Delivering Distributed Renewable Energy within Large-Scale Property Projects: Obstacles and Opportunities

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Abstract: In mature and emerging markets worldwide, large-scale property development projects routinely strive for excellence in environmental design. The potential of energy efficiency and on-site renewable / clean energy generation allows for demand reductions to leverage the remarkable performance and cost gains being realised in distributed renewable technologies. These factors – where supported by regulatory and market certainty for decentralised energy production, ownership and distribution - offer great promise to property developers seeking market differentiation and long-term value. Many projects, however, fail in the transition from intent to practice. 'Green' and low-carbon solutions which are thoughtfully conceived at concept stage and in early detail design face many obstacles as projects move toward full design, financing, and construction. A possible means to maintain this early-stage intent is to sever the property and energy financing so as to seek separate specialist debt and equity sources to fund the renewable energy assets, alongside innovative lease agreements between the underlying property asset and the overlaying energy source. This paper will explore the opportunities, benefits and risks of co-developing these assets - property and energy - utilising specialist finance and delivery structures.

1. Embedding Distributed Renewable Energy in Property Master Plans

Remaining within an internationally agreed-upon temperature change limit of 2 degree Celsius – a tenuous target given current trends, to be sure – will require action across linked multiple fronts of land-use, mobility and goods movement, and decarbonised energy supply. For the latter, distributed energy must play a prominent role. In fact, decarbonised distributed energy creates convergence with the other two: spatial planning that optimises building densities for small energy networks; mixed-use urban development that spreads demand profiles within small networks; tighter linkages between built areas and hinterlands for locally and regionally sourced bio-energy supplies; and vehicle electrification made possible through minimised travel distances and coordinated energy generation and storage. Thus, how the existing building stock is managed, and new building stock brought forward, is highly relevant.

Trends in energy generation and management, and in local distribution, are making viable ever greater shares of distributed power. The profound price drops in photovoltaic panel prices to points comfortably below €1 per watt have significantly lessened the upfront financial penalty. Ancillary price and technology improvements in two-way grid communications and metering, local storage, and demand management are commensurately improving resource efficiency and allocation. In combination, these can feed individual and community aspirations for energy autonomy – generating and controlling sufficient energy resources in lieu of traditional centralised suppliers and contracting arrangements with their inexorable price volatility. At the building scale, there are great opportunities to both reduce

energy demand, and to generate low-carbon power in-situ or within a community arrangement.

Coinciding with these trends, the EU's Energy Performance of Buildings Directive (EPBD) effectively obligates member states to deliver regulatory building code changes leading toward net-zero energy buildings in less than a decade. In practice, this will require buildings that are highly energy efficient, that generate a portion of their energy demand through on-site renewable or low-carbon power, and rely on closely sited renewables for the balance, as needed. Design standards and project exemplars such as Passivhaus[1], Plusenergiehaus®[2], ZED[3] (Zero Energy Developments), and One Planet Communities[4] clearly demonstrate the major energy demand reduction and energy supply opportunities available to the property design and development sector on commercial terms.

It is clear that developers of large, master planned property projects – involving land subdivision and delivery of dozens to hundreds of housing units, commercial spaces, and tourism, leisure and community facilities - have the design tools and the long-term regulatory vision at their disposal to guide decisions for low-energy design and on-site renewable energy infrastructure provision. Moving toward greatly reduced demand and local generation can clearly provide benefits for securing planning consents; in offering near-term product differentiation and long-term asset value maintenance; and controlling energy price variability for building owners and occupiers. Few, however, choose this path as a matter of course. It continues to be seen as an option entailing greater risk and cost than conventional property design and delivery pathways that simply tie into existing centralised power grids.

Within the property sector, there appears to be very little interaction and crossover with related professionals in renewable energy project finance and delivery. Thus whatever aspirations for on-site energy supply are put forward during concept design may founder due to this lack of engagement. Similarly from the perspective of an energy project developer, executing new projects within a property development footprint presents its own risks due to the unfamiliarity and minimal crossover between the sectors, as well as factors of time and scale. Working on sites unencumbered by new building development, or alternatively retrofitting renewable generation to existing properties, is simpler to execute. Though both the property and energy developer seemingly have something to gain from a linked project development process, each have access to more tried and true delivery pathways that offer the least resistance. This paper explores ways that these potential project partners can collaborate in spite of the ways they conventionally operate.

