academic fields (the "Road Map"). The author first outlines the origins of the Basic Strategy and the Road Map, and the respective legal bases for both.

🔗 [Full article here](#)

## Evolutionary Interpretation of Treaties - The Case of Green Hydrogen under the Energy Charter Treaty

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### Abstract

The word "hydrogen" is nowhere to be found in the Energy Charter Treaty ("ECT" or "Treaty"). Some readers may jump to the conclusion that green hydrogen is thus unprotected under the ECT. However, there does seem to be room for debate on the matter. Accordingly, this paper will discuss whether green hydrogen-related assets could fall under the investment protection regime of the ECT. Readers shall be introduced to the concept of evolutionary interpretation of treaties and how it can be applied to generic terms under the ECT. Concurrently, it shall be shown how the pro-renewable object and purpose of the ECT can support a pro-hydrogen construction of the Treaty.

The introductory part shall be followed by discussion of its application to the abstract case of "upgrading" of existing gas pipelines to embrace green hydrogen. To make the whole analysis comprehensible the author will propose how to best navigate between Treaty provisions critical during the jurisdictional phase of arbitral proceedings under the ECT (the product-activity-asset nexus).

🔗 [Full article here](#)

## Hydrogen - Risks and Dispute Resolution Landscape

*Luiz Aboim  
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### Abstract

(Will be added shortly) The two-decade old The Economist's edition of 30 March 2000 already raised the question of "How green is your hydrogen?" It explained that the answer depended on how the hydrogen is produced. That answer has not changed, and the use of hydrogen as a source of energy is not a new (nor uncontroversial). But climate change and energy transition efforts by oil and gas and power companies, as well as governments and international organizations, have given it a new hype. The substantial investment required across sectors, and at a global scale, to make hydrogen a viable energy source of energy increases the need to manage risk, and resolve disputes in a way that preserves investments. This article provides some background to the use of hydrogen as a source of power, identifies possible hydrogen related disputes, and considers whether the existing international arbitration legal landscape (and planned reforms, such as the Energy Charter Treaty reform) provides sufficient comfort to investors on hydrogen projects.

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## 2021

- OGEL 2 (2021) – The Hydrogen Economy
- OGEL 1 (2021) – Energy Transitions

## 2020

- OGEL 6 (2020) – Law and Policy of Energy Storage
- OGEL 5 (2020) – Environmental, Social and Governance (ESG)
- OGEL 4 (2020) – Regular issue
- OGEL 3 (2020) – Changing LNG Markets and Contracts
- OGEL 2 (2020) – Regulation of Petroleum Development in Guyana
- OGEL 1 (2020) – Social Licence to operate (SLO) in the Extractive and Energy Sectors

## 2019

- OGEL 5 (2019) – Natural Gas Pipeline Construction and Regulation
- OGEL 4 (2019) – African Extractive Sector (FDI)
- OGEL 3 (2019) – The Energy Union in the Next Decade
- OGEL 2 (2019) – Regular issue
- OGEL 1 (2019) – Energy Law and Regulation in Low-carbon and Transitional Energy Markets

## 2018

- OGEL 5 (2018) – Strategic Considerations in Energy Disputes
- OGEL 4 (2018) – Regular issue
- OGEL 3 (2018) – International Energy Law
- OGEL 2 (2018) – Decommissioning
- OGEL 1 (2018) – Regular issue

## 2017

- OGEL 4 (2017) – Liquefied Natural Gas (LNG)
- OGEL 3 (2017) – Energy Law and Policy in the Middle East and North Africa (MENA)
- OGEL 2 (2017) – Brexit
- OGEL 1 (2017) – Oil and Gas Law and Policy in West Africa

## 2016

- OGEL 4 (2016) – Regular issue
- OGEL 3 (2016) – Waste-to-Energy (WtE)
- OGEL 2 (2016) – Emerging Issues in Polar Energy Law and Governance
- OGEL 1 (2016) – Mexico's Oil and Gas Sector Reform

