

Strategic investments in off-grid energy access

Scaling the utility of the future for the last mile

Wood Mackenzie Power & Renewables in partnership with



| 28 February 2019



About Wood Mackenzie

We provide commercial insight and access to our experts leveraging our integrated proprietary metals, energy and renewables research platform

Wood Mackenzie is ideally positioned to support consumers, producers and financiers of the new energy economy.

- Acquisition of MAKE and Greentech Media (GTM)
- Leaders in renewables, EV demand and grid-connected storage
- Over 500 sector-dedicated analysts and consultants globally, including 75 specifically to power and renewables
- Located close to clients and industry contacts



 Wood Mackenzie offices

 Wood Mackenzie Power & Renewables offices

About our Partners

Collaborating to provide a lens into off-grid energy access markets



Verisk

Energy 4 Impact is a UK-registered non-profit organization which seeks to reduce poverty through accelerated access to energy, providing technical, commercial and financing advice to off-grid energy businesses in Sub Saharan Africa, including solar home system companies and mini-grids. Energy 4 Impact also provide support on the ground to these businesses in the form of pilots for new technologies and business models and mentorship services for micro-enterprises. Supported by a small head office in London, most of Energy 4 Impact's staff are based out of our offices in Kenya, Tanzania, Rwanda and Senegal. Energy 4 Impact has operated in Africa for the past 12 years and delivers results. The NGO's efforts have supported the growth of 4700 businesses, resulting in 17 million people gaining better access to energy, 10,000 jobs, and 12.8 million tonnes of CO2 being abated. The capital raised by those businesses with our support has amounted to \$135 million. For more information about Energy 4 Impact, please refer to our website www.energy4impact.org.

In 2016, the Verisk Corporate Gifts Program made a two-year commitment in support of Energy 4 Impact's efforts to provide access to sustainable energy in developing countries. In addition, professionals from Wood Mackenzie are collaborating with Energy 4 Impact to share expertise and data in support of Energy 4 Impact's initiatives. This report is the result of the first phase of collaboration. Verisk is the parent company of Wood Mackenzie, Ltd.



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1. Executive summary

Energy access represents a massive market opportunity in the energy transition

The value proposition of clean and reliable energy access as a gateway to the next billion is crystallizing

Macro trends driving off-grid energy markets:

Demographic shifts

600 million people are expected to gain access to electricity by 2030, but population growth will limit progress toward universal access. At the current trajectory, population growth is set to outpace new connections before 2040, such that **95 percent** of the remaining global unelectrified population will be in Sub-Saharan Africa¹.

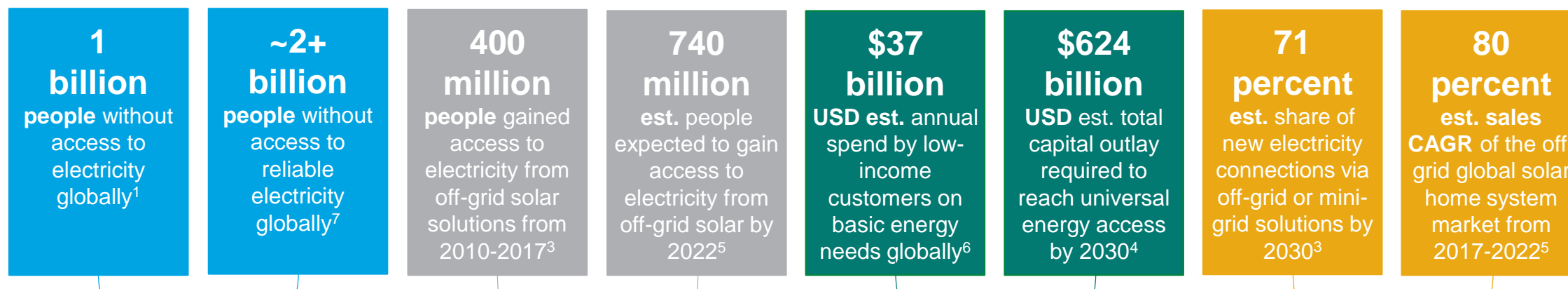
Electricity demand growth

To provide universal electricity access at global average per capita annual electricity consumption (3,104 kWh/year), global electricity consumption (and thus generation) would need to increase by **18 percent**. Access at the per capita level of Germany (7,019 kWh/year) would increase global electricity consumption by **40 percent**².

Investment gap

Recent estimates suggest that the total financing needed to reach universal electricity access globally by 2030 is at least **\$52 billion USD per year**³. Less than half of the total has been committed, and just over half of the annual run rate has been committed to date, only **1.3 percent** of which is focused on off-grid solutions.

Framing the market potential for distributed clean energy at the base of the pyramid

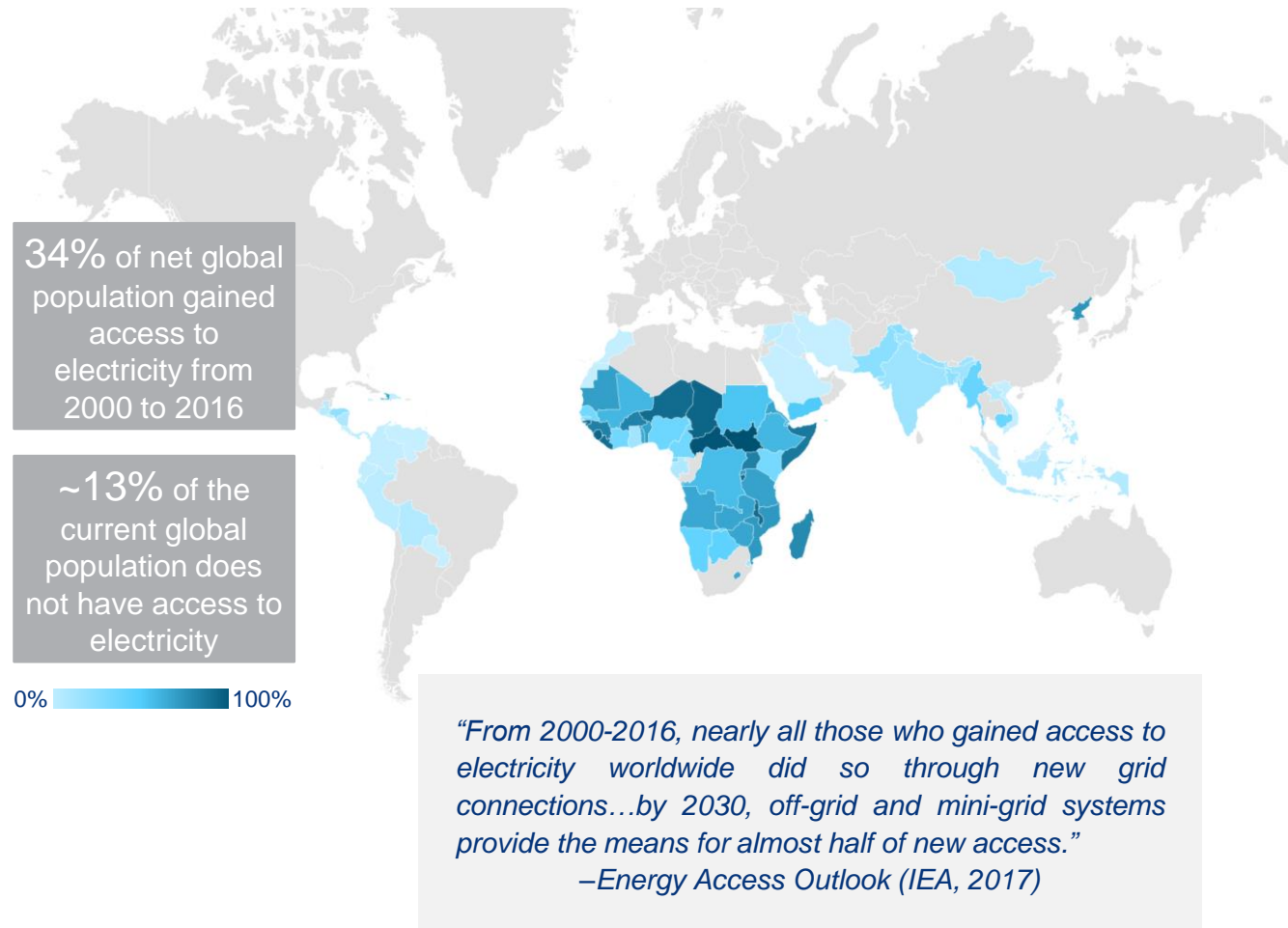


Sources: ¹ World Energy Outlook (IEA, 2018); ² The Transformations of Power (Wood Mackenzie, 2017); ³ Energy Access Outlook (IEA, 2017); ⁴ Energizing Finance: Understanding the Landscape (SE4ALL, 2018); ⁵ Off-Grid Solar Market Trends Report (Dalberg Advisors and Lighting Global, 2018); ⁶ Scaling Up Energy Access through Cross-sector Partnerships (PWC, 2013); ⁷ Energy Poverty Factbook (AT Kearney, 2018)

Decentralized off-grid clean energy markets are nascent, fragmented, and taking off

Momentum from the transformative trends of decarbonization and decentralization accelerate off-grid markets

Share of population without access to electricity (%)



- As one of the four Transformations of Power Wood Mackenzie Power & Renewables has identified in the changing global energy landscape, the market opportunity to provide access to reliable electricity is a pivotal and quickly emerging part of the energy transition in emerging markets.
- The pace and manner in which energy access is provided to more of the population will have a dramatic impact on power demand, grid extension and modernization investments, the siting of new generation sources and future carbon emissions reduction pathways.
- In many ways, the decentralized technologies and business models being deployed at the last mile are on the cutting edge of low-cost solar technology, IoT, advanced metering and remote demand-side management, micro-grids, and other trends shaping developed electricity markets.
- Recently, this rapidly emerging sector has seen accelerating investment and participation from global energy players taking steps towards becoming customer-centric virtual utilities, or looking to capitalize on new B2B opportunities in fast-growing emerging economies.



