Response to consultation on Non-Traditional Business Models: Supporting transformative change in the energy market

The iBUILD Infrastructure Research Centre brings together a multi-disciplinary team from Newcastle, Birmingham and Leeds Universities to improve the delivery of local and urban infrastructure. iBUILD is developing and demonstrating alternative infrastructure business models that: take a whole life cycle view of infrastructure systems; exploit technical and market opportunities from modern interconnected infrastructure; leverage economic, social, environmental, aesthetic and other values from infrastructure; identify changes in governance, regulation and policy to unlock improvements; and, use innovative financing and funding mechanisms.

The response below seeks to provide input on several of the discussion points raised in the consultation document on developments in business models identified during the iBUILD project.

iBUILD focuses on all infrastructure sectors, not just energy, but our review of business models has included those in other non-infrastructure sectors. Where our research is undergoing peer review we cite working papers which, amongst other work, can be found at www.ibuild.ac.uk.

This submission is complementary to a submission by Roelich et al from Leeds University who are summarising work, jointly funded by iBUILD and the Realising Transition Pathways project, that looks at energy issues in particular.

Discussion points:

- **What is your view on our definition of non-traditional business models?**

The definition of NTBM is limited and based on the assumption that there is a prominent current business model in operation that providers and users of the energy market have knowledge of and routinely work towards. If NTBMs are everything outside the current business model, a clear definition of the current BM is required. Based on research undertaken as part of the iBUILD project,[1] we raise four points for consideration in defining NTBM:

1. Current business models operating in the energy sector, and for infrastructure more generally, are diverse and incorporate a package of elements that construct the business model. *Non-traditional business models are not necessarily wholly new business models but may instead be a reconfiguration of assets, value propositions and finance/funding structures within 'traditional'*

[1] For further information see: Bryson, J.R., Pike, A., Walsh, C.L., Foxon, T., Bouch, C. & Dawson, R.J. (2014) *Infrastructure Business Models,* iBuild Briefing Note 2; Bryson, J.R., Mulhall, R.A. & Song, M. (2014) *Business Models and Local Infrastructure: Financing, Value Creation and Governance*, iBuild Working Paper 12.

business models that offer additional outcomes as well as outputs.

2. NTBMs are often used to meet different needs to mainstream 'traditional' business models. This may be in terms of scale, value proposition or how the model evolves to meet changing service needs. For this reason, *NTBM are additional rather than alternative models* for infrastructure delivery.

3. *NTBMs are also complementary to existing mainstream business models and may not be transformative to the wider sector*. Niche infrastructure services may not be supported by mainstream finance and funding mechanisms or aim to deliver services beyond the specific vision of the model.

4. *A narrow view of infrastructure can constrain innovative thinking and limit the development and implementation of NTBMs (Figure 1).* The energy infrastructure system spans from 'source' (e.g. of generation - coal; wind etc.) to 'beneficiary' (e.g. person, house, business) as well as the assets in between.[2] A business model describes the creation, delivery, and capture of value in economic, social, cultural or other terms.[3] A sustainable infrastructure business model secures the resources, financial or otherwise, to construct and manage infrastructure over its life cycle.

