Energy Transitions

Jonathan Young MP, National Party Energy & Resources Spokesperson

Energy Transitions

Tokyo	Waseda University – Automated Demand Response research
	Electricity & Gas Market Surveillance Commission
	Japan Electric Power eXchange
	Organisation for Cross-regional Coordination of Transmission
	METI – Hydrogen Roadmap
	Tokyo Gas – Hydrogen infrastructure

Energy Transitions

London

ICIS The world's largest petrochemical market information provider with divisions spanning energy and fertilizers.

Ofgem Executive Director of Consumers and Markets, Mary Starks

UK Climate Change Commission Chief Executive Chris Stark

Challenging Ideas (Thinktank) - Redesigning Regulation

British Petroleum Vice President, Group Strategic Planning for BP, Dr Dominic Emery

Energy Transitions

Aberdeen

Aberdeen City Region – Hydrogen Strategy & Action Plan

Aberdeen Centre for Research in Energy Economics and Finance (ACREEF), University of Aberdeen Professor Alex Kemp

Oil & Gas Technology Centre

Energy Transitions

Oslo

Ministry for Petroleum and Energy

Water Resources and Energy Directorate Wholesale Markets Section

Equinor (formerly Statoil)

Energy Transitions

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WASEDA U ity
経済産業省
早稲田大学
Energ
Design Your Energy 夢ある明日を
大阪ガス
関西電力
SHARP
DAIKIN
東京電力
TEPCO
TOSHIBA
Leading Innovation

EMS

Energy
Management
System

”電力×交通×情報×環境×サービス”の価値連鎖の創出に向けたスマートシティなどの実現支援に貢献

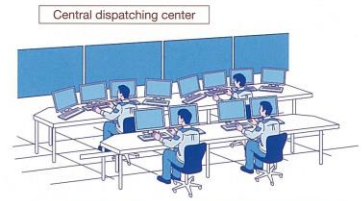
Designing Smart City

Electricity×Mobility×Information×Environment ···→ Services

ディマンドリスポンス信号送受信サーバ(DRAS)／配電系統シミュレータ／スマートハウス

我々の生活は「情報」に支えられています。その根幹の住・職の空間、エネルギー利用、移動が利便性高く快適に実現される未来、EMS実証センターは、情報の高度利用が拡く世界を追求していきます。

Our life is essentially supported by “information”. EMS Center explores an emerging world which is brought by advanced utilization of information, i.e., a future which enables high accessibility and comfort in living- and working-space, energy use and transportation.



Renewable energy　Demand response / negawatt

Energy Management System 01

DRAS Demand Response Automation Server

ディマンドリスポンス信号送受信サーバ

ディマンドリスポンス（DR）は、「アグリゲーター」とよばれる事業者を仲介して、電気事業者と需要家が情報でつながり、需要の増減を発電の増減として取引するビジネスです。当センターでは、IEC国際標準の通信規格であるOpenADRを用いて、DR通信を可能とするDRASを開発し、日本の標準基盤技術を確立しました。

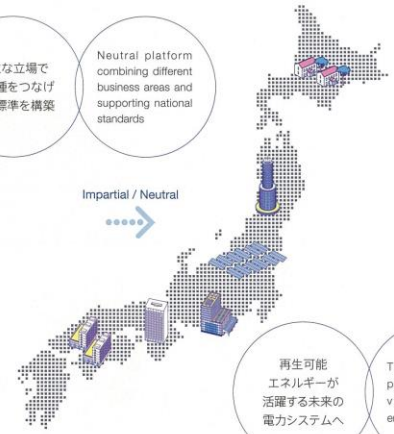
Demand Response (DR) is trading decrease/increase of demand as increase/decrease of generation through a communication link between a utility/retailer and customers, generally mediated by an "aggregator". EMS Center established the Japanese standard DRAS (DR Automation Server) based on IEC international standard communication, OpenADR.

研究・知見を
結集する
分野間連携
プラットフォーム

中立な立場で
異業種をつなげ
国の標準を構築

Neutral platform combining different business areas and supporting national standards

Impartial / Neutral



再生可能
エネルギーが
活躍する未来の
電力システムへ

Toward fut
power system
vital renewa
energy sources.

再生可能エネルギー拡大で複雑化する電力システムをサポート

相互連携技術の確立により、需要家も参加する再生可能エネルギー導入支援、電力システム安定化の基盤を提供します。

Supporting a power system being complicated with expansion of renewable energy sources.

We provide a base of further integration of renewable energy and stabilization of power system by realizing interoperability which enables participation of customers.

ネットワーク

標準化

Energy Management System

02

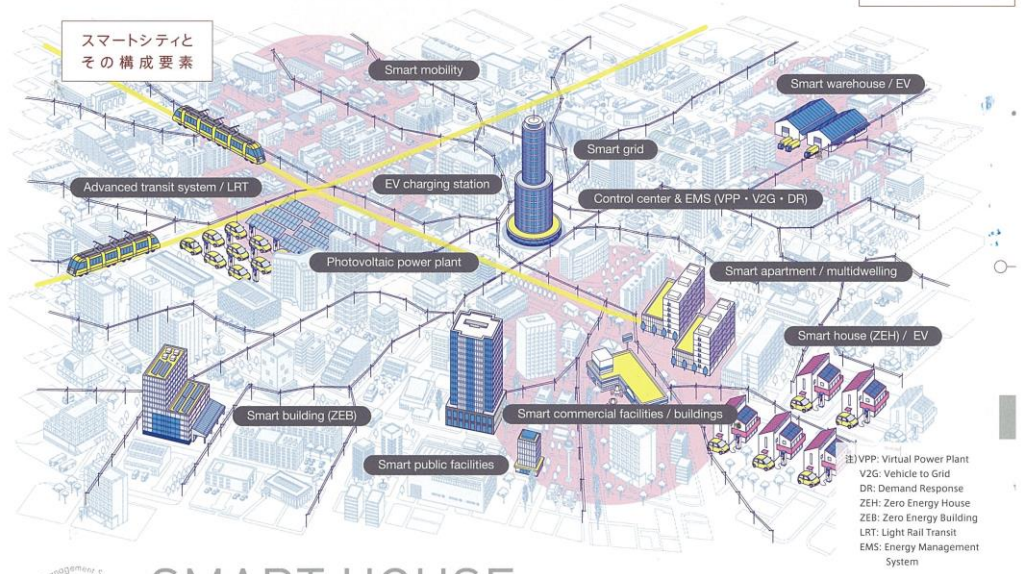
ANSWER

配電系統シミュレータ

6.6kV の電圧で運用される実際の配電系統を、三相 400V、単相 100V の電圧で模擬できるアナログ配電系統シミュレータ。一部屋の中に数 km の配電線を再現でき、高精度かつリアルな配電系統のシミュレーションが可能です。