Ringfencing the energy access ecosystem

Pico PV / Solar home systems (SHS)	Nano-Grids, mesh-grids, solar containers, kiosks, and DC mini-grids	Mini-grids and rural utilities / DESCOs	Traditional utility grid connections
<p>Residential energy solutions for off-grid households</p> <p>Typical system capacity: 5-250 W_{dc}</p> <p>Business Model: Cash or PAYG basis</p> <p>Average connection cost: ~\$80-550 USD (20-yr net present cost with replacement), though costs can be much higher with bundled appliances and add-ons</p>	<p>Any product ranging from a connected network of DC SHS systems to more centralized community or village-scale solutions</p> <p>Typical system capacity: 25-500 kW_{dc}</p> <p>Business Model: Power unit sales, PAYG</p> <p>Average connection cost: Vary significantly by solution</p>	<p>Remote grids designed to provide electricity connections to new residential & small commercial customers not connected to the grid</p> <p>Typical system capacity: 500 kW_{dc} to 5 MW_{dc}+</p> <p>Business Model: Rural utility with household and small commercial oftakers</p> <p>Average connection cost: \$500-\$2000 USD</p>	<p>Grid-scale power connections</p> <p>Typical system capacity: N/A</p> <p>Business Model: Traditional utility-customer billing on a unit basis</p> <p>Average connection cost: \$500-2200 (unsubsidized)</p>

Notes on data processing methodology and definitions

- We define the pay-as-you-go (PAYG) business model as one that allows end-users to finance their systems through a lease-to-own model, with a down payment and regular payments towards the balance of the loan. This model is predominantly used for SHS and pico PV systems, but is expanding in use.
- We distinguish “public” investments as those being sourced from governmental or multilateral sources (public sector), rather than those from publicly-traded companies. Likewise, private investment is from private sector sources, rather than non-public companies.
- Because some consortia deal announcements do not publish individual contributions from the group of investors that participated in the deal, we tally top investors in two ways: 1) Top investors by the sum of deal totals in which an investor participated and 2) Top investors by the sum of individual investment (where disclosed)



Customer value in the ‘next billion’ is increasingly attractive to strategic investors

They’ve participated in **\$875M+** in direct and indirect investments & formed **31** JVs & commercial partnerships

The energy access challenge is also an opportunity, and electrons are just the beginning of a journey up the energy ladder.”

–Shell New Energies

Africa is a laboratory in terms of what you can do with the end customer.”

–ENGIE

“We absolutely recognize the huge market opportunity at the base of the pyramid, and we want to be prepared for that.”

–EDP Renováveis

“Orange wants to be much more than a telecom operator in Africa. It wants to be a provider of essential services to the people...[towards] development of solutions that allow as many people as possible to access everyday essentials such as sustainable energy.”

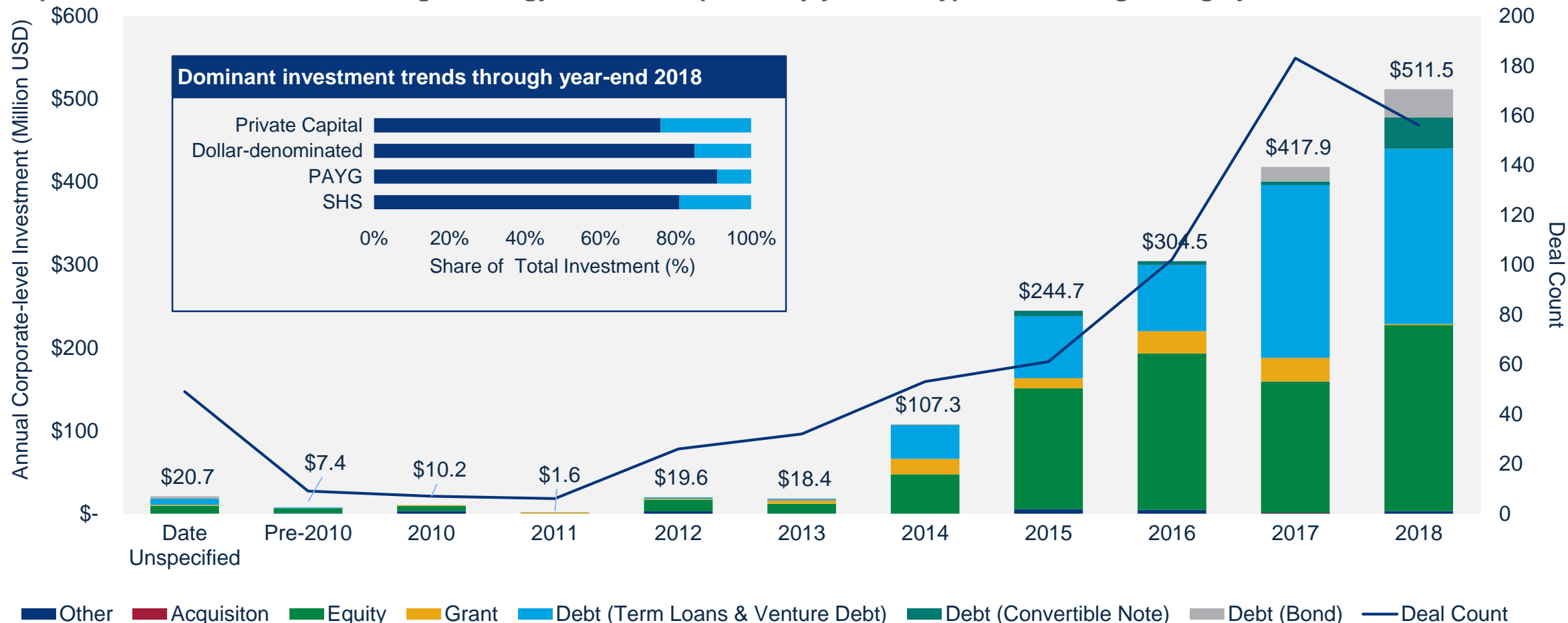
–Orange

- New top-down actors are investing in off-grid energy access markets. These **strategic investors** (**‘strategics’**) are primarily European oil and gas majors, utilities and IPPs, global OEMs, as well as market leaders from the tech, telecom, and fast-moving consumer goods sectors. Naturally, the strategic investors’ avenue to market align with their interests in engaging off-grid consumers.
- Many of these engagements were incubated within corporate social responsibility (CSR) investing and granting, but have in nearly every case, moved to venture investing, exploratory strategic partnerships, or core commercial groups.
- Particularly for utility-minded strategics (utilities, IPPs, and majors increasingly investing in the power sector), there is strong interest in evolving the utility business model beyond electricity service provision. Off-grid customers without an existing grid connection make an excellent controlled experiment in understanding how to layer other services on top of an existing customer relationship.
- Wood Mackenzie Power & Renewables, with the support of our partners at Energy 4 Impact, tracked and analyzed corporate-level investment activity into the off-grid energy access sector, and conducted **38 stakeholder interviews** with key players in the space to illuminate trends indicative of this nascent market’s future.

A banner year for energy access investments, 2018 saw deployments crack \$500M+

Off-grid energy access companies have absorbed just shy of \$1.7 billion in disclosed investments

Corporate-level investment into off-grid energy access companies by year and type of financing through year-end 2018



Source: Wood Mackenzie Power & Renewables, Energy 4 Impact

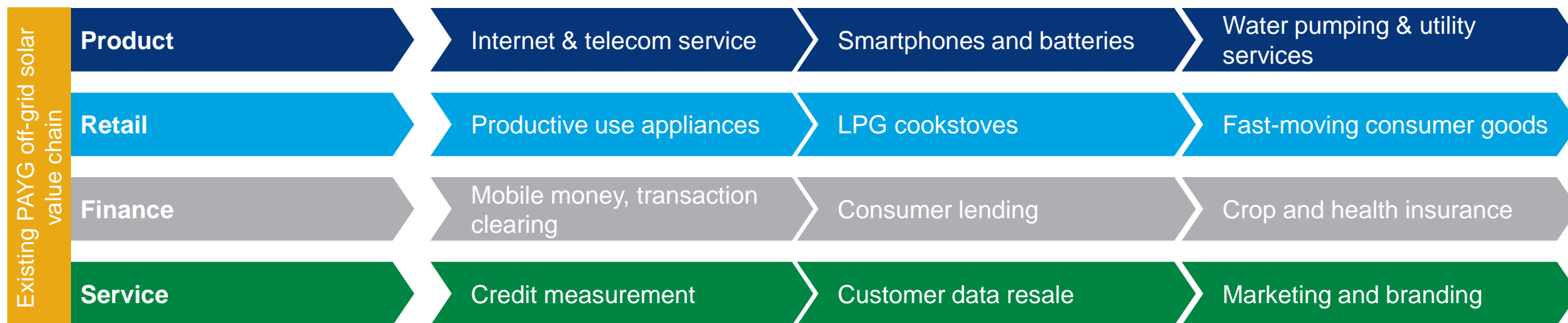
Wood Mackenzie Power & Renewables global solar and grid edge clients: we have built a live updated, interactive data dashboard allowing you to manipulate the proprietary investment database behind the key findings in this report. It can be accessed via the Power & Renewables client portal.

Customer-focused rural utilities are again redefining the utility business model

Value-stacking adjacent customer services will allow rural service providers to go beyond electricity

- As the value proposition of clean and reliable energy access as a gateway to the next billion consumers crystallizes, commercial interests in off-grid markets extend beyond providing basic electricity connections. Particularly for utility-minded strategic investors, there is strong interest in evolving the utility business model beyond electricity service provision. Leading distributed energy service companies and their strategic partners are experimenting with ‘value-stacking’ add-on services like internet, water, productive appliances, financial products and services, and other retail goods. Concurrently, as the PAYG sector’s value chain increasingly unbundles, sector leaders are testing the depths of customer value through value-adding adjacent services across their existing value chains like internet, cookstoves, insurance, and credit measurement.
- Ultimately, as off-grid energy service providers look to enter the next phase of growth, they will increasingly need to look towards strategic M&A in order to both scale past the low-hanging fruit in the addressable market and deepen customer value through value-stacking adjacent services on top of basic electricity connections.

“Going Deep”: Value-stacking on top of basic electricity connections



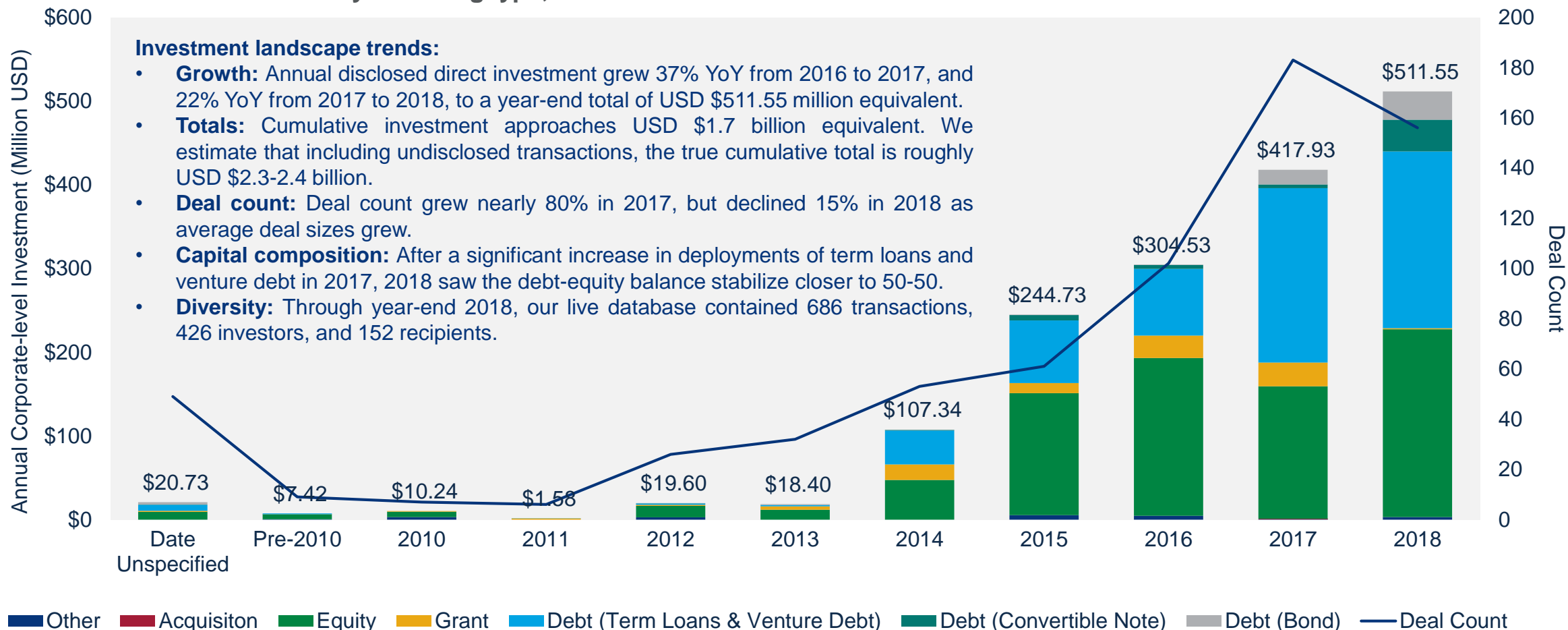
Source: Wood Mackenzie Power & Renewables