2. The Project Design and Delivery Process

The process for property development and renewable energy development follow a similar progression from concept, feasibility, regulatory approval, construction, and delivery. As a starting point, this suggests that these two types of project developers, who largely operate in separate universes, could find common cause and the means to collaborate to the mutual benefit of each other. Doing so may allow for separate but linked objectives to be met – delivering a marketable property asset, and an income-generating energy asset - within the same project 'envelope.' The descriptions below, though simplistic, outline the processes. They are applicable to multi-hectare, mixed-use property development projects; and energy

[1] http://passiv.de/en/
[2] http://www.rolfdisch.de/
[3] http://www.zedfactory.com/zed/
[4] http://www.oneplanetcommunities.org/

generation projects in the single to low tens of megawatts – nominally ground-mounted solar, but also conceivably wind, bio-energy, or geothermal energy sources. The projects can be either greenfield or brownfield sites.

Property	Energy
• A project developer assembles a new property, or draws from a bank of land (either already owned or in response to solicitations for lease and development), for development purposes. This represents the major equity stake for the developer of the project.	• Land is assembled or leased, similarly to the property project. This too represents the major equity stake of the project proponent.
• Market analysis and concept site planning are undertaken, supported by property economics and master planning professionals. Key outcomes will be confirmation of outline land use mix and the point of market entry (high-end; mid-market; etc.), a parcelised site plan and land use distribution, utilities requirements and building configuration, conceptual layout (building form, massing, and design vernacular), and phasing / staging plan.	• A similar market and site planning exercise is undertaken, though with variables related to the energy technology and yield: solar insolation, wind speed, underground energy resources, biomass, etc. Basic site layout for the energy equipment and connections will be completed.
• Concurrent with this is the production of market feasibility and project financials, essentially high-level cost and return models[5].	• Project market feasibility and financials will also be produced, considering the availability of tax credits, feed-in-tariffs, or other financial incentives; and ability to secure long-term power purchase agreements.
• Successive design and financial model iterations are undertaken involving greater detail on design and engineering, project costing, and sales / ownership and legal covenants. For the latter, there are a range of options along a scale of selling all individual parcels / building plots for end-purchasers / users, or keeping the plots and properties in a single ownership portfolio. There may be distinctions as well on land versus buildings – the land ownership is retained by the developer, and offered on lease terms in conjunction with the	• Detailed site planning and engineering design, and financial models, are undertaken. Operations and maintenance issues will be clarified, with consideration given to asset ownership or contractual O&M options.

[5] The two in combination – conceptual plan and layout, and financial model – can be used to attract additional equity investors or development or operations partners, or even create a break point for the initial project proponent to sell the land and concept and draw a return.

building sale – or qualifications on lease or right-of-way for various co-located utilities services or plant and equipment.

- The packages resulting from the above step are then used to secure the necessary regulatory approvals for the project, and construction financing. The regulatory process may include satisfying local requirements for sustainability broadly and energy generation specifically – requirements that are surely to become more stringent in coming years. All the activities are financed by the developer. This stage, too, may offer a break point for the project proponent to sell and realise a return on the equity investment.

- Similar to the property sector, regulatory approvals will be secured based on the preceding stages and information delivered. The activities to this point are developer financed. The project proponent may also sell at this stage to realise a return on equity investment.

- Once planning approval and financing is secured, the project will move into construction and delivery over the course of years with construction financing drawn down against agreed project milestones. At this point, the project becomes more substantially debt than equity financed.

- The construction and delivery phase proceeds, though on a comparatively shorter timeframe, typically measured in months rather than years. The project becomes more debt than equity driven.

- Land or building sales are commenced, with subsequent project stages partially dictated by transaction levels. The project proponent / landowner will again have an option to retain ownership for longer term return, or sell to a different portfolio owner and realise the development gain.

- Once completed and operational, the asset can be either retained by the project proponent for longer term returns, or sold for a return on equity invested.

3. Current Situation

Globally, there are only a small number of exemplar large-scale, commercially driven property development projects that include significant on-site renewable generation that was integrated into the master plan during the planning and design stage and then delivered in the built project[6]. In nearly all cases, the renewable energy assets were delivered in one of two ways.

