

Energy Supply
Strategy

2012-2015

EXECUTIVE SUMMARY



WHAT ARE WE AIMING TO DO?

The way the world produces and uses energy is not sustainable. It not only damages our natural world through climate change and resource use, but it also affects our quality of life through cost and comfort. At the Technology Strategy Board we take these sorts of challenges and turn them into opportunities for the UK to innovate and collaborate on new and potentially world-beating technologies. The Department of Energy and Climate Change (DECC) estimated that in 2010, UK energy industries contributed almost 4% of GDP (£60bn) and directly employed approximately 173,000 people and more indirectly.¹

Energy underpins almost every aspect of our daily lives. We have learnt to take it for granted and treat it as a commodity that will always be able to meet our increasing demands. However, global legislation such as the Kyoto Protocol² and domestic energy policies are now making us reassess our attitude to energy and its value.

Our energy programme will commit up to £35m per annum to specifically help UK industry profit from the changes the world will have to make to address the 'trilemma' of energy security, affordability and sustainability.

Manufacturing and scale-up of new technologies often takes place at the point of invention and creates local jobs and products capable of profiting from wider global markets; we want that place of invention to be the UK.³



OUR STRATEGY

Our technology strategy and opportunities for UK business

Against this background, and within a sustainability framework developed with Forum for the Future³, we are focusing our strategy on three overarching objectives where we believe UK business can really make a difference and generate wealth:

- to develop affordable and secure sources of energy supply which also reduce greenhouse gas (GHG) emissions
- to integrate future demand and energy supply into a flexible, secure and resilient energy system
- to reduce GHG emissions at point of use.

We will focus our support on addressing key challenges and breaking down market barriers to meet these objectives. In particular we will focus on cost reduction, supply chain development and energy infrastructure.

When the policy landscape, market conditions, UK capability and timeliness are all taken into account we believe that taking the following actions offer the greatest opportunities for UK business.

To develop affordable and secure sources of energy supply which also reduce GHG emissions,

we will:

- cut the cost of offshore renewable energy by funding collaborative R&D, knowledge transfer and the Offshore Renewable Energy Catapult
- develop technologies capable of supplying global civil nuclear programmes through funded feasibility pilot projects, collaborative R&D and knowledge transfer
- develop UK carbon abatement technologies by ensuring innovative small and medium-sized enterprises (SMEs) collaborate with existing large companies and utilities
- work with the pan-European research base to pull through next generation photovoltaics and bioenergy technologies into early stage commercial development opportunities for the benefit of UK business.

To integrate future demand and energy supply into a flexible, secure and resilient energy system,

we will:

- work with other Technology Strategy Board programmes to fund the development of new technologies and services that seek to integrate intermittent supply, storage, alternative power systems (such as fuel cells) and new demand technologies (such as electric vehicles and heat pumps) into a resilient energy system
- ensure conventional fuels such as oil and gas, and alternative fuels such as hydrogen and biofuels, are secure and sustainable through funded feasibility pilot projects and whole system collaborative R&D programmes
- work across industry sectors to ensure effective knowledge transfer and build interdisciplinary collaborations.

To reduce GHG emissions at point of use, we will:

- work with the research base and SMEs on collaborative funded projects to find novel ways of capturing CO₂ at point of energy use
- develop interdisciplinary collaborative R&D and feasibility studies in new hardware, software and services across energy transmission, supply and demand side energy management
- work to develop and encourage whole system approaches in the development of alternative ways of transporting, storing and using energy (alternative energy vectors) particularly with respect to hydrogen and bio-energy.

We cannot deliver this programme in isolation and as well as working with UK industry and the research base, we will ensure our programmes are aligned and coordinated across the innovation landscape. In particular we will work with the UK Low Carbon Innovation Coordination Group (LCICG) to ensure that together we address the needs of UK industry and UK energy policy in the most effective and efficient way. Where appropriate, we will continue to look for opportunities to co-fund innovation programmes with our partners in the LCICG.

For specific details of our competitions for project funding, networking opportunities, events and other work please see our *Delivery Plan*, published annually at www.innovateuk.org.

WHY IS ENERGY A PRIORITY FOR US?