2. The corporate-level off-grid energy access investment landscape

2018 was a banner year for energy access investing, crossing the \$500M+ mark

Energy access markets have absorbed just under \$1.7 billion in **disclosed** energy access investments

Annual disclosed investment by financing type, 2010-2018

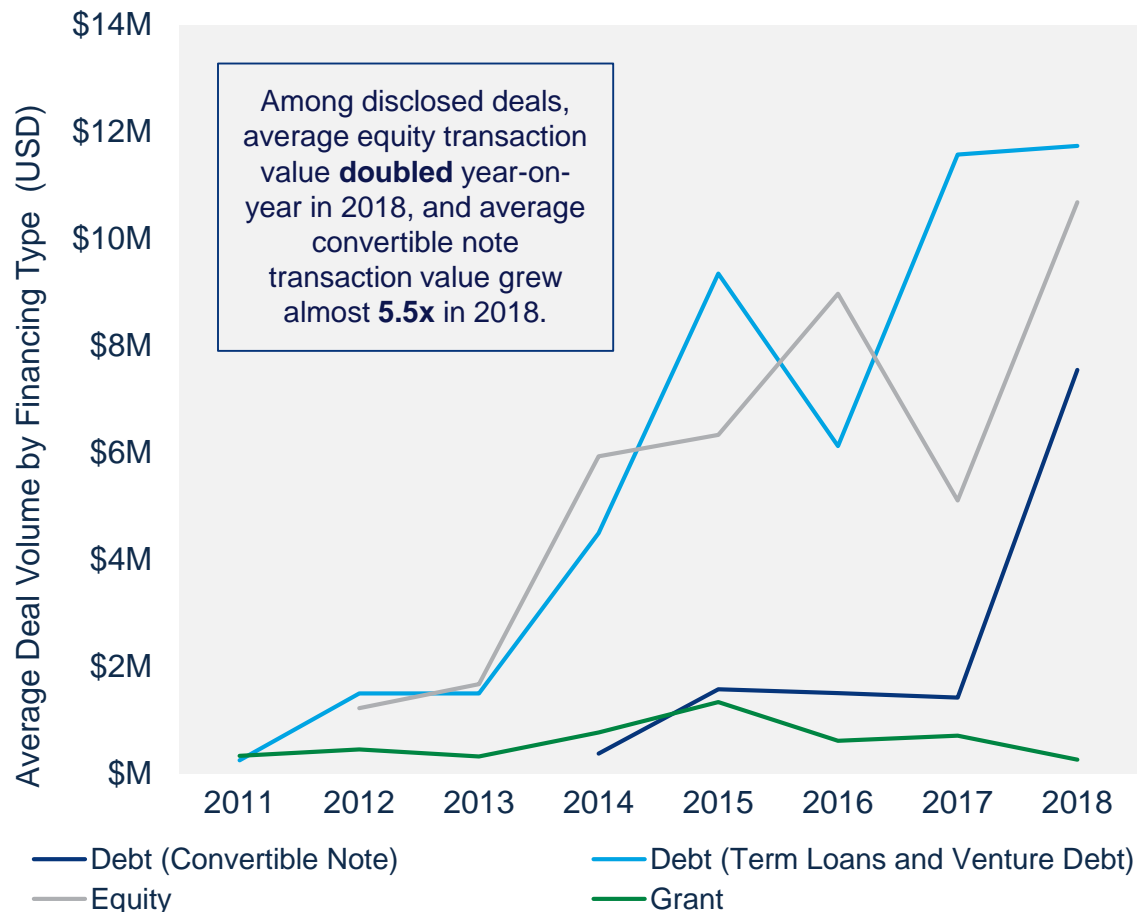


Source: [Wood Mackenzie Power & Renewables Global Off-Grid Renewables Investment Datahub](#)

Big ticket deals are picking up, but remain concentrated with already-scaled players

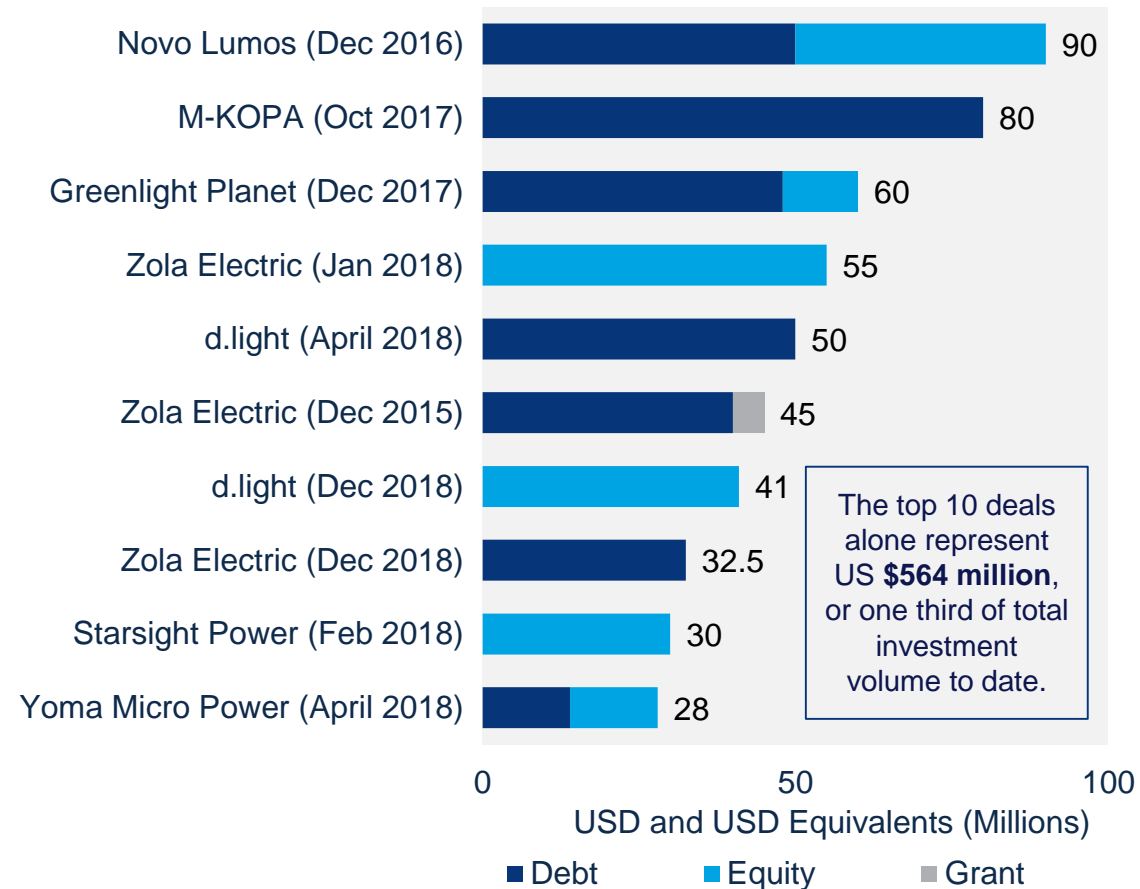
Mean deal values have shot up as the sector scales and demonstrates its creditworthiness

Average disclosed transaction value by financing type (USD or USD equivalent)



Source: [Wood Mackenzie Power & Renewables Global Off-Grid Renewables Investment Datahub](#)

Top 10 off-grid energy access investments by transaction value through year-end 2018



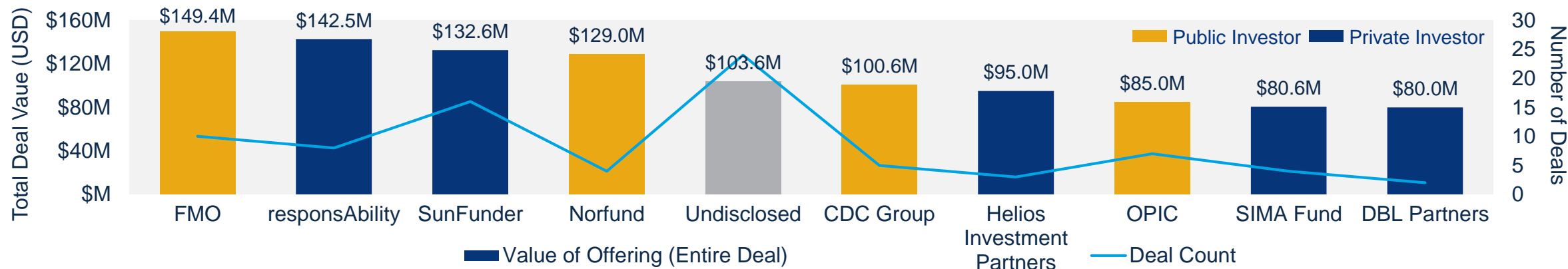
Source: [Wood Mackenzie Power & Renewables Global Off-Grid Renewables Investment Datahub](#)



The sector's top investors are mostly specialized public and private funds

Is public sector capital crowding in private investment—or crowding it out?