- The most common is for the property developer to take full design and delivery responsibility for the embedded energy assets. In effect, the developer takes on the integrated design and engineering, regulatory, and project finance obligations. It is

[6] Photovoltaics in the Urban Environment: Lessons Learnt from Large-Scale Projects. Edited by Bruno Gaiddon, Kenk Kaan and Donna Munro. Earthscan, 2009.

willing to do so in support of a strategic aim to deliver a 'best-in-class' project, driven by strong sustainability convictions and by confidence that the investment will offer a positive return. Typically, the ownership and operation of the energy assets rests with the property owner (in the case of rooftop PV, whether that property owner is the occupier or landlord); and / or becomes part of a community asset base retained by the controlling property corporation (commonly for district energy networks, but this can include the rooftop systems in aggregate).

- Other projects, smaller in number, have progressed through energy cooperative or specialist investment fund models, where the equity partner is an investment vehicle made of up of small-scale investors seeking a long-term guaranteed rate of return on the property and energy asset. In these cases, the cooperative or specialist fund is created to suit the property project, rather than progressed by a pre-existing energy fund or development entity.

Lastly, some projects have been progressed through partnership with an incumbent energy utility that installs, owns and maintains the energy asset, or provides a level of subsidy (often alongside other public subsidy sources) to help defray initial upfront costs. These tend to be special programmes or demonstration projects on the part of the utility and other parties.

A sampling of exemplar developments:

Schlierberg Solar Settlement, Germany[7]
59 residential units
Developer-led, with specialist investment fund

One Brighton, England[8]
172 apartments (studio – 2BR)
Community-owned district energy heating system

Premier Gardens Community, California[9]
95 residential units
Utility-financed distributed PV

Nieuw Sloten, the Netherlands[10]
23 residential units
Utility-owned distributed PV system

[7] Rolf Disch Solar Architecture
[8] One Planet Communities / One Brighton
[9] Bira Energy
[10] PV Upscale

Though successful, these projects ultimately are suited to a small universe of property developers and / or specialist small-scale energy funds that have thus far limited their uptake. By and large, there are few, if any, commercial projects that have been delivered jointly through property and generalist energy asset developers working in concert. The challenge, then, remains to find energy project delivery pathways and partnerships that both incentivise and de-risk the opportunity to embed distributed renewables for a much larger cohort of property developers: those motivated by sustainability considerations but who remain cautious if executing such a strategy distracts from the core objective, which is extracting value from the property assets.

4. Opportunities and Challenges

There's inherit logic in concurrently developing large scale property projects alongside on-site energy assets which return their own value. As the above section makes clear, there are obvious similarities between the project development processes. Thus bringing these two sectors - property development and energy asset development - together in a formal or informal joint venture can create a situation where both parties strictly focus on the design, engineering and financing aspects in which they are expert. It minimises risk for both while maximising the possible returns.

The benefits of co-located and concurrently developed assets can be summarised as follows.

- Project developers for large scale master plans will be responsible for costs to extend or link to existing power lines tied to centralised grids. Separating and assigning the energy asset delivery to a different development partner can lessen the capital outlay typically borne by the property developer.
- Most property investors are not yet fully conversant with pricing and financing energy assets embedded within the property. If a project plan is put forward that embeds on-site generation as part of the overall property finance package, the risk weighting assigned to it may negatively alter the entire package. It's sensible, then, for the developer to drop the energy element in order to keep delivery of the core asset – the property – on track. Alternatively, bringing in a separate finance and development team for the energy component lessens the risk to the project's debt and equity investors on the property side, and allows the energy concept plan to be executed.
- Mixed-use developments that include many different building types and uses can create energy balance benefits for maximising on-site thermal and electric energy supply and storage options. This can lead to complete energy self-sufficiency in certain circumstances, obviating the need for grid connections. Irrespective of whether energy self-sufficiency is a goal or technically feasible, the proximity between generation and consumption is inherently efficient and propels energy awareness amongst consumers.
- Securing the consents required to deliver a large-scale property project represents a sunk cost of the project developer. The incremental time and effort required for energy asset regulatory permitting should only be a modest impost and can take advantage of the professional and technical skills already present. Thus the regulatory planning costs can be shared amongst the two developers.
- Photovoltaic *Balance of Systems* costs – the ancillary equipment beyond the PV panel plus the on-site installation costs – can be significant and may make some distributed