ANSWER is a hardware testbed for distribution networks scaled down in a laboratory environment. Various distribution network configurations can be emulated by choosing and assembling suitable sets of devices, and any EMS schemes can be tested and analyzed.

電圧制御装置、高低圧配電線路模擬装置、負荷・DER 模擬装置、リアルタイムシミュレータを備えています。



注) VPP: Virtual Power Plant
V2G: Vehicle to Grid
DR: Demand Response
ZEH: Zero Energy House
ZEB: Zero Energy Building
LRT: Light Rail Transit
EMS: Energy Management System

Energy Management System

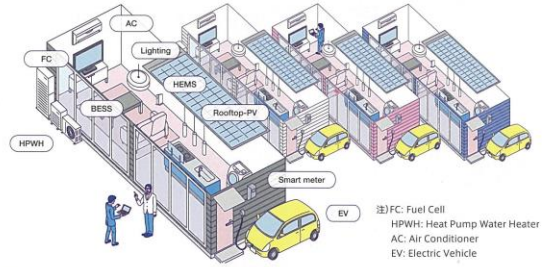
03

SMART HOUSE

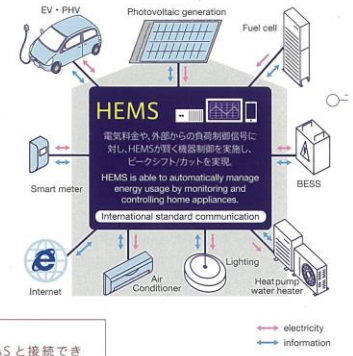
スマートハウス

需要家間のエネルギー融通や自立運転を含む需要家内のエネルギーマネジメント、関連する IoT サービスに対して、配電系統、機器、通信、制御等に着目した柔軟な先端研究開発が可能となっています。

Flexible advanced research and development focusing on electric distribution system, equipment, communication, control, etc. can be possible for energy exchange among customers, energy management in the customer including self-sustaining operation and related IoT service.



注) FC: Fuel Cell
HPWH: Heat Pump Water Heater
AC: Air Conditioner
EV: Electric Vehicle



DRAS と接続できる最新 HEMS、通信機能を有するスマートメーターや重点機器を備えています。

SMART CITY

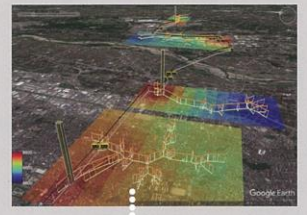
EMS

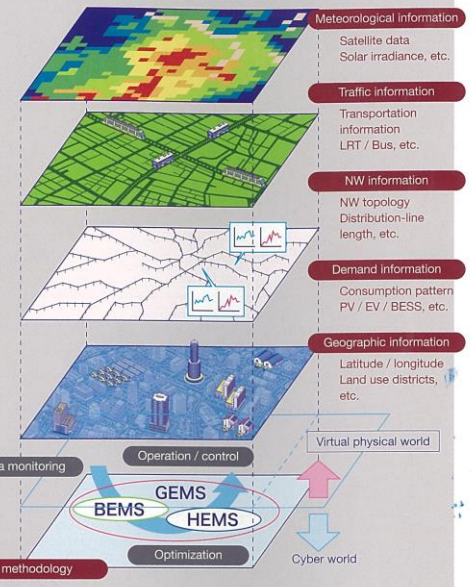
スマートシティ

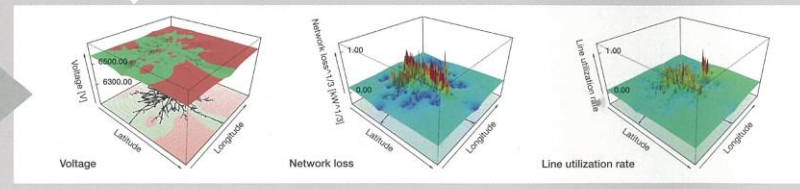
電力システムのモデル化とシミュレーション

衛星、交通、電力系統、需要、地理などの様々なデータを組み合わせることで、任意のスマートシティをデジタルツインで構築。多面的な評価指標から、スマートシティのあるべき姿を検討しています。

Digital-twin platform for a sustainable smart city can be constructed by combining various information platforms such as meteorological, traffic, distribution network, demand, and geographic information. We can design and evaluate smart cities from the assessment of specific policies and several indices.