Top 10 Investors by Total Deal Value (by sum of deal totals in which the investor participated), 2010-2018



Source: [Wood Mackenzie Power & Renewables Global Off-Grid Renewables Investment Datahub](#)

Catalytic capital from public sources is attracting more private money into the sector, but comes with risk for commercial debt

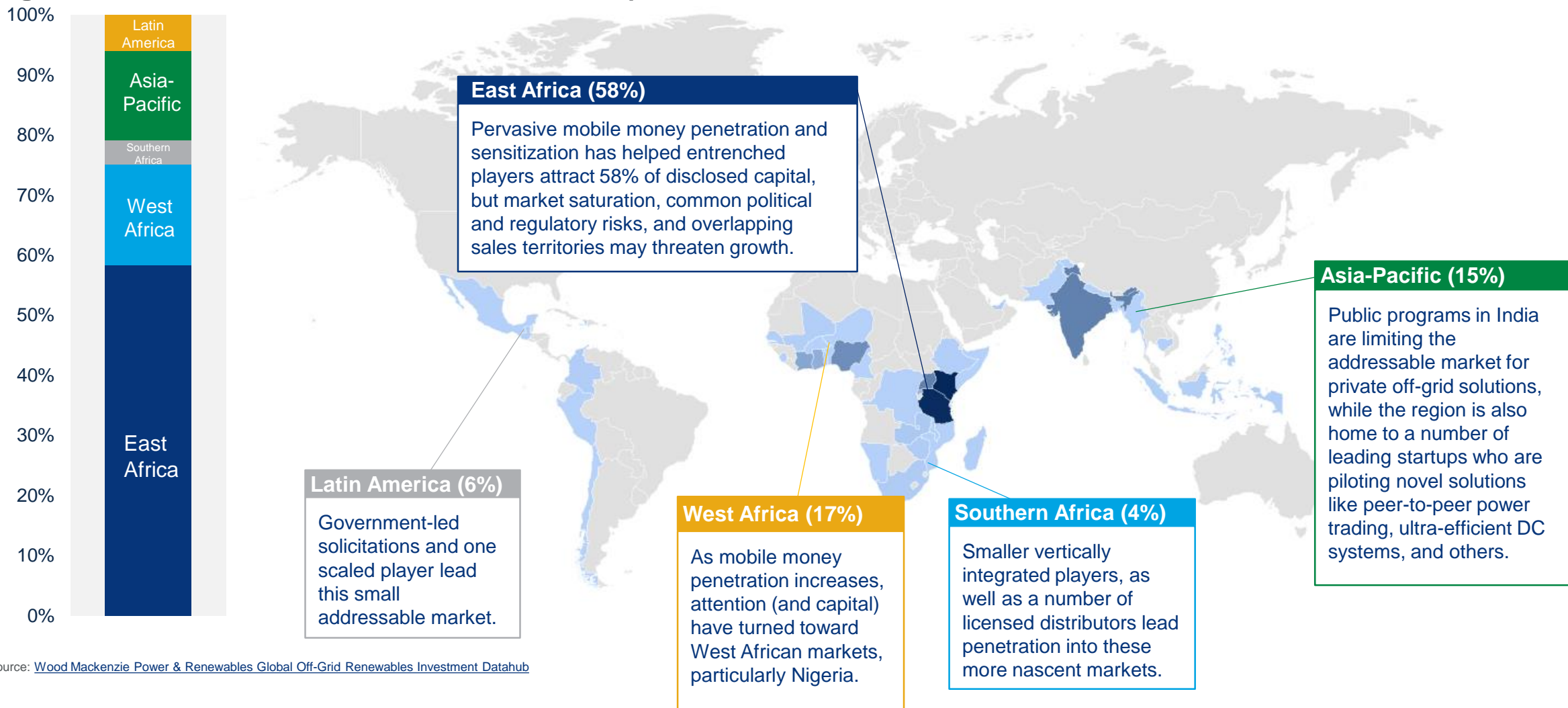
- The energy access investment landscape is dominated by private capital, but the sector's top dealmakers are still a mix of public and private investors, mostly leveraging specialized or dedicated funds focused on the energy access space. FMO takes the top spot as the largest investor by total deal value, with Norfund, CDC Group, and OPIC (under its current structure) also cracking the top 10. Among private sector investors, specialty equity investors lead the pack, with SunFunder being a notable exception as a debt provider to the energy access sector.
- The top 10 investors by total deal value (meaning the sum of deal totals in which the investor participated, given that many deals are made in consortia) have participated in transactions worth just shy of **US \$1.1 billion** equivalent, or **two-thirds** of total global investment into energy access markets.
- The ranks of top investors suggests that public and private deployments will increasingly intersect. In blended finance arrangements, early-stage capital, mainly patient and concessionary finance and grants from the public and donor sectors, de-risk deals and crowd-in private sector investors. However, concessional capital also may crowd out commercial debt. Competition for blended finance is still steep, and the sector needs ~\$1 billion of early-stage capital to scale further*.
- Thus far, most strategic investors are looking to buy small (~20%) equity stakes in players with growth potential and learning opportunities, not invest at this scale.

*Source: [Early-Stage Blended Finance for Universal Energy Access in Africa \(Catalyst and Shell Foundation, 2018\)](#)

Geographic concentration: 58% of disclosed investment has flowed to East Africa

Mobile money penetration is a key driver of capital flows, but regional concentration may not be capital efficient

Regional shares of total disclosed investment, USD equivalent 2010-2018

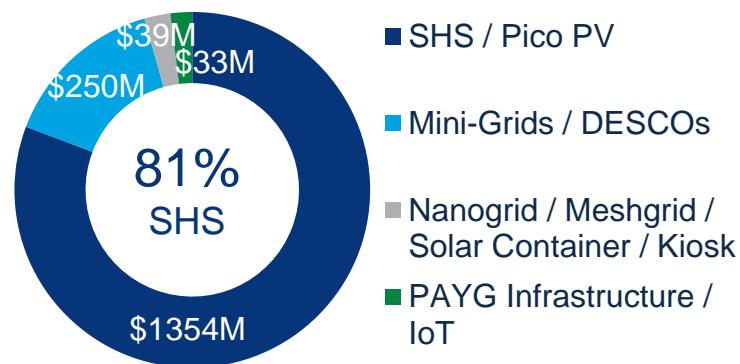


Source: [Wood Mackenzie Power & Renewables Global Off-Grid Renewables Investment Datahub](#)

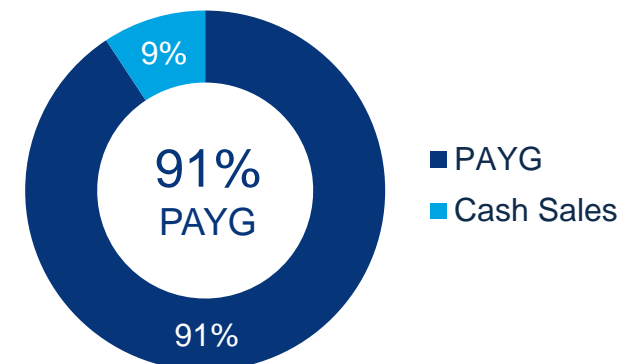
Dominant trends emerge in the corporate-level energy access investment landscape

Solar Home Systems, PAYG business models, private capital, and dollar-denominated deals are clear leaders

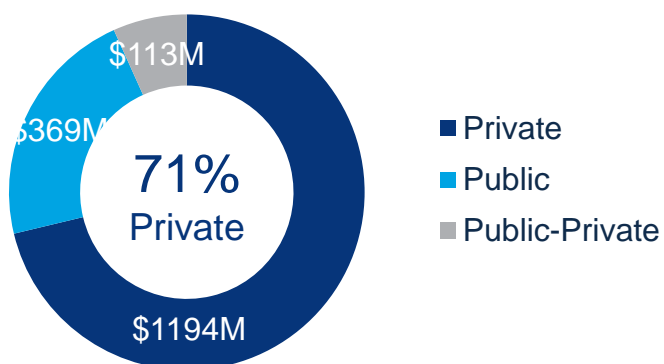
Solar Home Systems (SHS) and pico PV products dominate



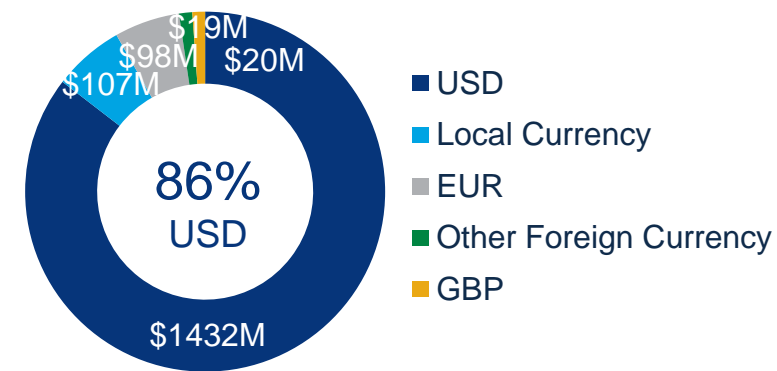
The PAYG business model is a clear winner over cash sales



Energy access finance is 71% sourced from private capital markets



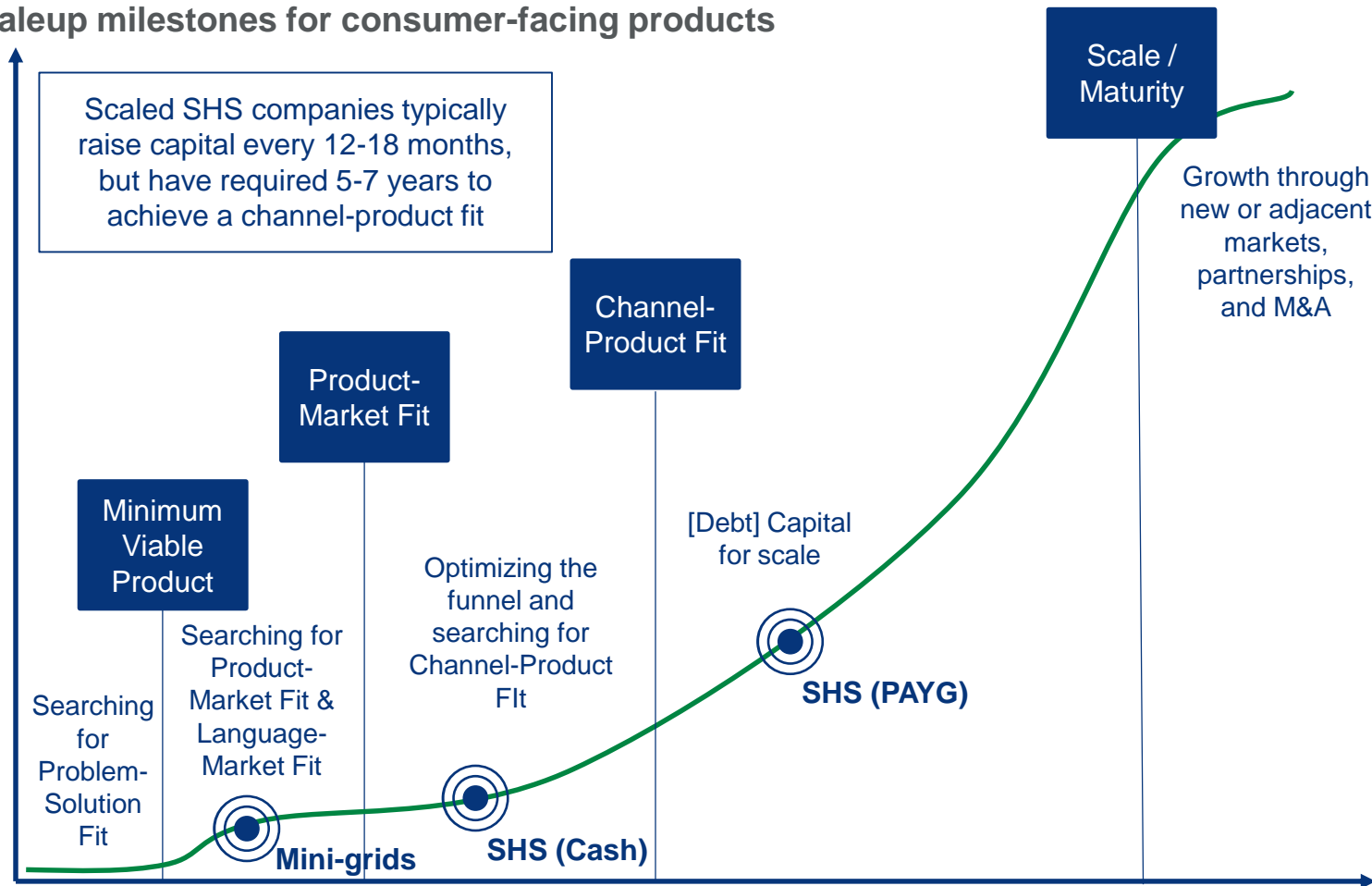
86% of investments are dollar-denominated, but local currency deals are on the rise