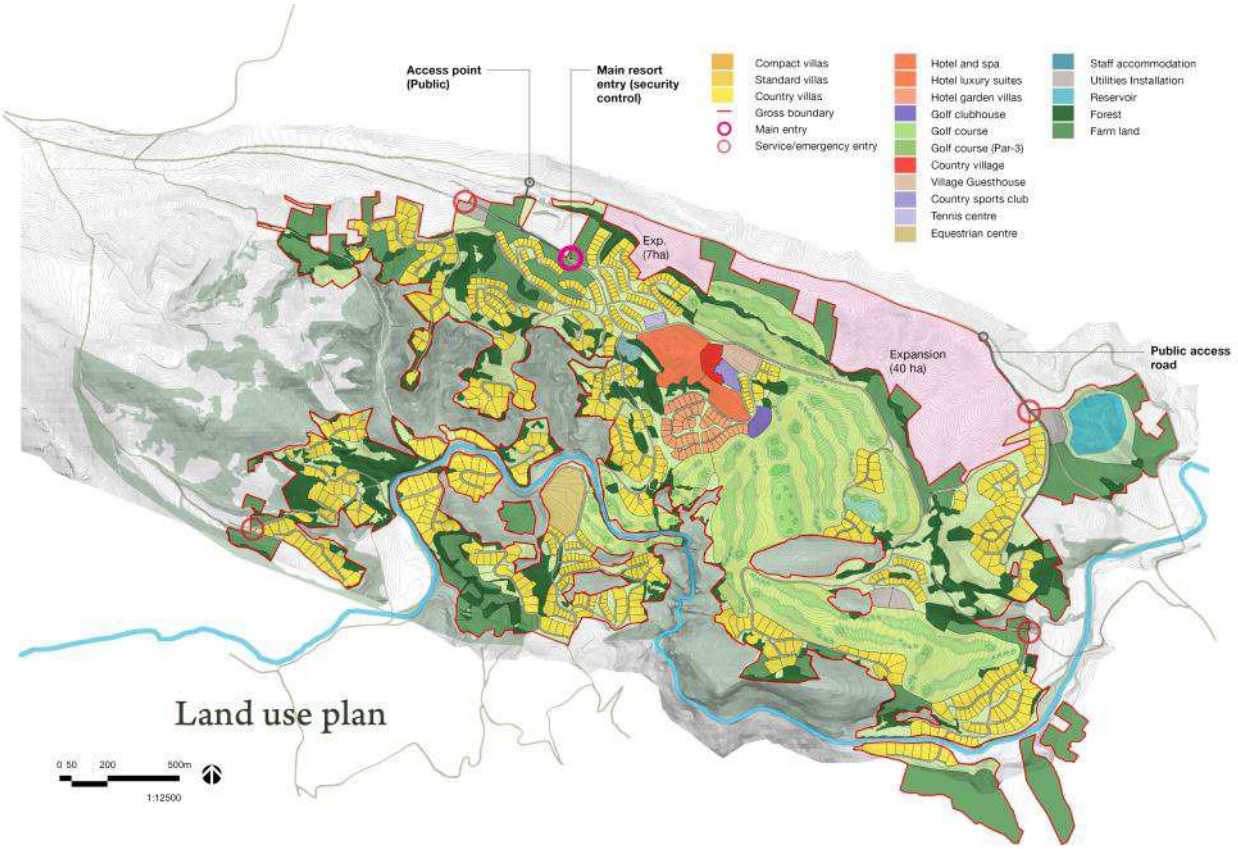
generation project uneconomical. But rolling out micro-generation across a large-scale project should create scalable balance of systems savings.

There are also challenges, however, to executing this model.