INTEGRATED EMS PLATFORM

EMS

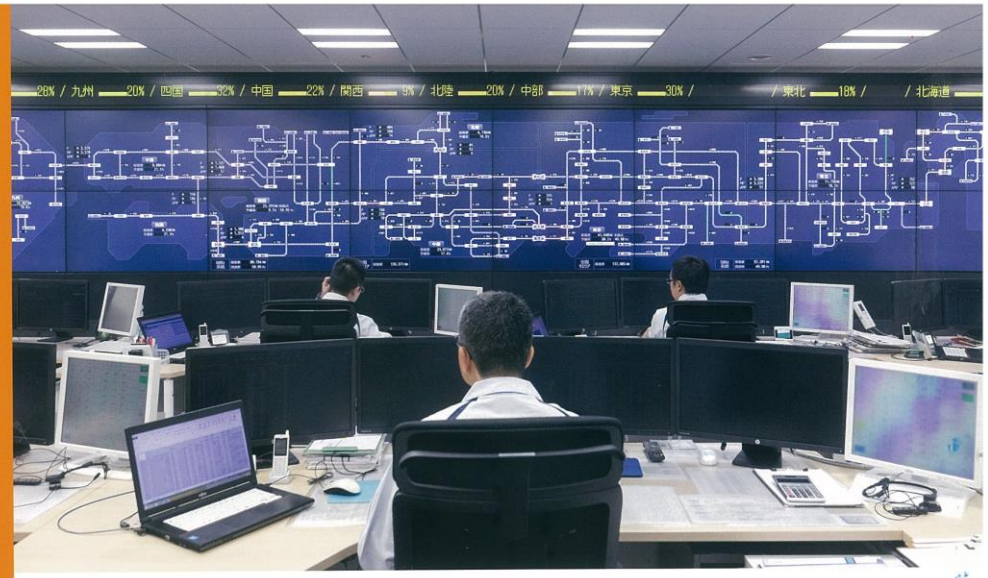
統合監視・制御システム

ANSWER、スマートハウス、DRASと連携し、リアルタイムでの監視・制御を実施することができます。実機を用いたEMS手法の有用性評価や実運用に向けた課題抽出を行います。

We can validate any EMS methodologies using an integrated EMS platform which can be communicated with other platforms and testbed. We also identify issues of EMS methodologies for practical use and improvement of system performance through the experimental simulation.

ANSWER・スマートハウス・DRASを統合管理するトータルデザインプラットフォーム

Organisation for Cross-regional Coordination of Transmission



Monitor Nationwide Conditions of Supply-Demand and Network System Operation

Monitor nationwide conditions of supply-demand and network system operation 24 hours a day, 365 days a year

OCCTO monitors and grasps, on a real-time basis, information such as supply-demand conditions monitored at the central load dispatching centers in each supply area by introducing the Cross-regional Operation System.

Furthermore, OCCTO manages the plans and actual performance of system users' supply-demand with monitoring supply-demand balance in each supply area provides immediate and precise judgments and instructions such as how much electricity supply, from/to electricity companies, etc.

Main content to be monitored

- Supply-demand conditions in each supply area and the main generator output condition
- Cross-regional network conditions including the usage status of interconnection lines between supply areas

Ongoing Projects (Supply-side)

METI
Ministry of Economy, Trade and Industry

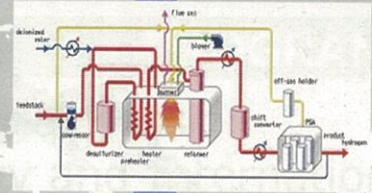
International H_2 Supply Chain

Japan-Brunai Pilot Project

2020～ AHEAD

Off-gas

Steam Methane Reforming



Hydro-genation*
(TOL→MCH)

Chemical Tanker

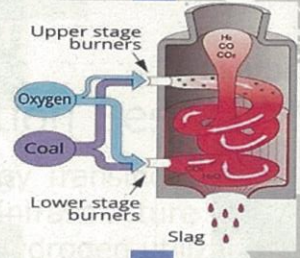
Dehydro-genation*
(MCH→TOL)

Japan-Australia Pilot Project

2020～ HySTRA

Brown Coal +CCS

Gasification



Liquefied H_2 Carrier*

Loading Facility*

Power-to-gas

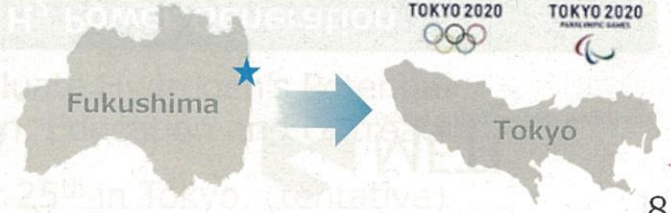
Fukushima Renewable H_2 Project

2020～ FH2R FUKUSHIMA HYDROGEN ENERGY RESEARCH FIELD

Power-to-Gas Plant*

Electrolysis System (Alkaline)

TOKYO 2020 TOKYO 2020



* Image

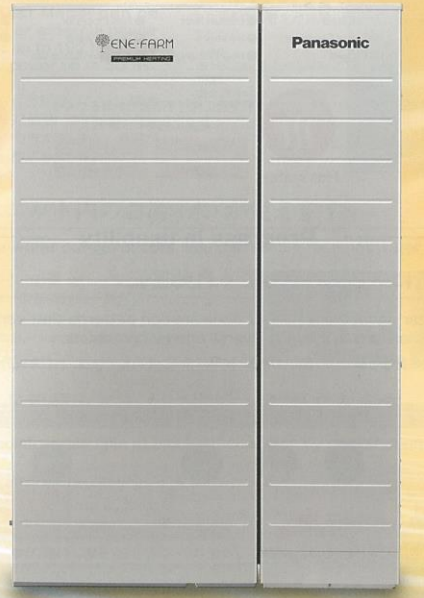
Panasonic

ENE・FARM
エネファーム

地球を楽しんで生きる人の新エネルギーライフ

～水素のチカラで電気とお湯をつくる～

New energy-life for people who think about the globe



自宅で発電するためムダが少なく高いエネルギー利用効率 97%※1 を実現

Overall energy efficiency is among the industry's best at 97%. No energy waste!