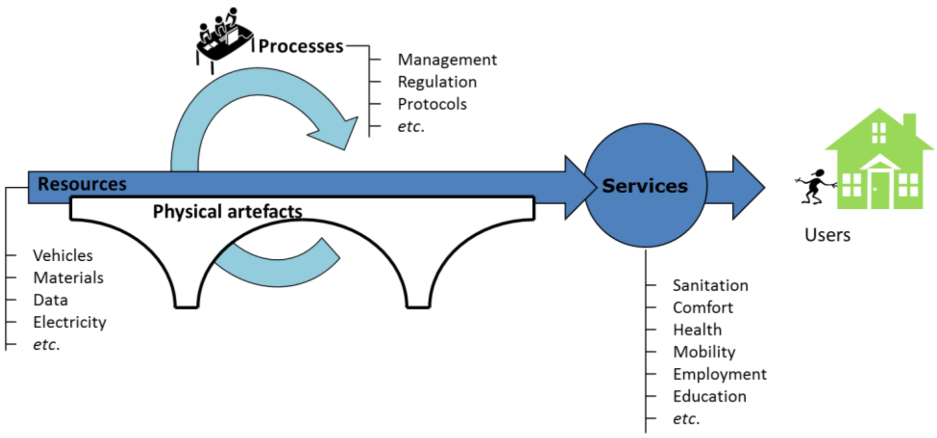

Figure 1. Overview of infrastructure system and issues relevant to NTBM (from [4])

[2] Dawson RJ (2013) *Bridges n'that: An infrastructure definition for iBUILD*, iBUILD Briefing Note 1.
[3] Bryson JR, Pike A, Walsh CL, Foxon T, Bouch C & Dawson RJ (2014) *Infrastructure Business Models*, iBUILD Briefing Note 2.
[4] iBUILD (2015), *Are you being served? Alternative infrastructure business models to improve economic growth and well-being, iBUILD manifesto and mid-term report*. Newcastle University. ISBN 978-09928437-1-7.

- **We would like to hear your views on the drivers for market entry. Do you think there are other important drivers?**

In addition to the drivers outlined in the discussion paper, two further drivers are impacting on the growth of infrastructure business models in the energy sector for non-domestic consumers.[5] First, access to the whole energy market is limited because of market complexity and the rigidity of purchasing arrangements. To manage this requires market expertise that small firms in particular do not have and this has led to the rise of third party intermediaries (TPIs). Second, the security of energy supply is a threat to large scale consumers and has increased their engagement with the energy market to generate alternative and complementary energy support systems.

Another key factor is system resilience. Predicted changes in the climate and socio-economic development will, without appropriate action, increase the risk of disruption from extreme weather. However, valuing the benefits of measures to enhance the resilience of infrastructure is challenging because of the long – often generational – timeframes involved and the relatively low frequency of extreme events under consideration. For example, flood defence appraisal guidance can bias investment towards the protection of housing and individuals, but this could be to the detriment of investing in protection for individual infrastructure assets, that provide critical services to entire communities. This can leave whole regions at the mercy of conventional benefit-cost ratios that lack consideration of wider economic and social value, strategic importance and interdependencies with other infrastructure services.[6,7] Crucially, it is important to think about the resilience of the service, which may include the role of measures such as behavioural change and spatial planning and not just reparation or strengthening of assets.

A review of international infrastructure business models has highlighted the risks of public and private sectors focusing on short-term financial gain instead of taking a long-term, strategic perspective on infrastructure, spatial planning and urban development.[8] To enable infrastructure systems to respond to future uncertainties in environmental, demographic and economic conditions, it is essential to consider future flexibility (i.e. to what extent options become closed) within an appraisal process. Infrastructure's long lifespan means that it is particularly important to consider long-term changes and uncertainties, to understand the true cost of disruption to infrastructure (e.g. in terms of access to employment, productivity, health and wellbeing), the costs of measures to enhance resilience and the opportunity costs of measures that reduce future flexibility. The source

[5] For further information see: Mulhall, R.A. & Bryson, J.R. (2014) Energy Price Risk and the Sustainability of Demand Side Supply Chains, *Applied Energy*. 123, 327-334.

[6] Wardman M, Mackie PJ & Gillies-Smith A (2014) Valuing systemic transport resilience: methods and evidence, in A Brown and M Robertson (eds.) Economic evaluation of systems of infrastructure provision: concepts, approaches, methods. iBUILD/Leeds Report.

[7] Dawson DA, Shaw J & Gehrels WR (in review) Sea-level rise and transport infrastructure: the case of the coastal railway line, at Dawlish, England, Applied Geography. Based on : Dawson D (2014) The need for new business models to maintain UK infrastructure resilience, iBUILD Working Paper 14.