## 2015

- OGEL 1 (2015) – Regular issue
- OGEL 5 (2015) – Yukos Special
- OGEL 4 (2015) – International Taxation in the Energy Sector
- OGEL 3 (2015) – Renewable Energy Disputes
- OGEL 2 (2015) – Laws Regulating the Polish Energy Sector – Transition
- OGEL 1 (2015) – Natural Gas Developments: An International and Challenging Legal Framework

## 2014

- OGEL 4 (2014) – Regular issue
- OGEL 3 (2014) – OGEL Special: Governance of Unconventional Gas outside the United States of America
- OGEL 2 (2014) – Energy Community
- OGEL 1 (2014) – Special: Offshore Petroleum Exploration and Production: Challenges and Responses

## 2013

- OGEL 5 (2013) – Regular issue
- OGEL 4 (2013) – Joint Operating Agreements & National Oil Companies: Challenges and Dynamics
- OGEL 3 (2013) – Eastern Mediterranean Oil and Gas
- OGEL 2 (2013) – Risks and Responses to Risk in the Energy Sector
- OGEL 1 (2013) – Nuclear Law and Policy

## 2012

- OGEL 5 (2012) – Regular issue
- OGEL 4 (2012) – The Interface between EU Energy, Environmental and Competition Law – A Survey
- OGEL 3 (2012) – OGEL Ten Years Special Issue: Internationalisation of Energy Law
- OGEL 2 (2012) – Arctic Region: Boundaries, Resources and the Promise of Co-operation
- OGEL 1 (2012) – A Liber Amicorum: Thomas Wälde – Law Beyond Conventional Thought

## 2011

- OGEL 6 (2011) – Regular issue
- OGEL 5 (2011) – Regular issue
- OGEL 4 (2011) – Indigenous People and Resources Development
- OGEL 3 (2011) – Cross-Border Pipelines
- OGEL 2 (2011) – Comparative Energy Law
- OGEL 1 (2011) – Regular issue



## **2010**

- OGEL 4 (2010) - Host Government Contracts in the Upstream Oil and Gas Sector
- OGEL 3 (2010) - Oil Spills
- OGEL 2 (2010) - Kazakhstan
- OGEL 1 (2010) - Antitrust in the Energy Sector

## **2009**

- OGEL 4 (2009) - Regular issue
- OGEL 3 (2009) - Student special
- OGEL 2 (2009) - EU - Russia relations
- OGEL 1 (2009) - Middle East With a Focus on Buy Back Contracts

## **2008**

- OGEL 3 (2008) - Eurasian Energy
- OGEL 2 (2008) - Venezuela: The battle of Contract Sanctity vs. Resource Sovereignty
- OGEL 1 (2008) - China's Energy and Environmental Challenges

## **2007**

- OGEL 4 (2007) - Energy Security
- OGEL 3 (2007) - Energy Litigation and Arbitration - Expert Perspectives
- OGEL 2 (2007) - Unisitation
- OGEL 1 (2007) - Electricity Interconnectors (2nd special) - Regular issue

## **2006**

- OGEL 4 (2006) - Pipelines
- OGEL 3 (2006) - Africa
- OGEL 2 (2006) - Electricity Interconnectors
- OGEL 1 (2006) - Liquefied Natural Gas (LNG) - Regular issue

## **2005**

- OGEL 4 (2005) - Asian Energy Law and Policy
- OGEL 3 (2005) - Coal
- OGEL 2 (2005) - Windpower
- OGEL 1 (2005) - Production Sharing Contracts

## **2004**

- OGEL 5 (2004) - Energy Charter Treaty
- OGEL 4 (2004) - Corporate Social Responsibility (CSR) - Regular issue
- OGEL 3 (2004) - Taxation / Latin America
- OGEL 2 (2004) - Renewable Energy
- OGEL 1 (2004) - Climate Change

## **2003**

- OGEL 5 (2003) - Corruption / Geopolitics of Oil and Gas
- OGEL 4 (2003) - Natural Gas
- OGEL 3 (2003) - Energy and Electricity Regulation
- OGEL 2 (2003) - Dispute Management in the Oil, Gas and Energy Industries
- OGEL 1 (2003) - Regular issue