- There's likely to be a temporal and asset scale mismatch. A large property project that might yield several megawatts of energy demand and on-site energy generation potential may take anywhere from a few years to more than a decade to develop, and roll out in many stages. Yet a similarly sized renewable energy project developed on a site unencumbered by buildings would typically be executed in a far shorter timeframe. How to account for this multi-year timeframe when preparing energy project financing models creates complexity for an energy project developer that is typically absent from more conventional projects. Such complexities include: accounting for the variability of installation costs (fortunately, these are following a general downward trend with expectations of further drops); and an unfortunate degree of policy and / or regulatory uncertainty (as national policies such as FITs have proven subject to unforeseen and materially relevant changes).
- Similarly, most conventional renewable energy developers pursuing non-utility scale projects typically see tens of megawatts rather than a few megawatts as the best fit for their models.
- If the energy assets are financed and delivered by a specialist project partner, it will likely seek to maintain ownership of the assets. Thus, lease and covenant agreements between building owners that host the generation plant and the owner of the value stream, will be required. Executing such agreements amongst dozens or potentially hundreds of individual owners may create intolerably high transaction costs. These agreements could also be further complicated by the nature of the underlying mortgage that secures the property. The length of term may be considerably different than the life of the asset and / or term of the power purchase agreement. For example, many commercial properties have mortgage notes that are refinanced every three to five years, whereas the energy contact requires a 20- to 25-year certainty.
- Depending on the model executed, the energy generated on-site may need to be sold to the building occupants. Some property developers would see this is an unnecessary restriction placed on sales and marketing, and potentially a risk to purchasers should the power supply not prove robust. Linked to this is the fact that the energy developer may also require a pre-build commitment for a number of connections or installation points.
- In the case of roof PV panel systems, it is conceivable that the roof itself (not just the energy generation asset) could be severed from the property asset so that property buyers are purchasing the building minus the roof. Similar, then, to the above point is the view that this could be a hindrance, rather than a positive selling point, in the marketing of the property.
- Success will be highly dependent on local context. Factors will include the presence of feed-In tariffs (FITs) or other incentives, as well as a stable policy environment, grid interconnection and site planning regulations, availability of operations and maintenance support, grid energy prices, and asset / share investment and ownership laws.

5. An Indicative Master Plan

As a means to apply the conceptual elements of this paper, an actual property development proposal is offered as a reference. WATG are currently preparing a concept master plan for a 400-hectare site in mainland Greece. It is planned as a second-home and resort community centred round a golf course. The site is located within complex topography which means that significant portions of the land will be left in reserve. There are two areas of more intensive development – one a 'resort village' with a hotel, clubhouse and small commercial area; and one area where the bulk of the residential units will be situated. Smaller groupings of residential clusters will be spread as the site topography allows. In general, the development sits on the higher elevations of the site. Total built area is projected to be 175,000m^2, including 700 individual housing units.



Source: WATG

The master plan offers many advantages for on-site distributed renewable or low-carbon energy, principally photovoltaics and perhaps a small district combined heat and power (CHP) system. These include:

- Good solar insolation levels.
- A uniform low-rise building typology, with most structures nominally designed at two stories.
- A mix of uses, with steady demand for thermal energy in the hospitality segment of the development.

- The lack of energy infrastructure at the immediate site boundaries suggests that the development project faces inherent sunk costs in new distribution provision.
- The nature of the target market means that occupancy levels will be variable and rarely full-time. There's a good likelihood of a yearly energy surplus from on-site generation.
- The developer intends to keep a long-term interest in the project. The land supporting up to 75% of the built floor space may be retained under single ownership.
- The topography of the development area lends itself to ground-mounted photovoltaics in certain sections which are south-facing, not suited to buildings, and that would not be visible from the main built areas. These otherwise unusable areas can thus become value generators.
- Greece offers a renewable feed-in tariff, and a simplified regulatory / permitting regime for small systems. Tariff payments established in 2012 are guaranteed for 20 or 25 years, depending on the size of the system. Current payment rates are adjusted at 6-monthly basis and there are three system size bands that range from 0.172 to 0.239 €/kWh.[11]

As a guide, based on Polycrystalline PV modules (circa 15% efficiency), the figures below offer an indicative yield under optimal conditions if both the roof- and ground-mounted areas[12] were deployed for distributed renewable energy.

	Roof-mounted	**Ground-mounted**
Deployable area	35,000 m^2	50,000 m^2
MWp	5.3	7.5
MWh	7,350	10,500

Thus the total indicative yield for both areas would be **12.8 MWp** and **17,850 MWh**.

6. Development and Finance Models for Consideration

There is sufficient evidence on technology performance and energy yield to project long-term, guaranteed returns from the energy generation, supported largely through FIT-based power purchase agreements. And there are distributed renewable development and finance models in existence, some of which are described below and elements of which could be the basis for financing special purpose energy vehicles that are better suited to large, developer driven, equity and debt financed master plans.

- Energy co-operatives. These are legal entities that own and operate distributed energy assets. These are typically found in villages and towns where local residents purchase shares in an investment vehicle for the sole purpose of deploying renewables in that

[11] Hellenic Association of Photovoltaic Companies / Greek Ministry for Environment, Energy and Climate Change. (NB: current on-the-ground conditions are challenging for the renewable power sector due to the national government's financial situation. Presently, few if any projects are receiving FIT certification, and feed-in tariff rates have been cut from their recent peak. The feed-in tariff is sure to be revised again in the near to mid-term , and the investors lack certainty and the confidence needed to bring project forwards.)