[8] Bryson JR, Mulhall R & Song M (2014) *Business Models and Local Infrastructure: Financing, Value Creation and Governance*, iBUILD Working Paper 12.

and mix of energy supply are clearly important, but there are also well documented concerns regarding interdependencies between critical infrastructures; a localised failure in the power network can have widespread, cascading effects. [9]

NTBM provide the opportunity to develop regulatory or market mechanisms to support the implementation and valuation of resilient energy infrastructure.

- **Have we accurately described the NTBM environment? Have we missed something?**

The themes identified in the discussion paper reflect the different examples of NTBM operating in the energy sector. However, we would like to make some additional points for consideration:

1. The stability of operation is an important factor in NTBM environment. *Non-traditional models often arise to serve a discrete objective over a period of time.* The need or method of delivery is often not stable or necessarily sustainable, which can lead to non-traditional models evolving into more traditional models.

2. *NTBMs are interdependent with traditional business models in the current market environment*, which has implications for the security and consistency of supply of energy in the market.

3. The groupings in the discussion paper are based on the output of the infrastructure business model. However, *variation in business models can arise from the configurations of leadership, value network and ownership, and the finance and funding package* used in the model.

4. *An alternative characterisation of infrastructure business models can be developed based on value delivered by the business model*, following that outlined by Morris et al. (2005)[10]. In this approach, the business model is deconstructed into the particular aspects of the NTBM environment that support the model: for example, how is value created in the business (at the highest, most general level); what sort of combination of variables is used to create value; and, what principles for execution of the business are used to create value.

5. It is crucial to understand how all infrastructure systems are interconnected; infrastructure depends on other infrastructure to work, not just technically, but also economically and socially. The iBUILD definition of infrastructure is broader than many others that, for example, often focus on infrastructure as an asset class. We consider infrastructure to be '*the artefacts and processes of the inter-related systems that enable the movement of resources in order to provide the services that*

[9] Fu G, Dawson RJ, Khoury M & Bullock S (2014) Interdependent networks: Vulnerability analysis and strategies to limit cascading failure, *European Physical Journal Part B*, 87(7):148.
[10] Morris, M., Schindehutteb, M., Allen, J., 2005, 'The entrepreneur's business model: toward a unified perspective', *Journal of Business Research*, 58, 726– 735.

mediate (and ideally enhance) security, health, economic growth and quality of life at a range of scales'[11] (Figure 1).

Included in this definition should be housing. UK national infrastructure planning, and specifically the National Infrastructure Plan (NIP)[12] gives limited attention to buildings or property and the important social and economic services they provide. Many local infrastructure plans recognise the importance of housing efficiency and demand reduction measures. The UK has some of the oldest building stock in the EU, and as much as 80% is expected to still be in use in 2050.[13] The majority of the UK's housing stock is not particularly energy efficient, and this makes it even harder to address wider issues of fuel poverty and greenhouse gas emission reductions.

Buildings, and spatial planning more generally, play a critical role in modulating the demands placed upon energy networks. Reducing demand for these services through 'hidden infrastructure', such as investment in efficiency measures and demand management strategies, reduces consumer bills, frees up capacity to support growth and regeneration, and defers the need for expensive capital investment in new infrastructure (e.g. for new power stations). The National Infrastructure Plan, for example, sets out a pipeline of £65 billion investment in energy generation and £45 billion investment in energy networks over the coming years. Yet, investing a third of this in energy efficiency measures over the next four decades could free up 12% headroom in generation capacity.[14] These measures are critical to generating long-term and sustainable economic, social and environmental value and must be co-ordinated more effectively.[15]

- **We'd like to learn more about organisations using NTBMs. If you are prepared to discuss this please contact us.**

The iBuild research project has undertaken a review of 115 international local infrastructure business models, both traditional and non-traditional, across all infrastructure asset classes. The energy sector has a considerable number of business models at the local scale that provide additional services within the current market. The business models are diverse. Value creation includes social, economic and urban regeneration outcomes as well as direct outputs in terms of energy supply. International comparison has illustrated how the development of business models from niche to established mainstream models reflects the regulatory, political and socio-economic context. For example, the success of municipal decentralised energy supply in Denmark and subsidy-supported business models for local energy supply in the UK.