※1 LHV基準。 HHV 基準=87.6%

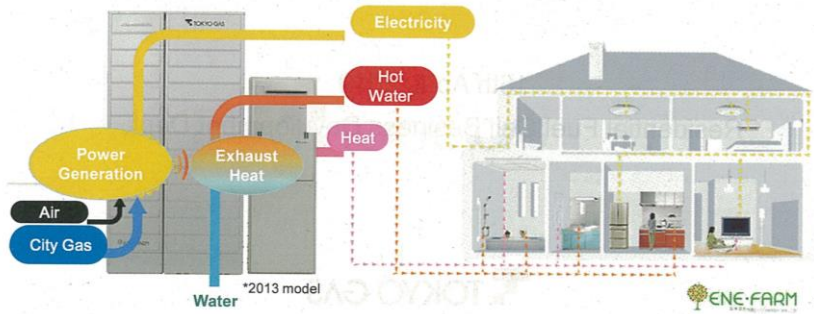
●LHV=燃料ガスを完全に燃焼させた時に生成する水蒸気の凝縮潜熱を差し引いた発熱量。 ●HHV=燃料ガスを完全に燃焼させた時に生成する水蒸気の凝縮潜熱を含めた発熱量。


W発電/エネファーム
太陽電池パネルコーナー
Panasonic
ENE-FARM
ネファームの仕組み

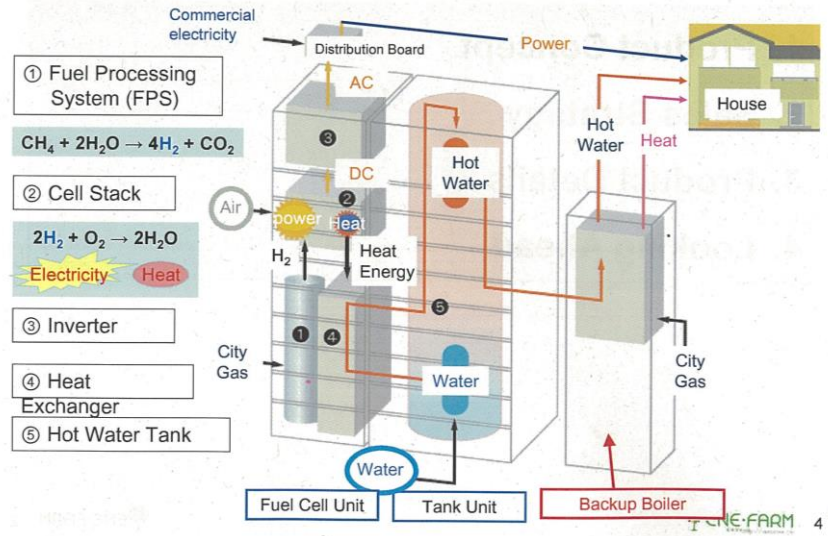
What is ENE-FARM?

- ENE-FARM is a residential micro-CHP (Combined Heat and Power) system that provides home with electricity, hot water, and heat with high energy efficiency.
- ENE-FARM enables power generation at home and covers 50-60% of power demand of a typical household.

ENE-FARM



Configuration of the ENE-FARM System




エネルギー・フロンティア
TOKYO GAS


B 倉庫
Fuel Cell Vehi
20-20

Energy Transitions

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Ofgem Executive Director of Consumers and Markets, Mary Starks

UK Climate Change Commission Chief Executive Chris Stark

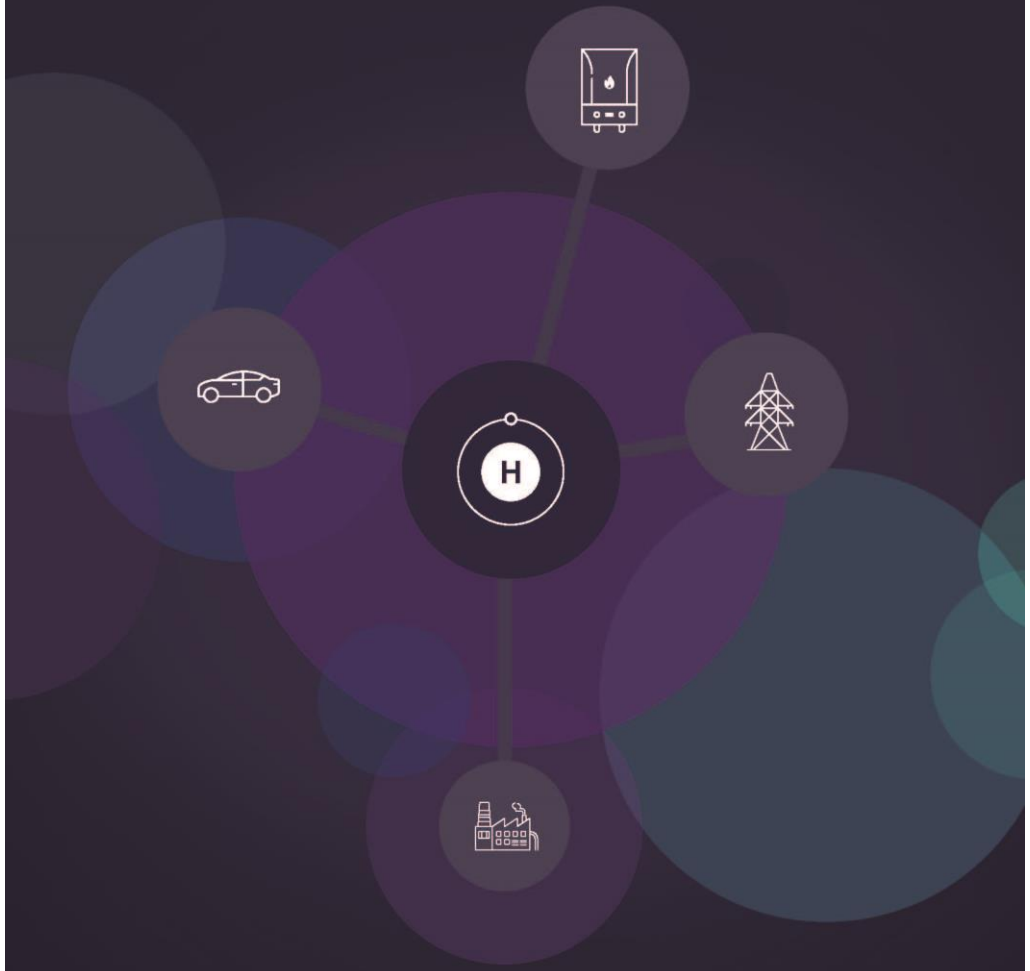
Challenging Ideas (Thinktank) Redesigning Regulation

British Petroleum Vice President, Group Strategic Planning for BP, Dr Dominic Emery

Committee on
Climate Change

Hydrogen in a low-carbon economy

Committee on Climate Change
November 2018




1FY·9EY


17.5°C
Range
418 mi
Consumption
ø from start
0 20 40 60 80 Max
mpg
Charge
18:23
Saturday
04/20/2019
mph
61
R
N P
D7
S
99 km/h
LIM
DIESEL/GAZOLE

Energy Transitions

Aberdeen

Aberdeen City Region – Hydrogen Strategy & Action Plan

Aberdeen Centre for Research in Energy Economics and Finance (ACREEF), University of Aberdeen Professor Alex Kemp

Oil & Gas Technology Centre

HYDROGEN FUEL CELL VEHICLE

HYDROGEN RENEWABLE, ABUNDANT, NON-TOXIC

On-site electrolysis allows storage of energy from renewables such as wind, solar and hydro, by producing hydrogen from water.