[12] The figures assume approximately 35-40% of total available roof area, and 1.25% of the total land area of the development parcel, is suitable for PV.

local area. The share or investment offer may not necessarily be restricted to local residents, though they typically represent the majority (and in many cases the sole) investor bloc. The infrastructure deployed is more likely to be situated on communal land or existing public buildings than on private property, though this can surely be accommodated through lease terms with the owners. Co-operatives are generally in rural areas allowing for technology deployment spread across wind, solar, and bio-energy.

- Dedicated real estate investment funds. The Sonnenschiff in Vauban was financed through real estate investment funds which were geared toward small investors. Here, the fund invests in and holds the property which includes the rooftop photovoltaics. There is no ownership separation between the property and the energy asset; the return on investment is calculated both through property rental income and guaranteed feed-in tariff income.
- Individual system third-party ownership. In the United States, there are several companies that offer third-party financing to individual homeowners to install rooftop photovoltaics. With no upfront payment, the solar company provides the homeowner with a guaranteed electricity tariff for their energy consumption. In return, the solar company is granted roof rights for a fixed term, owns the panel, and keeps the income for the energy that is produced and sold to the grid. The solar company's upfront investment can be securitised, with the panel and income acting as collateral.
- Also in the United States, the concept of Solar REITs (Real Estate Investment Trusts) is being considered. These would be funds that invest in distributed energy assets and generate returns based on the income from the power generation, with investors buying and selling Trust shares as they would company stock.

To execute a strategy within a large-scale development project where the property and energy assets are severed for separate due diligence, financing and ownership will require a level of upfront effort and innovation on the part of both parties. The master plan described above offers a scale that ought to interest an energy developer, though the phasing would remain a challenge. But there a range of benefits – the long-term ownership interest, assumed feed-in tariff, property mix and occupancy profile – that suggests a realisable return on investment can be secured. As there are few if any existing models to go by, some investment and delivery concepts which borrow from those already described are offered below.

One can anticipate a special purpose vehicle where both parties – energy and property developers – take an equity stake to move the project toward finance-ready. If the project were to follow more of a private equity model supported by conventional debt finance, delivering the ground-mounted generation on land that is surplus to the proposed built area should be prioritised. This would offer both a more immediate income stream and an effective break point where the property investor could release its equity stake. Within the overall project timeframe, this point is still at early construction stages, so the quick exit and return can serve as an appropriate incentive for the property lead. Further construction finance tranches can be structured to mirror the larger finance packages for the property construction, and released on shared milestones. Asset ownership will more likely remain with the energy project developer, so the ability to secure lease agreements is an important consideration.

Another option, which is perhaps more labour-intensive but locally-rooted, is establishing a local energy cooperative / community benefit corporation to act as financier / owner / operator of the energy asset. Seed equity from the property developer would similarly improve the chances for success, supported by other small local (preferably) or non-local investors. The

value in such a model is the potential lower upfront capitalisation required and an ability to attract finance from small investors coordinated with the pace of the property build-out. As properties are constructed and sold, investor shares can be offered to owners who wish to take ownership of the building-integrated energy via participation in the investment vehicle. While the asset is not owned outright by the property buyers, they become shareholders in an enterprise in which they are centrally connected. They also secure a steady return on investment as per the fund structure (nominally 5-7% per annum).

7. Conclusion

The regulatory mandates that will be filtering through the European property sector over the next decade will make a necessity of effective finance and deployment of on-site renewables – irrespective of the future proofing advantages that local energy generation confers. A financial and delivery partnership approach between property and energy asset developers can reduce risks and broaden opportunities to both parties where substantial crossover is presently lacking.

Fortunately, there appear to be ample sources of ‘green’ finance available through socially-conscious long-term investors such as pension funds; from investor and fund management firms with experience in financing energy efficiency; and individual investors of various sizes. Similarly, a class of property developers who are sympathetic to the aims of a lesser environmental footprint and renewable supply perhaps only need the right partner and modest modifications to their typical project execution strategy to find the risks have been effectively managed. There will not be a one-size-fits-all approach, as individual project circumstances and the local context will vary. But projects that become the first movers can surely help to create replicable models to the benefit of both industries.