[11] Dawson RJ. 2013. Bridges n'that: An infrastructure definition for iBUILD. *iBUILD Briefing Note 1*
[12] HM Treasury (2014) National Infrastructure Plan, London, HM Treasury.
[13] BPIE (2011) Europe's buildings under the microscope, Buildings Performance Institute Europe.
[14] Gouldson A, Kerr N et al. (2014) Innovative Financing Models for Low Carbon Transitions: Exploring the case for revolving funds for domestic energy efficiency programmes, iBUILD Working Paper 6.
[15] Gouldson A, Colenbrander S, McAnulla F, Sudmant A, Kerr N, Sakai P, Hall S, Papargyropoulou E & Kuylenstierna JCI (2014) The Economic Case for Low Carbon Cities. New Climate Economy and Stockholm Environment Institute, Stockholm. Available at: http://newclimateeconomy.report.

- **Our main focus in this paper is on regulatory issues arising from future energy market transformation, but we recognise that there are relevant issues within current regulation. Please let us know if there are any other issues?**

One area of relevant legislation is the role of 'City Deals'. Between 2011 and 2014, 29 'City Deals' were signed between Local Authorities, Local Enterprise Partnerships and Central Government. A number of City Deals were designed to introduce new forms of infrastructure funding and financing. The City Deals that agreed 'innovative' infrastructure models saw central Government maintain strict fiscal control over their operation and there have been highly uneven outcomes in per capita financial allocations to city-regions. Whilst the City Deals are an important development, when viewed in an international context they do not represent radical decentralisation or opportunity for NTBM. A more comprehensive and systemic approach to providing stronger fiscal autonomy and public service integration across cities and local areas, within a stable national framework, to support NTBM infrastructure investment and delivery, is required.[16]

- **Are these benefits experienced by all energy consumers or only those directly receiving the NTBM's services?**

To answer these questions it is important to have the clear and systemic view of business models and the energy infrastructure. Systemic mapping of the values (economic, social, environmental etc.), agents, physical assets etc. enables identification of the different values, and costs, associated with alternative approaches. A diversity of models enables communities and companies to identify and tailor the most appropriate for the circumstances.

Lessons from the ICT sector have shown that few NTBM are readily supported. For example, the provision of high quality broadband to properties in the rural areas of the UK is an ongoing challenge as it is not considered economically viable using mainstream methods. Broadband for the Rural North (www.b4rn.org.uk) have built a community owned gigabit fibre optic broadband network in the sparsely populated, rural uplands of Lancashire in the north west of England. Attempts to use existing infrastructure networks to carry the fibre were hampered by existing regulation that discourages such sharing. Costs were reduced: by laying optical fibre cables across land owned by members of the co-operative (as opposed to alongside roads); by members carrying out much of the installation work themselves; and, by members investing in the scheme receiving tax relief through the Government's Enterprise Investment Scheme. To date, nearly 500 km of duct has been installed and nearly 1000 properties have been connected at a rate of between 50 and 100 properties per month. The scheme has expanded into North Yorkshire with connections in Cumbria are imminent.

[16] O'Brien P & Pike A (in review) The Governance of Local Infrastructure Funding and Financing Journal of Infrastructure Complexity: Special Issue of the UK Infrastructure Transitions Research Consortium Economics Conference, Cambridge, 27-28 March 2014. Based on an earlier working paper: O'Brien P & Pike A (2014) Deal or No Deal: UK City Deals as Infrastructure Funding and Financing Mechanisms, iBUILD Working Paper 13.