This can be used for transport, stationary fuel cells or even pumped directly into the gas network.

Hydrogen is the most abundant element in the universe and is entirely renewable. It can also be produced from other sources such as excess grid energy, oil, natural gas and biomass.

HOW IT WORKS STEP BY STEP

FUEL CELL CONSTRUCTION

The Hirai is the first dedicated mass-produced fuel cell vehicle.

It is a vital step in solving the energy demands and emissions issues that come with traditional cars. It solves the issues of range, power grid capacity and charging time experienced with pure electric vehicles.

Electricity is generated in a fuel cell through a chemical reaction between hydrogen and oxygen from the air, using platinum as the catalyst.

The fuel cell needs no maintenance and will outlive the vehicle.

ABERDEEN CITY REGION HYDROGEN ECONOMY

H2 Aberdeen

ABERDEEN CITY COUNCIL

H2 Aberdeen is an initiative working to bring about a hydrogen economy in the Aberdeen City region.

The Aberdeen City Region Hydrogen Strategy and Action Plan 2015-2025 will deliver:

- innovative hydrogen projects;
- develop the use of hydrogen technologies; and
- Aberdeen as a centre for excellence for hydrogen technology

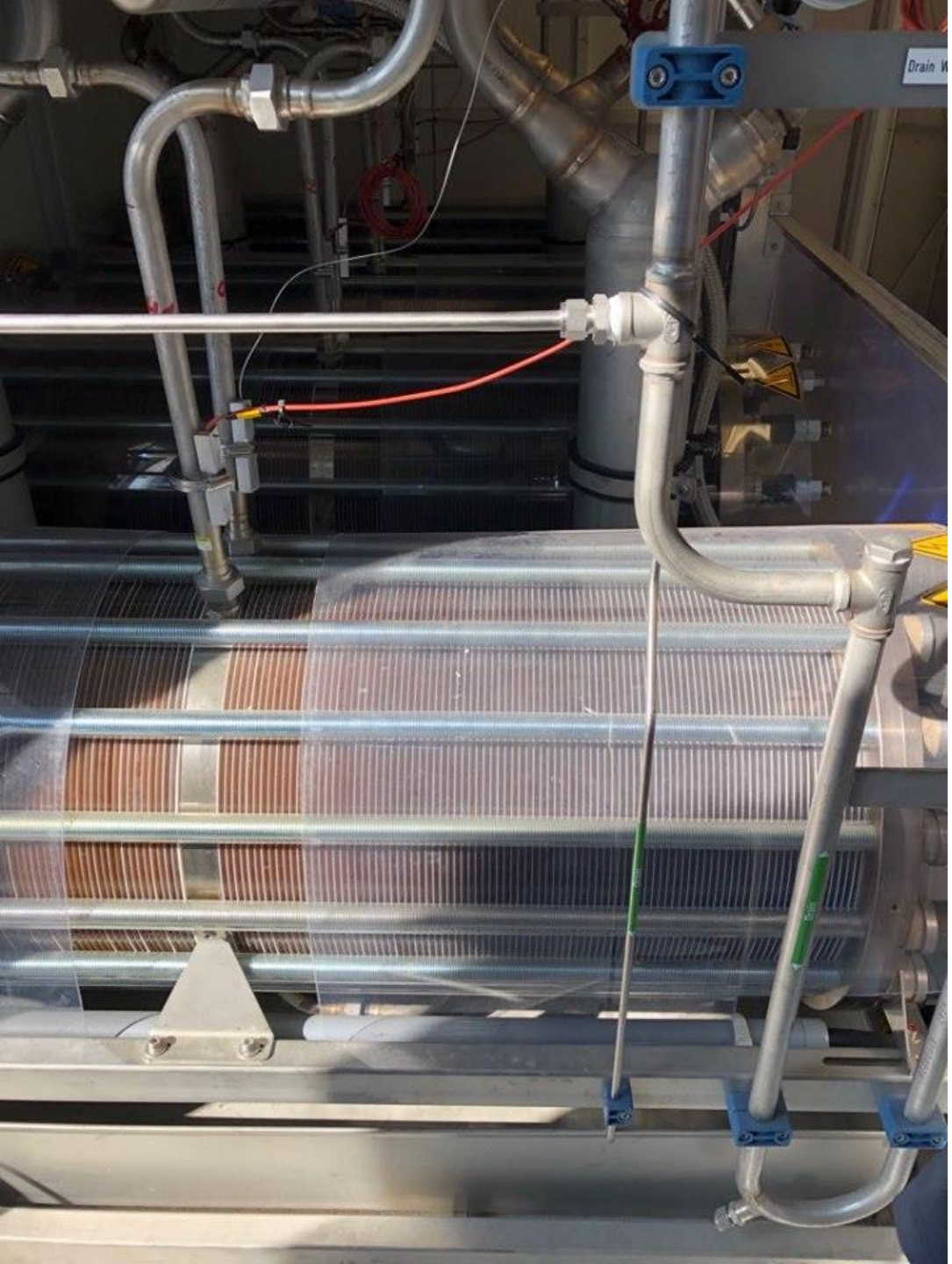
This will further enhance Aberdeen's reputation for energy innovation, and support Scotland's ambitions to become a world-leading destination for investment in Supporting Renewables and low carbon energy.