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In 2010 UK energy industries contributed almost 4% of GDP (£60bn) and directly employed approximately 173,000 people or 7% of industrial employment (according to DECC estimates).

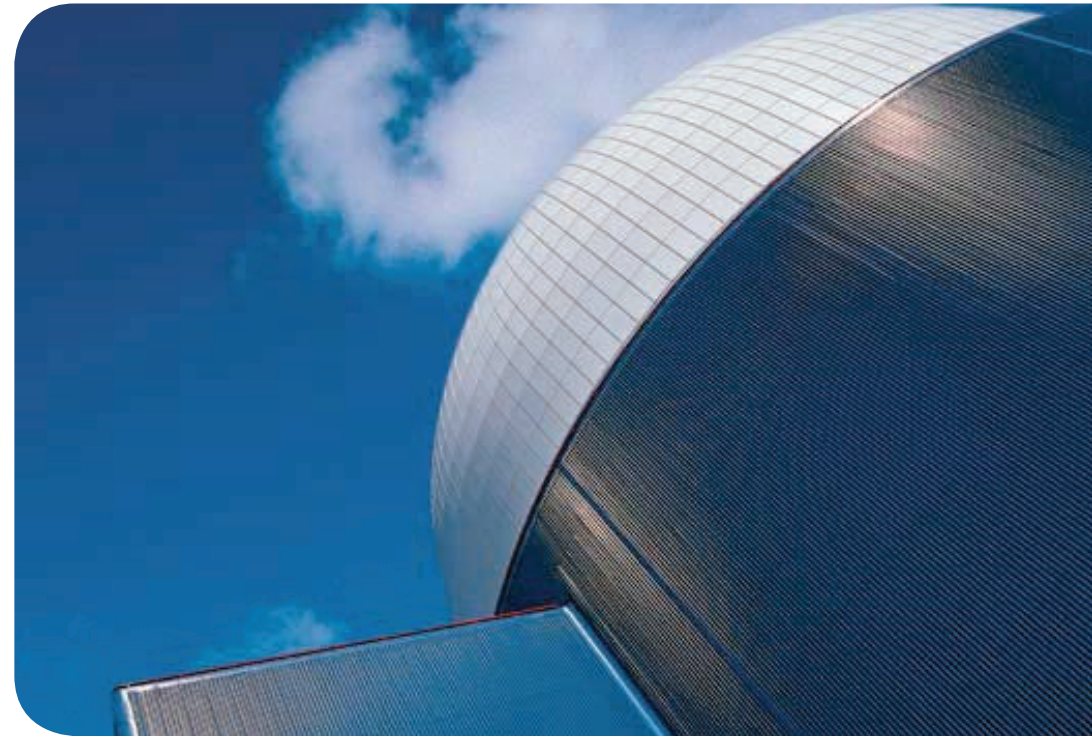
Energy underpins almost every aspect of our daily lives and we have been taking it for granted. However, global legislation such as the Kyoto Protocol², domestic energy policies, regional supplier disputes and rising consumer costs mean we cannot do so any more. Consistent policy, regulation, coordination and funding are needed to ensure innovative technologies can be developed and demonstrated effectively.

Our role in the Technology Strategy Board is not to deliver energy policy; rather it is to ensure UK business benefits from the opportunities that policies and demand for innovation bring, and to focus limited funds on the greatest opportunities. Manufacturing and scale-up of new technologies often takes place at the point of invention and creates local jobs and products capable of profiting from wider global markets; we want that place of invention to be the UK.

In the energy programme we believe the following UK domestic policy and legal requirements offer real opportunities to develop innovative new products and services in the UK:

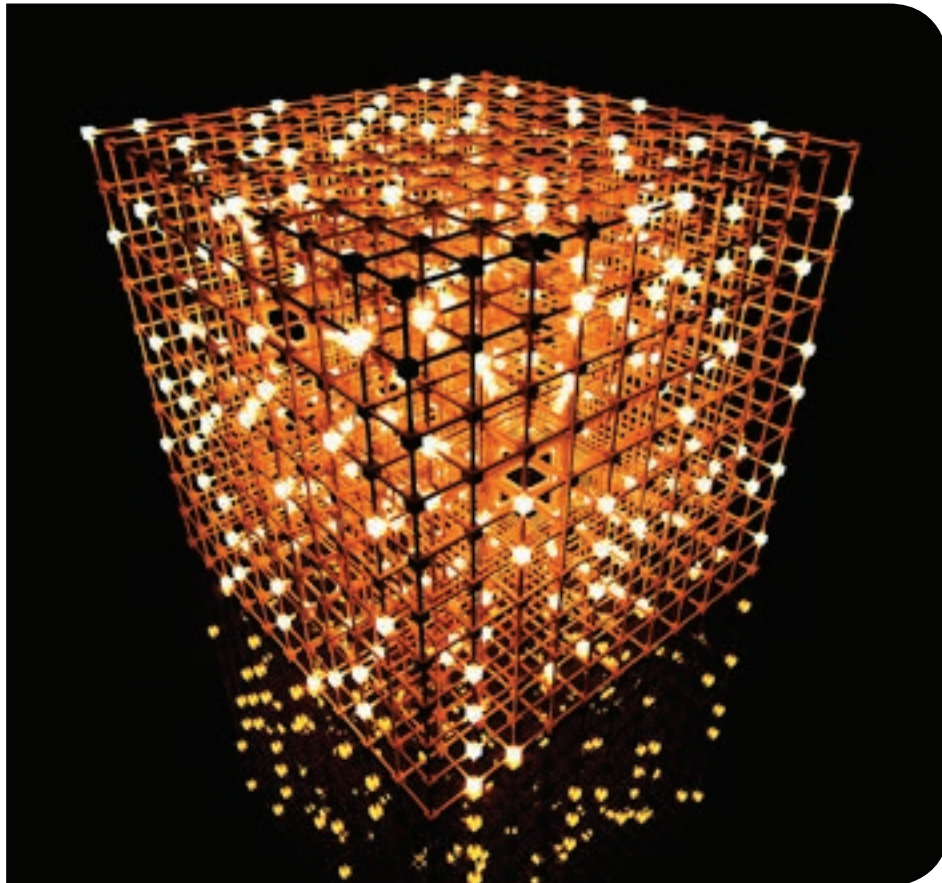
- the legally binding obligation that in the UK, 15% of total energy must come from renewable sources by 2020
- the statutory requirement that UK greenhouse gas emissions must be reduced by 34% by 2020 and 80% by 2050 (on 1990 levels)
- the four Carbon Budgets covering five-year periods from 2008-2027
- the security of an estimated 85GW indigenous supply requirement in the UK by 2020
- the need to provide affordable energy for all.

We believe the priority for our programme should be in innovations that can have an impact in the next 10 to 20 years and that we should **use UK policy and government action** as key drivers for a programme that develops UK test beds for demonstration, UK SME supply chains, knowledge transfer and expertise.



‘The ‘trilemma’ of energy security, affordability and sustainability.’

WHAT ARE THE CHALLENGES FOR ENERGY INNOVATION?



New energy technologies, deployed now, are likely to determine how we supply energy until 2100. Ever-increasing consumption of petroleum, ageing generating assets, global energy price swings, natural resource constraints, global warming and increasing energy costs, all mean that change and innovation must happen now. To meet these needs, there are key challenges to overcome; challenges that can offer profitable opportunities for UK business.

Cost reduction

New technologies are costly. Energy is a commodity and to compete, new technologies must ensure they add value in terms of security, sustainability and affordability. Offshore renewables are a good illustration of this balance. In the UK we have prodigious offshore wind, tidal stream and wave energy resource, more than any other European country. Although this offers a sustainable and indigenous source of supply, the cost is currently prohibitive without significant government subsidy and is a major challenge to the industry.

Supply chain development

To be competitive, new energy technologies must have capable and innovative supply chains. There is an opportunity for the UK to develop goods and services in those parts of the supply chain where maximum value can be created and captured.

Expert workforce

A skilled and well-trained workforce is needed to deliver often very technical and safety-critical innovations⁴. In a number of energy sectors, there is considerable concern regarding skills gaps and human capital depreciation. Equally, there is a challenge regarding how to transfer knowledge and innovation from the research base into industry.

Infrastructure development

Innovation needs a capable infrastructure to manage, transmit and distribute new energy technologies, both in terms of supply but also on the demand side. Above all, the future energy system has to be flexible and be able to handle a mix of generating technologies, deal with intermittency of renewable supply, automate the management of energy demand and inform consumer response and behaviour.