- **Are there additional wider benefits to the energy system and beyond it?**

Developing and implementing NTBM in the energy sector provides some benefits, but as outlined in response to earlier questions, our infrastructures are increasingly interconnected and some of the most promising opportunities are from thinking about delivering what people really require i.e. warmth, light, mobility etc. rather than electricity, gas, roads. This can help identify NTBM that deliver efficiencies across multiple 'traditional' sector boundaries. A rapidly emerging interdependence is between electricity and transport infrastructure – most notably uptake of electric vehicles (EVs). Coupled analysis of energy and transport systems models, has demonstrated that distribution networks could accommodate higher growth in electric vehicles than previous studies have suggested. Exploiting the geographic spread and different timings of EV charging can limit the impact on power infrastructure. Distribution network operators should collaborate with new market players, such as charging infrastructure operators, to support the roll out of an extensive charging infrastructure to make both networks more robust.[17]

A well-established demonstration of the value of an NTBM applied to an industrial park – now an industrial ecosystem – is the closing of material and energy loops locally with integrated infrastructure in Kalundborg, Denmark. Since 1972, this industrial park has evolved from a single power station into a cluster of companies that exchange materials and energy for mutual benefit as by-products from one business are often inputs for others. For example, treated wastewater from a refinery is used to cool a power station which in turn provides steam for the refinery and a pharmaceutical plant. Surplus heat from the power station is also used for warming nearby homes and businesses. This has led to substantial annual savings of resources and costs – for example, a reduction in water consumption of 3.3million m3/year, savings of $15m from resource sharing and far larger savings by sharing infrastructure have been reported – highlighting how integrated infrastructure business models can produce substantial savings.[18][19]

There are many potential ways of organising and regulating such interactions to create efficiencies. For examples, in 1887 in Indianapolis, local civic leaders established a natural gas company as a Public Trust, with an aim to "create the greatest long-term benefit for customers and communities". Today, the Citizens Energy Group owns and operates a large portfolio of physical infrastructure assets that deliver multiple services including energy, water and wastewater for 800,000 people and thousands of businesses in the Indianapolis area. This has provided community services that are entirely compatible with good financial management. The group was awarded a top rating (MIG 1)

[17] Neaimeh M, Wardle R, Jenkins A, Hill GA, Lyons P, Yi J, Huebner Y, Blythe PT & Taylor P (in press) A probabilistic approach to combining smart meter and electric vehicle charging data to investigate distribution network impacts, *Applied Energy*.

[18] Chertow MR & Lombardi DR (2005) Quantifying Economic and Environmental Benefits of Co-Located Firms, *Environmental Science & Technology*, 39(17):6535 -6541.

[19] Chopra SS & Khanna V (2014) Understanding resilience in industrial symbiosis networks: Insights from network analysis, *Journal of Environmental Management*, 141:86-94.

by Moody's credit rating agency in 2014, a reflection, in part, of the strength of the company's infrastructure business model.[20]

By recognising the opportunities from the interdependencies of modern infrastructure, and explicitly designing this into our energy and other systems, this not only offers opportunity for NTBM but also can be used to deliver flexible and permutable infrastructure systems that can enhance resilience.[21]

- **How will NTBMs help to drive innovation within the energy system?**

An established example of a NTBM driving energy system innovation is the sustainable energy initiative of Woking Borough Council over the past two decades. This has included small scale combined heat and power systems, integrated photovoltaic and CHP systems and a public-private joint venture energy services company. In recent years NTBMs within community based sustainable energy systems have proliferated in the UK and elsewhere in Europe[22]. There are many other articles on this in recent years in the journal Energy Policy[23] which include work by Nolden (2013) that shows how social and technological innovation can develop in small scale community led initiatives. Social innovation can involve embedding energy in people's lives while technological innovation can be facilitated within networks spawned from these many smaller scale initiatives, but without broader institutional support (from within the policy and regulatory framework) smaller scale NTBMs are unlikely to seriously challenge the established energy system regime.