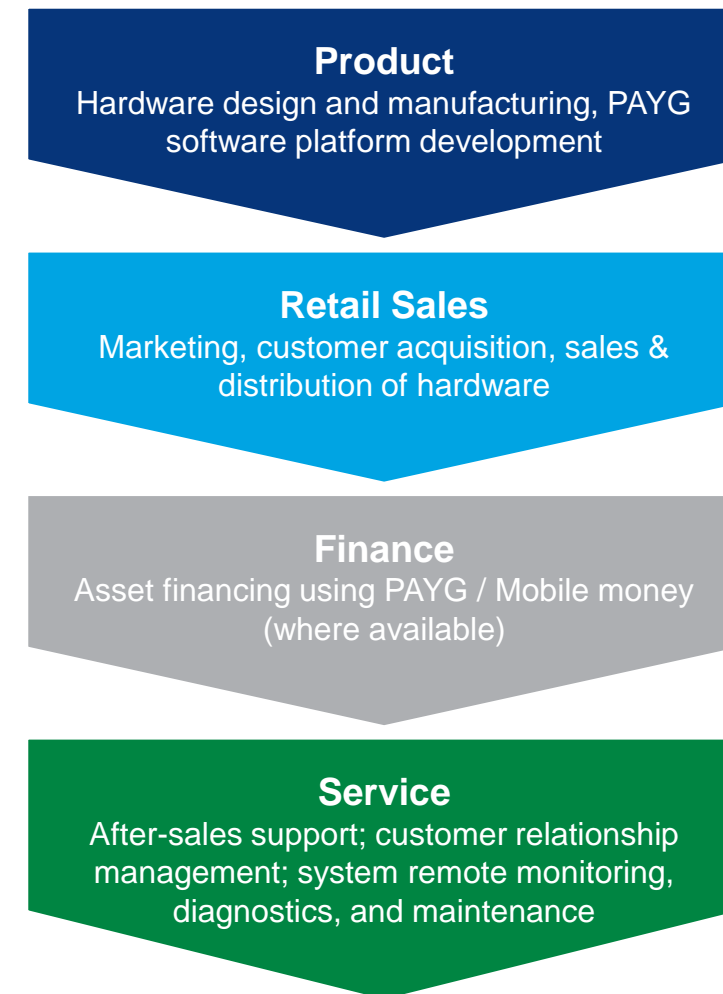
Capital concentration by product segment is an accurate representation of maturity

PAYG SHS passed the channel-product fit milestone, and raised its first wave of debt capital for scale

Scaleup milestones for consumer-facing products



The PAYG SHS Value Chain

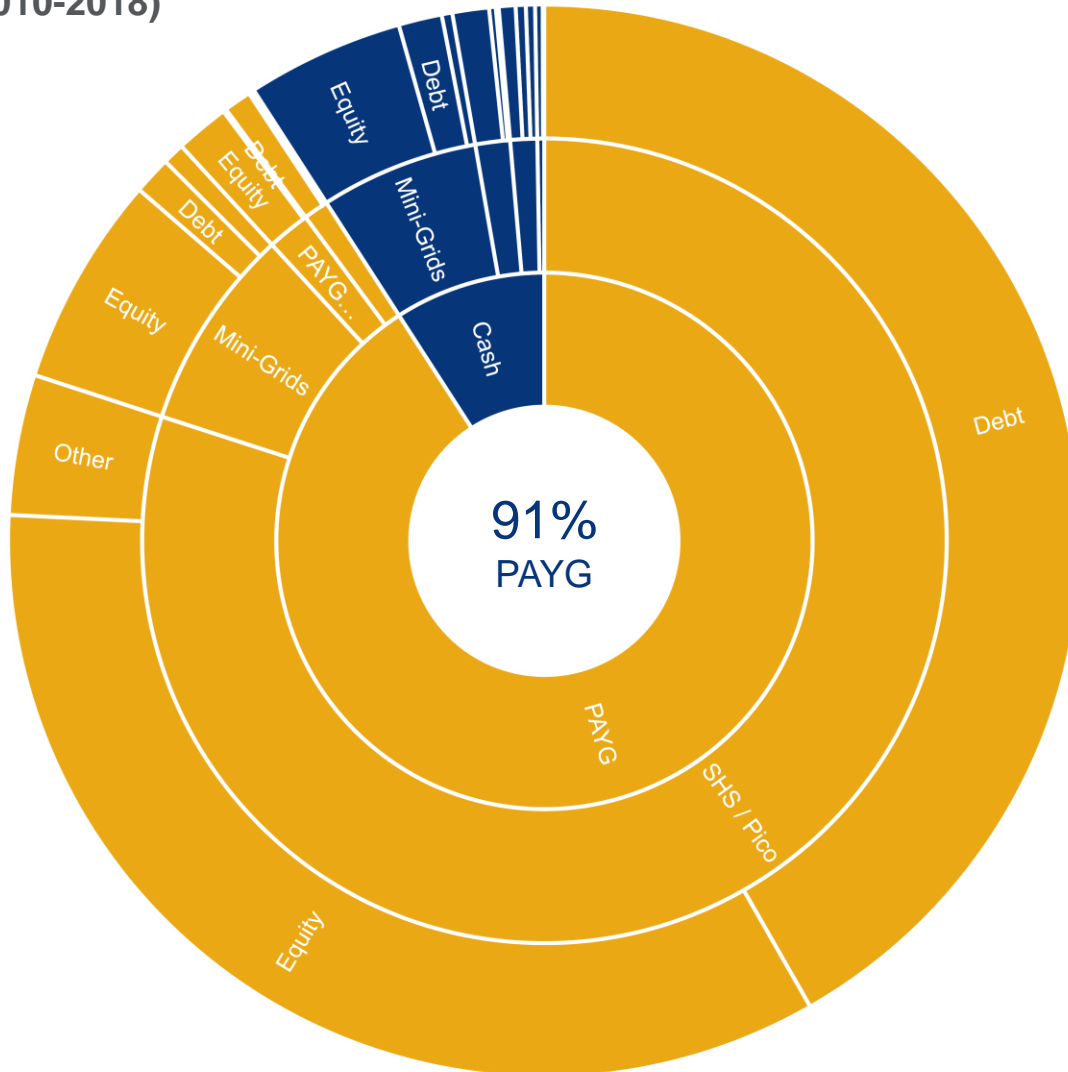


Source: adapted from Phases of the Startup Lifecycle by Morgan Brown



Why do PAYG business models dominate the investment landscape?

Investment breakdown by business model, technology, and type (2010-2018)



Quirks of the PAYG business model: are they features, or bugs?

- Enabled by mobile money and GSM coverage, the pay-as-you-go (PAYG) solar business model allows end-customers to finance their small-scale systems through a lease-to-own model, making them more affordable, with the PAYG company typically holding that consumer debt on its own balance sheet.
- The PAYG business typically has higher gross margins (product margin + financing margin) than cash sales (product margin only), but is much more complicated and requires much higher operating costs.
- Because they are extending consumer credit without accepting deposits like a commercial bank, in the short term, they also require regular injections of working capital to cover their receivables for the tenors of the customers' loans (typically 18-30 months), requiring regular raises from capital markets. This is part of the reason that availability of competitively priced debt can be such a bottleneck in financing energy access. Recently, leading PAYG players have been going to crowdfunding markets to cover short-term, targeted working capital needs without needing to navigate the investor landscape or go to more strategically-minded investors.
- PAYG is also more financeable, as prepaid platforms can collect and monetize customer data, independently assess credit risk, and cultivate long-term customer relationships that can be leveraged in other sectors.
- This hybrid role that PAYG business play makes them part manufacturer, part energy service company, part product retailer, part financial institution, each of which must be assessed differently*.

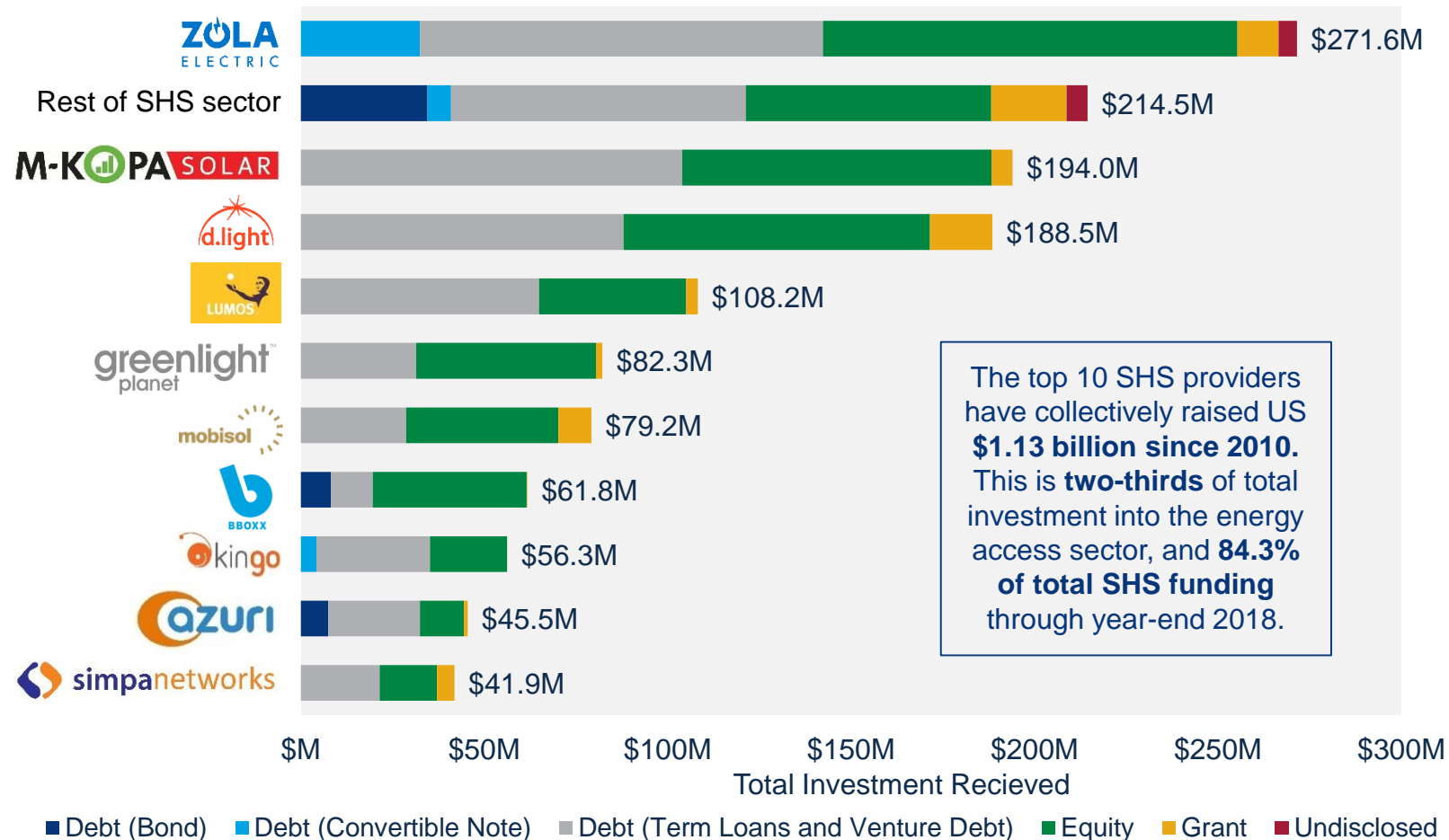
*Strange Beasts: Making Sense of PAYGo Solar Business Models (CGAP, 2018)