Key industry and public sector players joined forces to fund and deliver the world's largest demonstration of hydrogen fuel cell buses in Aberdeen in 2014. The hydrogen fuelling station installed at Kittybrewster is the largest station in Aberdeen and can store 374kgs of hydrogen. Fuelling a fleet of ten fuel-cell-powered hydrogen buses operated by the UK's bus leading bus operators, the buses consume more than 80 metric tons of hydrogen per annum.

Aberdeen City Hydrogen Energy Storage (ACHES), the region's second hydrogen refuelling station and storage facility, is located south of the city and launched early in 2017. This facility primarily refuels cars and vans, with the potential to produce 100kgs of hydrogen per day and store 180kgs of hydrogen. The launch of this refuelling station coincided with the expansion of the fleet of hydrogen vehicles being used within the region including 10 Toyota Mirais.

For more information please go to: http://www.h2aberdeen.com


EX
Danger
Explosive
atmosphere




The
Oil & Gas
Technology
Centre
Your Innovation Partner


Rt. Hon. Nicola Sturgeon MSP
First Minister of Scotland


Showing All Markup


Feasible
Viable
Desirable


SMIT KAMARA
Boskalis
PETERSON
UCS

Energy Transitions

Oslo

Ministry for Petroleum and Energy

Water Resources and Energy Directorate Wholesale Markets Section

Equinor (formerly Statoil)

Norwegian Ministry
of Petroleum and Energy

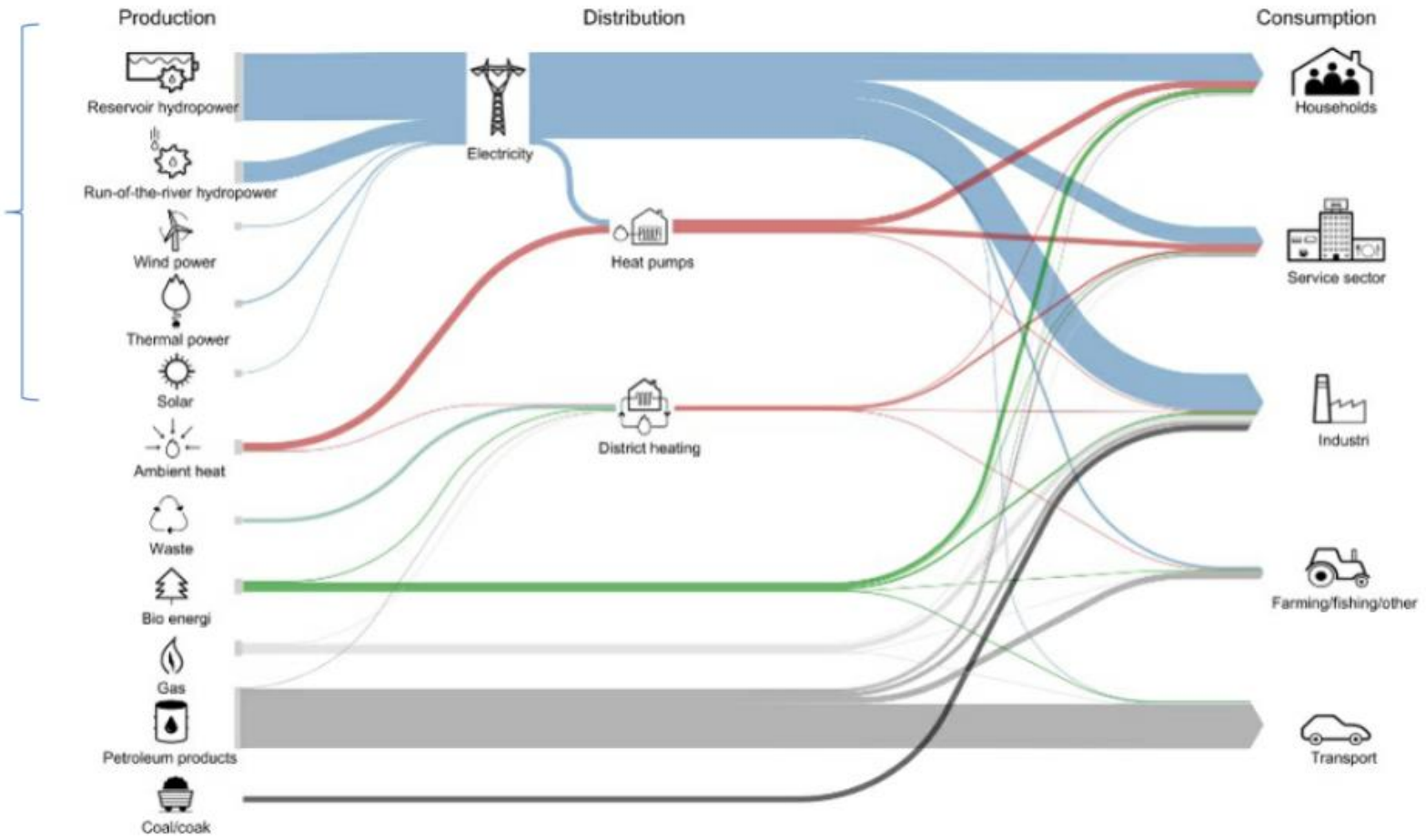
The role of renewable energy in Norway

Mr. Øivind Johansen, Assistant Director General

Meeting with Jonathan Young, MP from New Zealand. 23 April 2019

A large share of energy use in Norway is renewable

98 % of electricity production is from renewable sources



Electricity makes up a larger share of energy use than in most countries.

Large hydropower-based industrial sector.

Renewable electricity used for heating and in parts of the transport sector.

Still heavy fossil energy use in some sectors, especially transport.

High renewable share = much lower greenhouse gas emissions from energy use than in many countries.
Effective policy instruments are driving a continued transition to more renewable energy use.