Stable policies

Stable and consistent energy policies are needed to give industry the confidence to invest in innovation. Policy and regulation are fundamental in determining the pace of market development. To invest in new infrastructure, new generating capacity and demand side measures, new supply chains and new skills, industry needs certainty with regards to regulation, planning and capacity targets.

WHAT ARE THE OPPORTUNITIES FOR U

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Our energy programme focuses on three key areas where we believe there are real opportunities for UK business.

In the development of affordable and secure sources of supply which also reduce GHG emissions, the opportunity for UK business is to:

- supply innovative new products capable of reducing the cost of offshore renewable energy and de-risk deployment by breaking down technical barriers to commercial scale demonstration
- supply the nuclear energy industry with innovative products to ensure the safe and sustainable construction, commissioning, operation, monitoring and decommissioning of nuclear power stations worldwide
- develop pilot systems, subsystems and components that will cut cost and improve efficiency in CO₂ capture, transport, storage and alternative uses from power plant
- develop next-generation energy technologies capable of reducing GHG emissions.

In the integration of future demand and energy supply into a flexible, secure and resilient energy system, the opportunity for UK business is to:

- develop technologies that enable renewable generation technologies to be effectively and affordably connected to national energy infrastructures and enable flexibility through energy storage innovation
- develop technologies that ensure fuel systems for current and future demand side applications are secure and operate within environmental risk boundaries
- use innovation to address flexible demand patterns and integrate new emerging energy demand technologies in a way which is capable, secure and cost effective
- develop innovative transmission and distribution technologies to ensure reliable and efficient new energy systems.

In the reduction of GHG emissions at point of use, the opportunity for UK business is to:

- develop pilot systems and subsystems that seek to reduce GHG emissions from industrial processes and demonstrate alternative uses for captured CO₂
- develop technologies that dynamically match demand with supply and thereby reduce emissions at point of use
- develop innovative alternative power and heating systems for transport and buildings.



K BUSINESS?



Case study

Fuelling innovation

The Technology Strategy Board has been investing in business growth by supporting the development of fuel cells and hydrogen technologies since 2007.

The programme has aimed to support early-stage technology companies at different points in their innovation 'journey' through materials innovation, technology development, vehicle integration, technology demonstrators and most recently whole system integration.

With our funding partners in DECC, we have invested over £40m in projects with a total value of nearly £90m. This has helped businesses grow, gain further private funding, take on more research and production staff, participate in EU programmes and form strategic partnerships.

This funding has been instrumental in the commercialisation of new products in a number of diverse sectors including transport, the built environment, and industrial off-grid power generation.



‘We have been able to take on projects with new partners that would have been too risky otherwise, but that have led to new business opportunities for us and our supply chain.’ Dr Jonathan Frost, Director, Johnson Matthey Fuel Cells

OUR TECHNOLOGY STRATEGY

As an organisation we have been supporting, facilitating and co-funding innovation in the energy sector since 2007. Going forward, we will balance our portfolio to reflect the work we have done and a new strategic emphasis focused on our current objectives.

We have mapped our three strategic objectives against our core investment criteria and our organisational strategy *Concept to Commercialisation*⁵ to create a programme that we believe addresses market barriers and creates opportunities for UK business over the next four years.

We have assessed domestic and global markets, UK capability, timing and how we can use the tools available to us at the Technology Strategy Board, and have chosen a technology strategy capable of helping UK business exploit the market opportunities we have described.

As a member of the Low Carbon Innovation Coordination Group we have taken into account the Technology Innovation Needs Assessments (TINAs), where detailed information can be found on various aspects of low carbon innovation and UK opportunities.⁶



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CATAPULT Offshore Renewable Energy



Case study

Catapult – Anchoring offshore renewables innovation in the UK

The Catapult will offer the offshore renewables energy industry access to the UK's world-leading expertise and test facilities in offshore engineering. The Catapult will accelerate innovations that focus on cost reduction in offshore renewables and ensure that UK business is able to extract maximum value from the supply chain in this emerging industry.