The top 10 SHS market leaders have raised \$1.1B+ since 2010, over 50% of it debt

The SHS segment is top heavy, with very dense capital concentration in the most scaled players

Top 10 SHS recipients by disclosed financing type, cumulative to year-end 2018



Spotlight: SHS market factsheet

- **Market segment:** Household retail and financial product
- **Estimated household connections globally by 2030:** 194 million*
- **Primary capital needs:** 2-3 year commercially-priced debt for working capital
- **Financing barriers:** investor confidence, high repossession costs in asset finance models, unrealistic valuations and return expectations (in some cases), elusive profitability, small shares of local currency lending
- **Regulatory barriers:** VATs and unclear import tariff application impact operations planning and raise barriers to entry for price-elastic customers
- **Top Investment Risks:** Severe regional and corporate concentration of capital; disparate repayment risk; high cost of repossession, hard to quantify true commercially addressable market

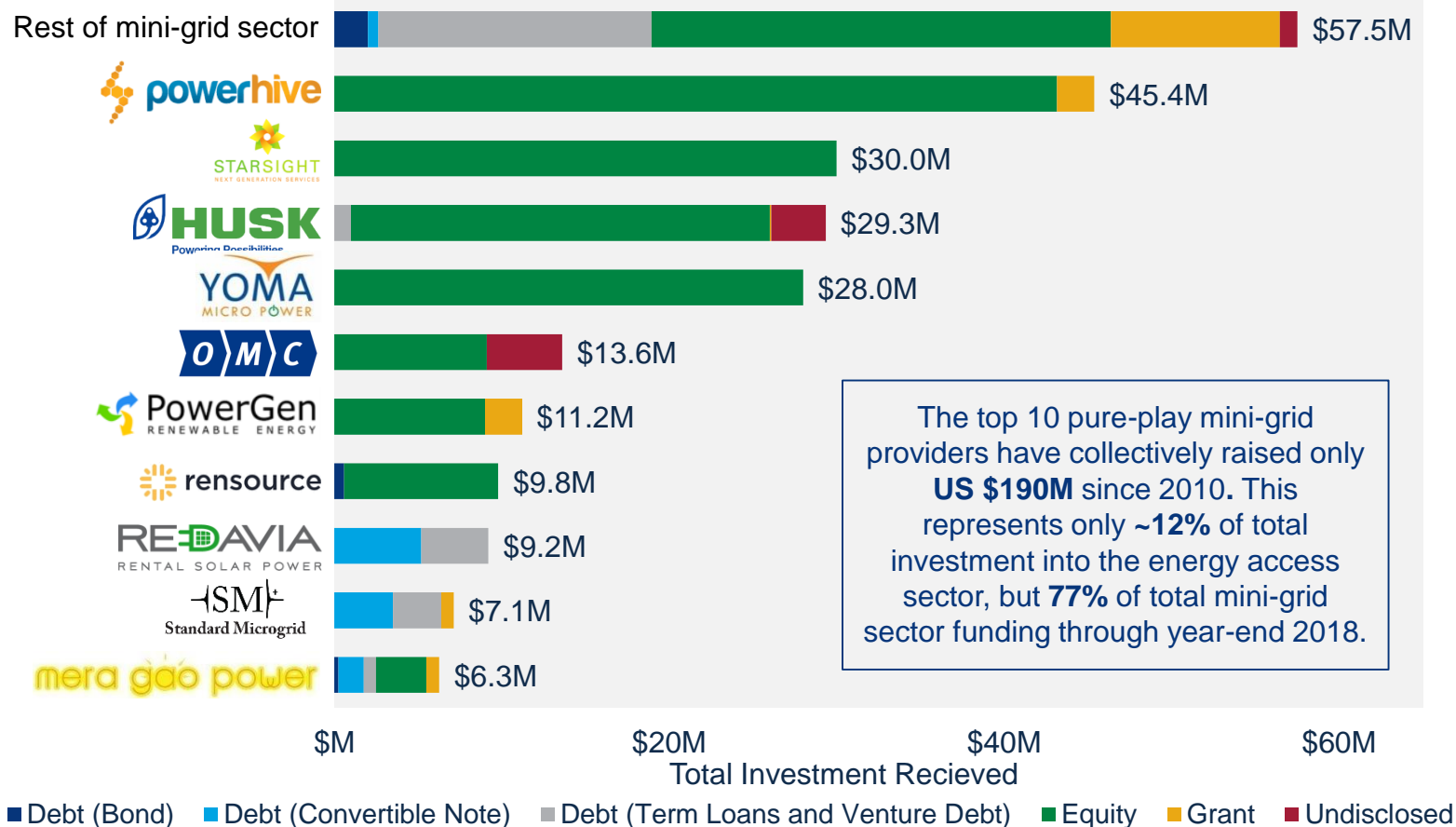
Source: Wood Mackenzie Power & Renewables Global Off-Grid Renewables Investment Datahub

Source: * Energy Access Outlook (IEA, 2017)

The top 10 pure-play mini-grid developers have raised \$190M, 83% of it equity

The commercial infrastructure debt gap keeps developer capital tied up in projects with long payback horizons

Top 10 Pure-Play Mini-grid recipients by financing type, cumulative to year-end 2018



The top 10 pure-play mini-grid providers have collectively raised only **US \$190M** since 2010. This represents only ~12% of total investment into the energy access sector, but 77% of total mini-grid sector funding through year-end 2018.

Spotlight: Mini-grid market factsheet

- **Market segment:** Private grid infrastructure projects
- **Estimated household connections globally by 2030:** 292 million*
- **Primary capital needs:** 10-15 year infrastructure debt
- **Financing barriers:** Lack of access to infrastructure-priced, patient debt; project viability gap still grant-supported in many markets
- **Regulatory barriers:** Most markets don't have bankable mini-grid policy at all, red tape in licensing and registration, restricted tariff levels to match (often subsidized) grid tariffs, weak stranded asset provisions
- **Top investment risks:** Concentrated project repayment risks; thin power demand and willingness to pay without productive use applications; customer affordability, hard to benefit from economies of scale; site-specific considerations.

Source: [Wood Mackenzie Power & Renewables Global Off-Grid Renewables Investment Databook](#).

Note: This chart excludes companies that develop mini-grids alongside grid-tied solutions or for diesel displacement rather than new connections, focusing on pure-play energy access mini-grid companies; here Enerwhere, Cygni Energy, and Kalangala Renewable Energy were excluded.

Source: * [Energy Access Outlook \(IEA, 2017\)](#)



Findings: Energy access investment landscape trends

The energy access investment landscape increasingly shows signs of maturation:

- Investment is accelerating in the energy access sector. Nearly **USD \$1.7 billion** in disclosed investment has been deployed into energy access markets through the end of 2018, over \$1.2 billion of which was deployed since the beginning of 2016.
- We estimate that including undisclosed transactions, the true cumulative total may be roughly USD **\$2.3-2.5 billion**.
- For the first time ever, total annual investment **surpassed USD \$500 million** in 2018.
- In 2017, YoY transaction value grew **37%**, and total capital composition by volume shifted to over 50% debt, signalling scale-up and further maturation of the sector.
- In 2018, total transaction value grew another **22% YoY**, and the deal count declined for the first time since 2011 as the average equity investments doubled and debt increased nearly **5.5x** YoY.

But capital concentration is a near-term risk:

- The investment landscape shows clear leaders: Companies deploying solar home systems (SHS), pay-as-you-go (PAYG) business models have attracted **81%** and **91%** of investment, respectively. Deals are overwhelmingly sourced from dollar-denominated (**86%**) funds and private capital (**71%**), though innovative local currency deals and lending facilities are picking up.
- Concurrently, transaction volumes are increasing. Average ticket values for convertible notes and equity have grown **6-8x since 2013**. Through the end of 2018, the top 10 deals alone represented **US \$490 million**, or **one third** of total investment volume to date.
- The top 10 SHS companies have raised over **USD \$1.1 billion**, representing **over two-thirds** of the total investment into the energy access sector. In the SHS segment, just over 50% of total capital raised is debt, ~44% is equity and ~6% is grants.
- In contrast, the top 10 mini-grid companies have raised only **USD \$190 million**, representing ~12% of total investment into the energy access sector. Our database confirms the common refrain that the sector has yet to successfully attract scaled debt finance, with **over 82%** of total investment being equity.

3. Strategic investments in energy access markets



Strategics take three broad go-to-market routes correlated with their risk tolerance

They've participated in **\$875M+** in direct & indirect investments, formed **30+** JVs and commercial partnerships



1. Direct investments and M&A

Strategic investors and their affiliates have made or been involved in over **110 direct investments** in the energy access sector worth over **US \$383M** in disclosed value, representing nearly **25% of total investment volume**. Alongside commercial return expectations, most have interests in capitalizing promising ventures to catalyse future investment, buying a minority stake for a seat on the board to glean learnings from the field, and better valuing the depth of ARPUs / LTVs for last-mile customers to better be able to size the market opportunity. In a few cases, strategic investors are looking for investees that are a synergistic operational fit.