Norway's power balance in 2018

- Production 145,7 TWh
- Consumption 135,4 TWh
- Net surplus 10,3 TWh (~ 7 % of production)

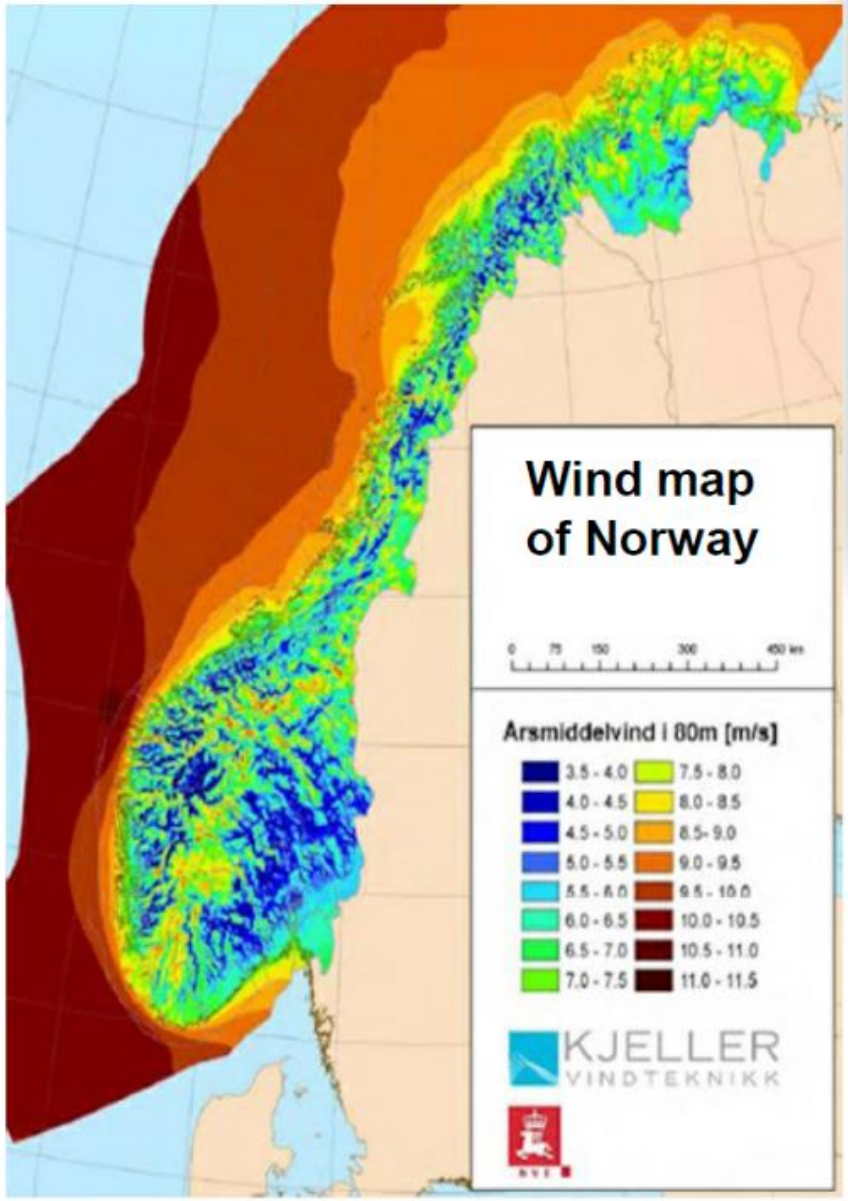
- The electricity sector is almost 100 % hydropower based

Wind power

In operation (end of 2018)
- Capacity: 1 695 MW
- Production: 3 870 GWh
- Turbines: 610
- Load factor: 2 856 hrs