The UK's renowned strength in offshore engineering, built largely through our oil and gas industry, and understanding of the marine environment – combined with the UK's abundant natural resource and world-leading offshore wind market – makes the UK an excellent base for offshore renewable energy innovation.

'Affordable offshore renewable energy represents a once-in-a-generation opportunity for the UK. World-class innovation will be needed to overcome the cost challenge; we envisage the Catapult at the centre of that process.' Andrew Compton, Strategic Account Manager, Alstom

'The Catapult should play an important role in driving down the costs of offshore wind and progressing the UK's current competitive advantage in marine energy – actions crucial to meeting the UK's future energy security and carbon reduction targets.' Ian Marchant, CEO, SSE plc

The Catapult has its headquarters in Glasgow, with an operational centre in Northumberland.

www.catapult.org.uk/offshorerenewables

In offshore renewable energy,

we will:

- support the deployment of wave and tidal arrays by funding demonstration of technologies that tackle common issues such as tidal array cabling, subsea electrical hubs, installation and maintenance vessels, and anti-fouling
- fund collaborative R&D to help build UK supply chains and enable UK innovation that adds value to those original equipment manufacturers and project developers working on mid round 3 build-out in offshore wind
- leverage the UK's world-leading oil and gas supply chain and offshore engineering expertise through knowledge transfer and collaborative R&D to reduce the cost of energy through more efficient offshore installation and support services
- establish an Offshore Renewable Energy Catapult Centre to facilitate innovation in offshore renewables and provide a central point of access to the UK R&D base, test facilities and other UK assets
- use Knowledge Transfer Partnerships to foster innovation in SMEs capable of supplying the offshore renewable energy sector.

In civil nuclear energy,

we will:

- build on the successful outputs of previous feasibility studies and fund a number of small scale pilot system and sub-system/component demonstrators
- focus on collaborative R&D across the nuclear supply chain that will have wide benefits and broad applicability globally, including: lowering the cost of high value manufactured parts, innovative construction and assembly methods, operation and maintenance technologies, and decommissioning methods
- use Knowledge Transfer Partnerships to provide targeted innovation support to SMEs in the nuclear sector.

In grid balancing, management and infrastructure,

we will:

- focus on research that will develop products and services across the future grid including: hardware (such as energy storage, sensors and power electronics), software (such as virtual power plants, automation and demand side response) and network infrastructure (such as security, data storage and communications)
- fund R&D to underpin and build on our other Technology Strategy Board energy-related programmes, including electric transport, offshore renewables and grids, and the modern built environment
- use our programmes, networks and knowledge transfer activities to build the interdisciplinary collaborations required to ensure a flexible, secure and resilient energy system.

In oil and gas,

we will:

- work with other innovation partners to deliver R&D funding for pilot technologies focused on enhanced production and asset reliability where we believe targeted public sector support is needed to leverage additional private sector investment and accelerate new technology deployment
- build and exploit the potential synergies with wider energy technology sectors through our Knowledge Transfer Networks and Knowledge Transfer Partnerships
- encourage SMEs in the oil and gas supply chain to consider our cross-sector programmes such as those in offshore renewables and marine transport, and our underpinning technology programmes such as materials and sensors, as further opportunities for innovation.

OUR TECHNOLOGY STRATEGY continued



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In carbon abatement technologies,

we will:

- take our previously funded feasibility studies closer to commercialisation by funding pilot, sub-system or component demonstrators in areas applicable to both industrial and power generation emission reductions
- develop the UK supply chain by linking innovative SMEs with existing large companies to develop underpinning and next generation technologies that will focus on cost reduction and efficiency improvement in carbon abatement.

In fuel cells,

we will:

- use cross-sector collaborative R&D to integrate fuel cells into the wider energy system as a solution to securing flexible and resilient energy supply and reducing emissions at point of energy use
- fund R&D that supports cost reduction and performance improvement through developing manufacturing processes and supporting next generation technologies in UK supply chains
- support market access for businesses by facilitating engagement and collaboration with EU programmes.

In alternative energy vectors,

we will:

- work with our other innovation programmes to integrate alternative energy vector technologies with end-use application technologies, particularly transport applications, with a view to supporting and optimising the whole fuel system
- use collaborative R&D and knowledge transfer to address key technological challenges to market adoption of new energy vectors, including for example storage, transport and fuel safety
- support market access for businesses by facilitating engagement and collaboration with EU programmes.