2. Commercial Partnerships and Joint Ventures

Strategic investors have formed at least **31 commercial partnerships and joint ventures** with off-grid energy access companies. These allow a diverse array of technical partners, and the leveraging of internal resources like R&D, marketing, etc. These are primarily low-risk avenues to exploit operational synergies, move up the learning curve, and leverage the distribution network and on-the-ground markets expertise of credible partners. Many are also motivated by strategic plans or targets to be operating in multiple markets by 2030.


















3. Indirect Investment (Funds and Financial Intermediaries)

Strategic investors have participated in **fund investments worth over US \$461M**. Most of these investments by volume are into funds managed, seeded, or created within or alongside the corporate structure of the investor, such as Schneider's Energy Access Ventures, All On, or the Microgrid Investment Accelerator. SunFunder is also a major recipient. This is beneficial to strategics as a vehicle for diversified co-investment with other limited partners, decreased diligence and direct administration needs for venture teams, and geographically diversified risks and learnings.

Customer value in the 'next billion' is attractive to strategic investors

75 percent of strategic investments support fully commercial, exploratory, or first-mover activity

Go-to-Market Pathway

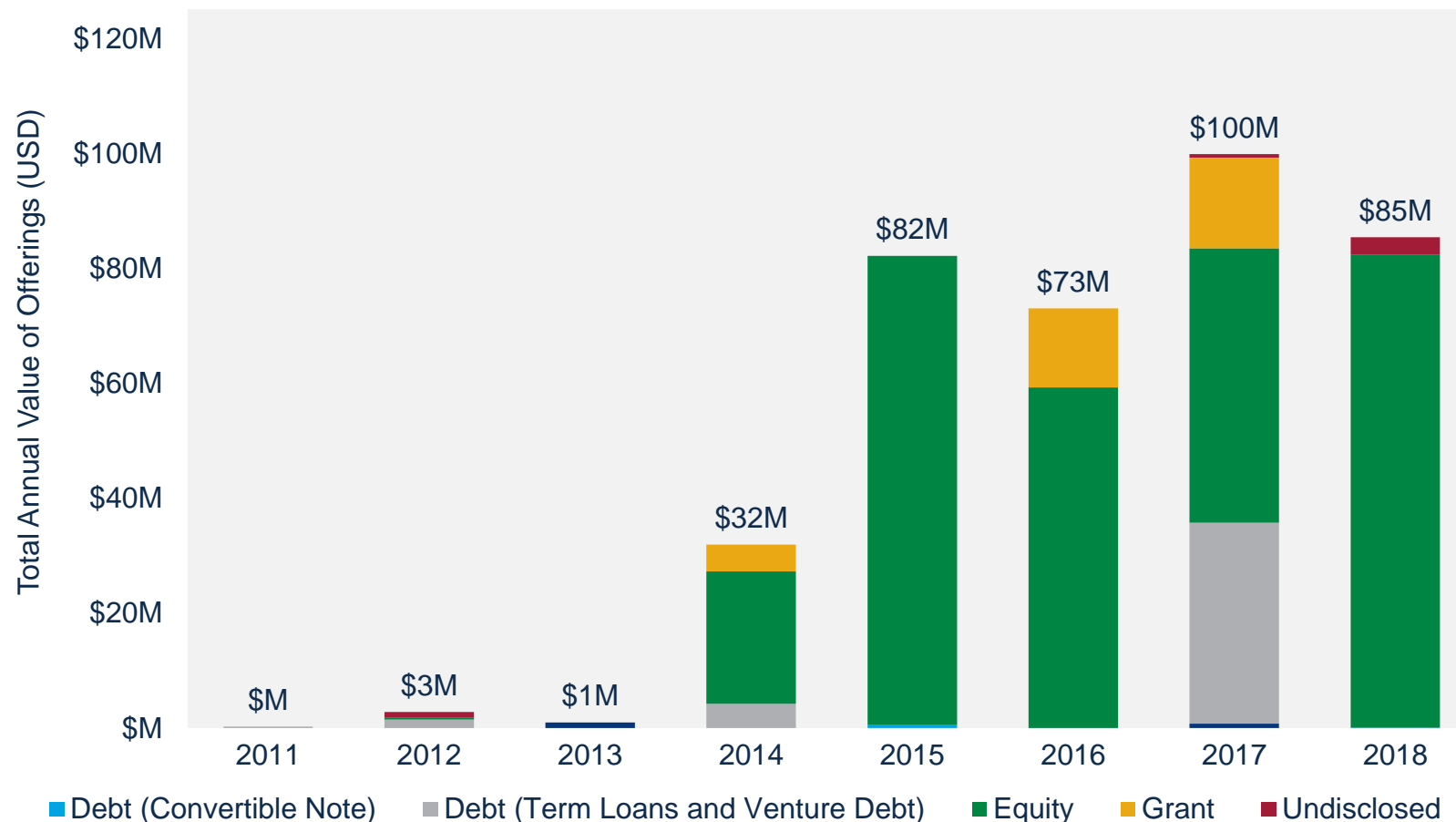
 Direct Investment					
 JVs & Partnerships					
 Indirect Investment					
Corporate Social Responsibility (CSR)		CSR with Long-term Commercial Objectives		Exploratory or First-Mover Commercial Activity	Fully Commercial Line of Business

Interest

Direct & venture investing: Strategic investors have directly deployed US \$375M+

Equity to SHS companies brings learnings and the opportunity to test the depths of customer-centric solutions

Disclosed direct corporate-level investments by strategics and financing type, 2011-2018



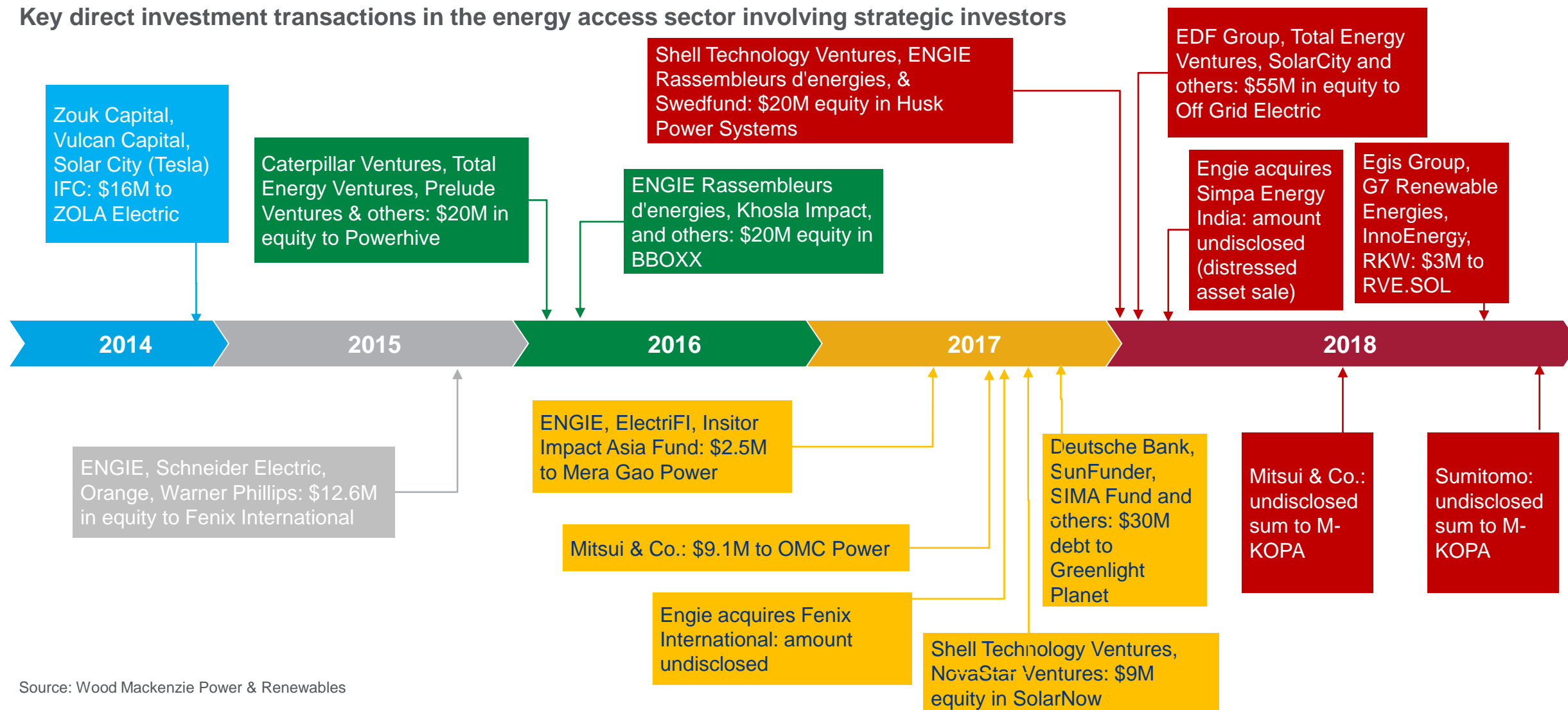
- Strategics have been involved in **114 transactions** with **54 unique recipients**.
- Ranging as high as **US \$100M** in a single year, strategic investors in energy access have directly deployed over **US \$375M** into the off-grid market.
- These deals are **78% equity by volume**, reflecting the value of a minority stake for a board seat for top-down investors looking to guide fast-growing players towards increasingly customer-centric solutions.
- Additionally, **74% of capital by volume has gone to SHS** companies, mainly because of their existing base of customer relationships.
- Much of the strategics' CSR work has acted as an incubation opportunity for the parent company to make commercial investments down the line.