Under development (Q3/18):
16 farms totalling
2 436 MW, 8 284 GWh

License granted, not developed yet:
37 farms totalling
2 735 MW, 9 814 GWh



Source: NVE

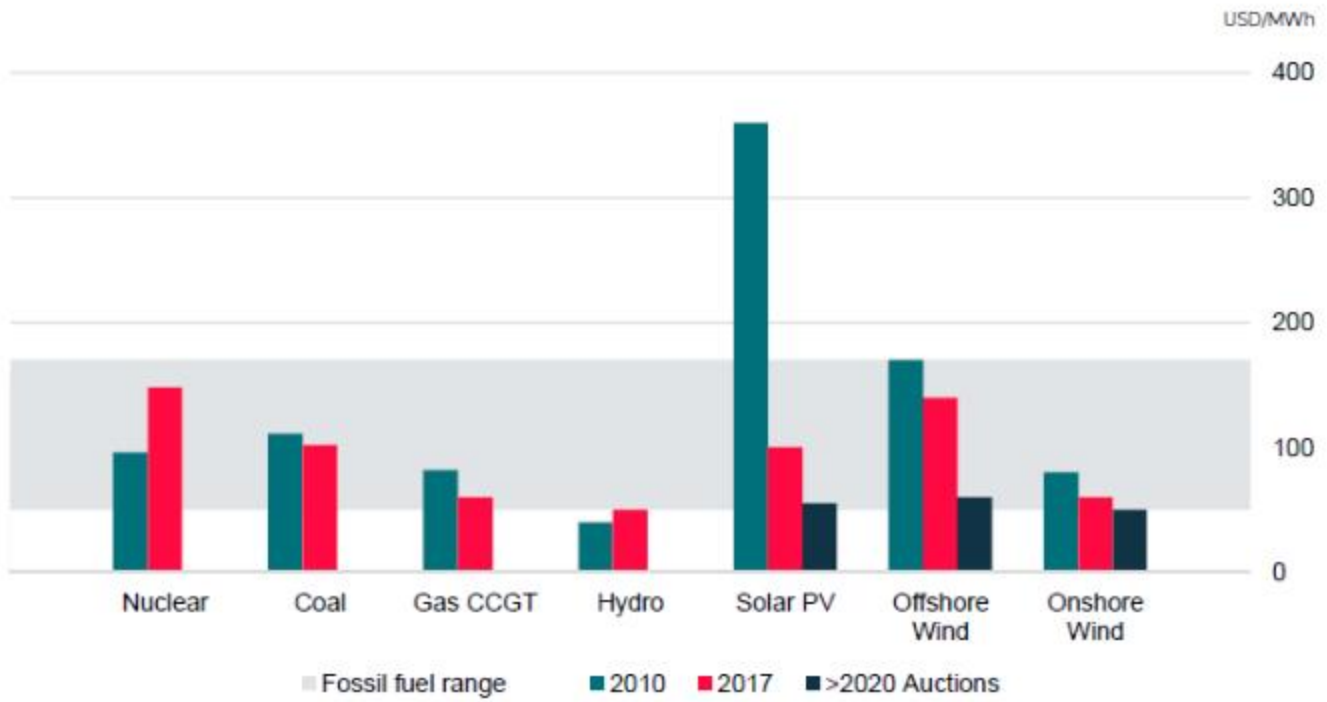
Wind farm at Smøla. Photo: Statkraft

Photo: Equinor


equinor
Martin Linges vei 33

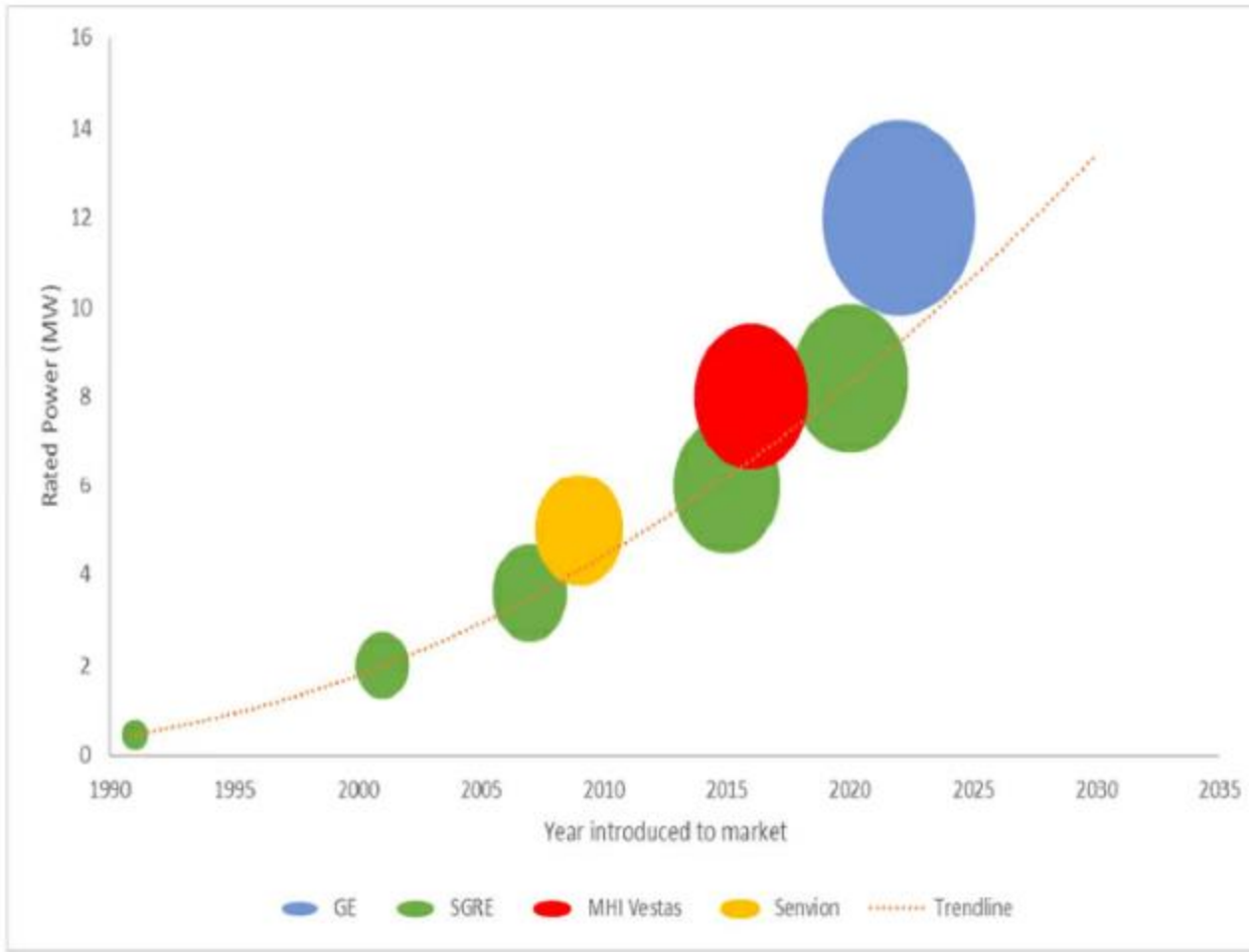
Cost reductions leading to exponential growth

Global levelised cost of electricity from utility-scale generation technologies



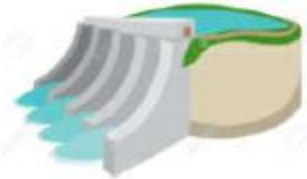
Source: IRENA, Lazard

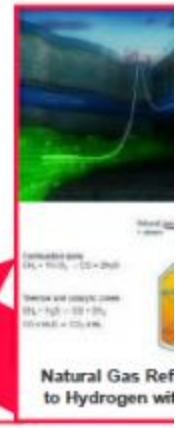
The Turbine: Size matters – however?



Decarbonising Energy, Industry and Transport Systems

Easy ⟵ complexity to decarbonise ⟶ Hard

Transport	 Battery (mostly) plus Hydrogen for Heavy Duty	 Hydrogen Fuel-Cell Trains	 Liquid Hydrogen and Fuel-Cells for long haul Big Ships
Power	 Large Battery Systems for Daily Swing (night-to-day)	 Hydro-Power as Battery for Small Scale Intermittency	 Hydrogen fired CCGTs Clean Back-Up Power for Large Scale Intermittency
Industry	 Light Industry powered by Renewable	 Heavy Industry powered by Hydrogen from Natural Gas + CCS	 CCS for Industry without other Alternatives
Heat	 Heat Pumps For Efficient Use of Electricity in Homes	 Hydrogen for Efficient Transfer of Energy from Production to End-Users	 Hydrogen for Large Scale Seasonal Storage



Multiple technologies to address the challenge

Hywind Floating wind farm (Scotland)

https://youtu.be/PUlfvXaISvc