- **How could regulatory arrangements change to accommodate NTBMs?**

Different regulatory requirements are necessary for NTBMs to operate at the local scale. Infrastructure systems are increasingly interdependent because of their proximity - for example, utility networks are co-located underneath roads; operational reliance - for example, infrastructure relies on energy or information communication technology; or, economic or regulatory frameworks - for example, assets and systems may share similar investment cycles or finance models. These

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[20] www.moodys.com/research/Moodys-Concludes-Review-and-Confirms-MIG-1-on-Indianapolis-Indiana--PR_302963

[21] Khoury M, Bullock S, Fu G, and Dawson RJ (2015) Improving measures of topological robustness in networks of networks and suggestion of a novel way to counter both failure propagation and isolation, J. *Infrastructure Complexity*, 2(1):1-20.

[22] Roelich K & Bale CSE (2014) Municipal energy companies in the UK; Motivations and barriers, in *International Symposium of Next Generation Infrastructure*, Vienna, October 2014.

[23] Chmutina K. and Goodier C (2014) 'Alternative future energy pathways: assessment of the potential of innovative decentralised energy systems in the UK', *Energy Policy*, 66: pp62-72; Nolden C. (2013), 'Governing community energy – Feed-in tariffs and the development of community wind energy schemes in the United Kingdom and Germany', *Energy Policy*, 63: pp543-552; Parag Y., Hamilton J., White V., and Hogan B. (2013), 'Network approach for local and community energy governance in the UK: the case of Oxfordshire', *Energy Policy*, 62: pp1064-1077; Seyfang G., Park J. J. and Smith A. (2013) 'A thousand flowers blooming? An examination of community energy in the UK', *Energy Policy*, 61: pp977-989.

interdependencies can create risks,[24] but they also present opportunities for NTBM, particularly at the local level where these interdependencies are closely related and tightly coupled.

The current disjointed nature of local infrastructure planning, investment and management is complex, uncertain and produces inefficient outcomes.[25] Enhancing coordination, through local NTBM, of the planning, delivery and management of multiple infrastructure classes would enable infrastructure systems to be developed around the principle of providing the highest level of service at the lowest level of resources used. This would generate additional wider social and environmental benefits such as tackling fuel poverty, reducing carbon emissions as well as creating local jobs and reducing costs.[26] Local actors need additional capacity and empowerment, including more effective decision support tools, alongside national reforms in policy and regulation, to enable places and organisations to integrate local infrastructure provision.[27] A major appeal of infrastructure to investors is the potential for stable returns at low risk over the longer term. Current governance and regulatory arrangements typically foster investment on a sector or project specific basis which can create objectives that conflict with those taken by an integrated approach. Bundling the physical, social and economic components of multiple infrastructure services into a single investment package is one option to address this. Ongoing iBUILD research is exploring the potential for other financial instruments that are consistent with an integrated approach but package investments and returns in different ways that capture value whilst minimising risks for investors, operators, users and tax-payers.

[24] Fu G, Dawson RJ, Khoury M & Bullock S (2014) Interdependent networks: Vulnerability analysis and strategies to limit cascading failure, European Physical Journal Part B, 87(7):148.
[25] Roelich K, Knoeri C, Steinberger JK, Varga L, Blythe PT, Butler D, Gupta R, Harrison GP, Martin C & Purnell P (2015) Towards resource-efficient and service-oriented integrated infrastructure operation, Technological Forecasting & Social Change, 92(1):40-52.
[26] Roelich K & Bale CSE (2014) Municipal energy companies in the UK; Motivations and barriers, in International Symposium of Next Generation Infrastructure, Vienna, October 2014.
[27] Rogers CDF & Leach J (2013) Future Urban Living: Empowering Cities and Citizens, University of Birmingham Policy Commission.

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