In next generation photovoltaics,

we will:

- enhance the UK supply chain by bringing together innovative SMEs with early-stage research and existing large companies, to develop underpinning technologies that focus on cost reduction and efficiency improvement
- assess where the UK can best engage with Europe to develop and exploit new technologies
- analyse our current portfolio of investment and work with Research Councils UK and other Technology Strategy Board programmes such as materials and photonics, to address how we can continue to support early-stage translational R&D.

We have assessed where we can create a better innovation environment for UK business and complement and connect with the work of our partners across the innovation landscape. In particular, we will work with those directly involved in energy innovation, including our colleagues in the Low Carbon Innovation Coordination Group (LCICG), UK Trade & Investment, and the overseas Science and Innovation Network (SIN).

Our programme will be delivered using all the tools available to us, including funding for R&D, Knowledge Transfer Partnerships and Knowledge Transfer Networks.

We will tackle our priorities through specific technology-focused programmes based on potential to accelerate the innovation journey from concept to commercialisation.

For specific details of our work and opportunities to participate in our programmes see our *Delivery Plan*, published annually on our website, and sign up for alerts, newsletters and information at www.innovateuk.org



Case study KTP – putting innovation at the core

When Geotek, a specialised geological equipment manufacturing and service company based in Daventry, needed to develop innovative analysis capability it turned to the Knowledge Transfer Partnership (KTP) programme.

Together with the University of Southampton and KTP associate Matthew Druce, Geotek devised a new product and service – PCATS Triaxial - to measure the mechanical properties of marine sediment cores recovered under in situ hydrostatic pressures. Geotek anticipates PCATS Triaxial will provide a return on investment within two years and significant profits in subsequent years.

The partnership also benefitted Matthew in kickstarting his career, and ultimately Geotek hired him as production manager.

‘KTP enabled us to take an idea from the drawing board to a saleable product, and bring in a valuable employee.’

Peter Schultheiss, managing director, Geotek Ltd

www.ktponline.org.uk

References and sources

This strategy has been developed following extensive consultation with business, academia, industry organisations, partner organisations, government and other interested parties.

¹UK Energy In Brief 2011, Department of Energy and Climate Change (DECC), www.decc.gov.uk

²Kyoto Protocol, http://unfccc.int/kyoto_protocol/items/2830.php/

³Forum for the Future, an independent organisation working towards a sustainable future, www.forumforthefuture.org

⁴BIS economics paper No.15, innovation and research strategy for growth <http://www.bis.gov.uk/assets/biscore/innovation/docs/e/11-1386-economics-innovation-and-research-strategy-for-growth.pdf>

⁵*Concept to commercialisation*, Technology Strategy Board's corporate strategy 2011-2015, www.innovateuk.org

⁶Technology Innovation Needs Assessments (TINAs), www.decc.gov.uk/en/content/cms/funding/funding_ops/innovation/tinas/tinas.aspx

The TINAs aim to identify and value the key innovation needs of specific low carbon technology families to inform the prioritisation of public sector investment in low carbon innovation.

The TINA for each low carbon technology:

- analyses the potential role of the technology in the UK's energy system
- estimates the value to the UK from cutting the costs of the technology through innovation
- estimates the value to the UK of the green growth opportunity from exports
- assesses the case for UK public sector intervention in innovation
- identifies the potential innovation priorities to deliver the greatest benefit to the UK.

In addition to offshore wind, the following technology sectors are being assessed using the TINA methodology; marine energy, domestic buildings, non-domestic buildings, heat, bioenergy, electricity networks and storage, carbon capture and storage, and nuclear fission. Summary reports for these TINAs will be published during 2012 and 2013.

Catapult centres: www.catapult.org.uk

Knowledge Transfer Networks: <https://connect.innovateuk.org>

Knowledge Transfer Partnerships: www.ktponline.org.uk



Images:

Cover image: NRSC Ltd, Science Photo Library

Satellite image of the British Isles at night, showing the distribution of city lights; page 8: Single cell assembly, Johnson Matthey Fuel Cells; page 8: Nose cone assemblies for RePower offshore wind turbines, Technology Strategy Board.

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