Source: [Wood Mackenzie Power & Renewables Global Off-Grid Renewables Investment Datahub](#)

Source: Wood Mackenzie Power & Renewables

Direct & venture investing: Strategics are testing the waters for future M&A targets

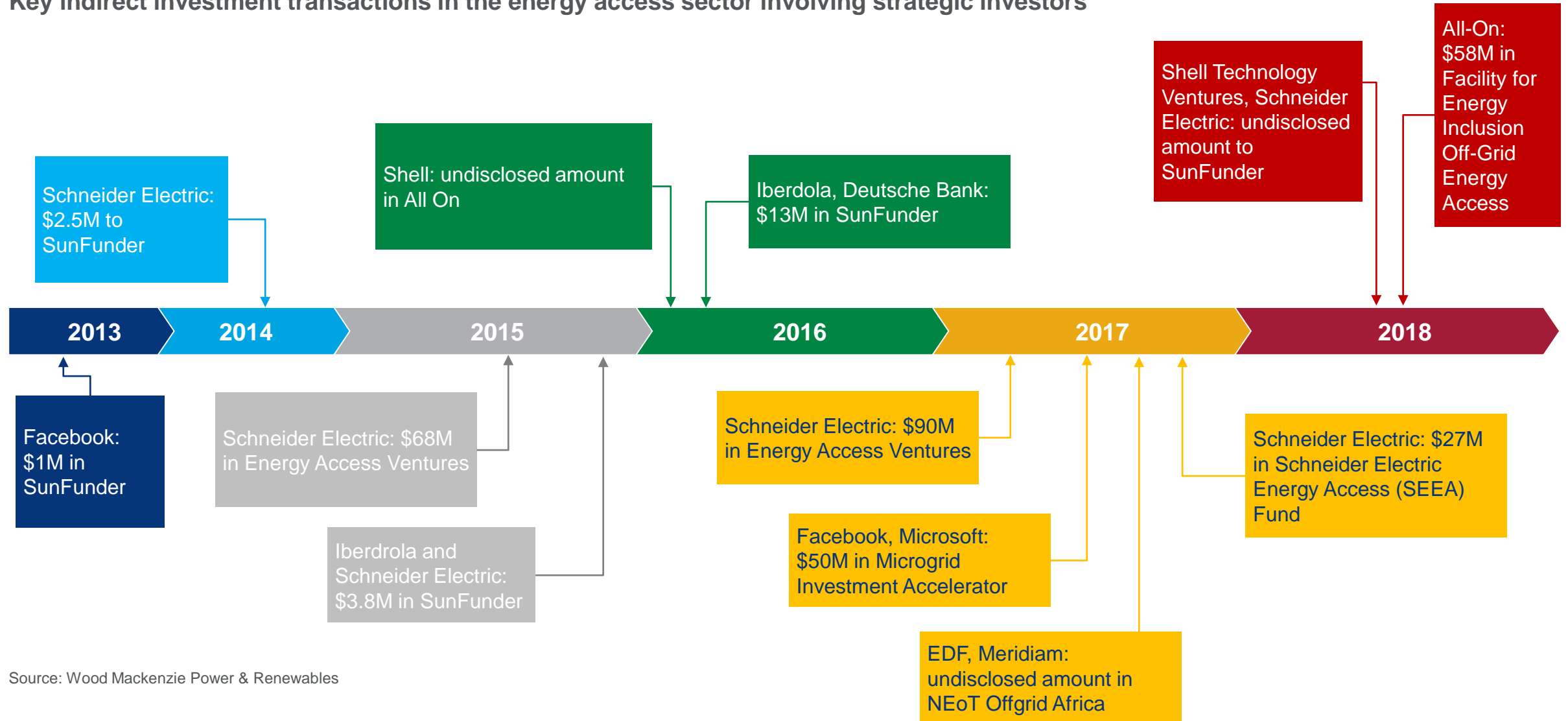
Key direct investment transactions in the energy access sector involving strategic investors



Source: Wood Mackenzie Power & Renewables

Indirect investments: financial intermediaries bring broad sector learnings

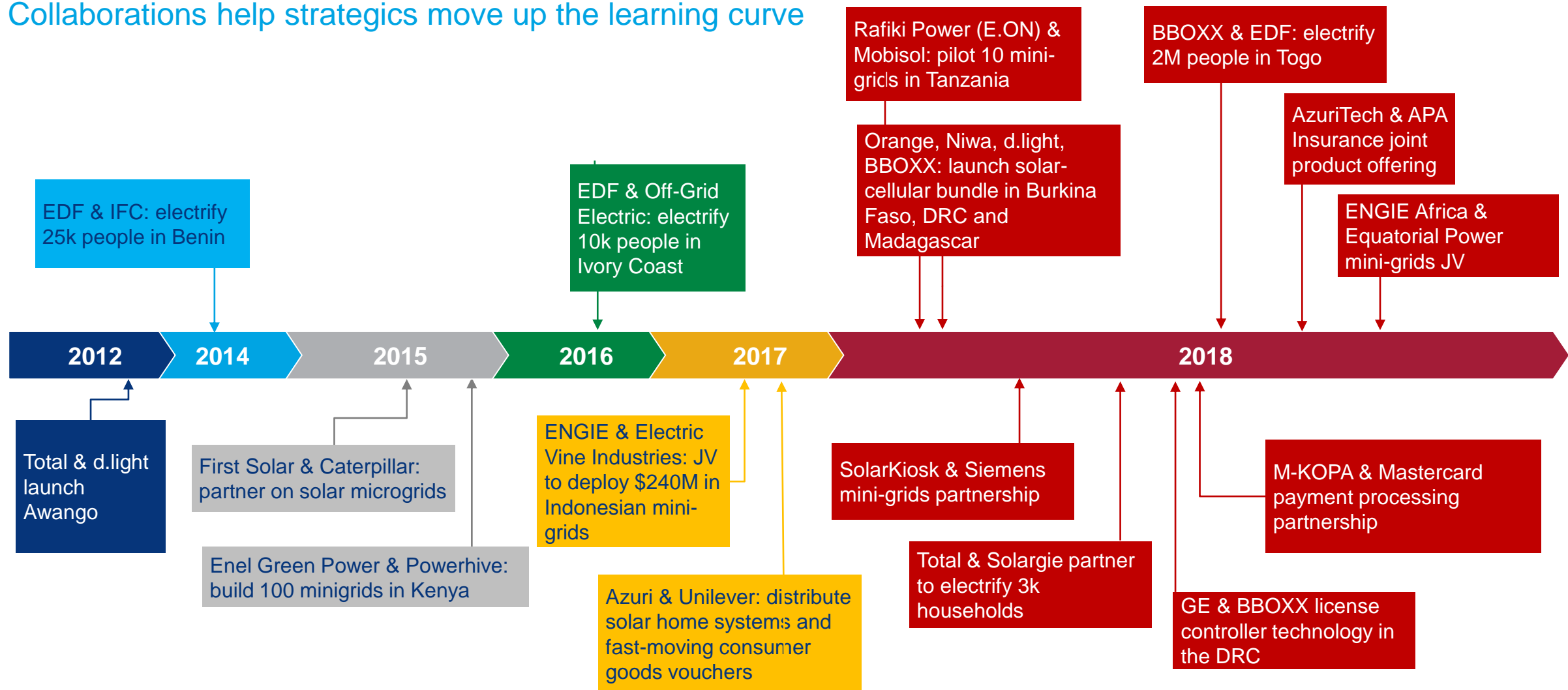
Key indirect investment transactions in the energy access sector involving strategic investors



Source: Wood Mackenzie Power & Renewables

Partnerships and joint ventures highlight operational synergies

Collaborations help strategics move up the learning curve





Strategic interests vary by customer segment

Customer-centric utilities want to understand the off-grid customer, but vendors just want to open new markets

B2C: Value-stacking utility 2.0 services

- For customer-centric (B2C) strategic investors, the ‘next billion’ represent far more than unelectrified utility customers. These off-grid households lack access to a long list of services, not just electricity.
- They also represent a controlled customer experiment. Households that have never had a reliable grid connection are a ‘blank-slate’ opportunity to redefine the utility-customer relationship, and the utility business model altogether.
- Not unlike the evolving utility-customer relationship in the West, the next-generation rural utilities and DESCOS of the future are customer-centric, decentralized, interoperable, flexible service providers that can own much more of the customer value chain beyond a basic electricity connection.
- Forward thinking DESCOS are experimenting with “value stacking” to understand how deep customer lifetime values (LTVs) are when other value-add services like appliances, various financial products and mobile money, internet connectivity, and others are stacked on top of a basic electricity connection.
- This business model also lends itself to cost-sharing and channel partnerships with the likes of telcos, fast-moving consumer goods companies, digital financial institutions, and other adjacent sectors looking to build customer relationships with the next billion.

B2B: New markets exploration or entry

- For equipment vendors, weak infrastructure represents an obvious commercial opportunity.
- OEMs and equipment suppliers (B2B) may use investments in the energy access sector to build go-to-market channels for components in future growth markets.
- Non-vertically integrated OEMs may be looking to expand their business down the value chain into system design and installation or operations as an IPP, and are planting a flag in emerging markets.
- Beyond simple market diversification, large corporates may benefit from first mover advantages, even if the market is not yet large enough for their existing product line
- Particularly in the power electronics subsegment, off-grid business units can be testbeds for the most advanced applications of their technologies.

Local capacity building

- Identify and vet credible local channel partners and distribution networks, and establish a commercial presence in a new and difficult market
- Test pilot projects, seed the ecosystem for future entry, and even providing relevant skills training

Social impact and CSR

- Investing in companies providing energy access to off-grid customers is a way for energy strategics to have field-relevant social impact
- Some CSR groups have mandates for triple or quadruple bottom line investments and grants

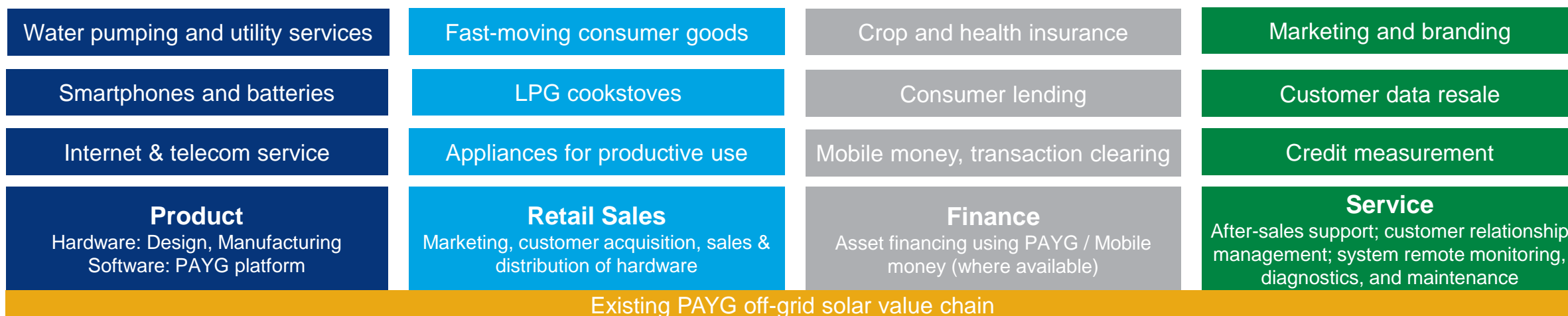
Electricity is just the beginning: Value-stacking ‘utility 3.0’ services at the last mile

A massive opportunity: “Owning” the next billion consumers, their evolving needs, and their data

DESCOs and their strategic partners are again redefining the customer-centric utility business model– by looking beyond kWhs

- Off-grid energy access provision—particularly through the PAYG value chain and its associated data infrastructure—is becoming a converged solution and enabling mechanism for a host of other goods and services that bankable off-grid customers are willing and able to pay for, most of which require basic electricity access.
- Ultimately, upselling these value-stacked services enable the DESCO to boost a customer’s lifetime value (LTV) and the average revenue per user (ARPU), which may already be 3x more in PAYG customer relationships vs cash sales*. They also lead to more continuous and meaningful engagements, more data, and better assessment of a customer’s true credit risk if the DESCO offers an increasing number of essential services to the end consumer.
- Riding the sector’s broader trend towards vertical disaggregation, leading value-stacking DESCOs like BBOXX and Azuri are leveraging strategic partnerships and JVs as the vehicle to pilot bring these value-add services to market.
- As value-stacking on top of the PAYG value chain grows, investors from adjacent industries may increasingly deploy capital into the off-grid solar sector to support the enabling environment for their own partnered solutions, but may run into issues when competing with their partners for a limited share of limited income.

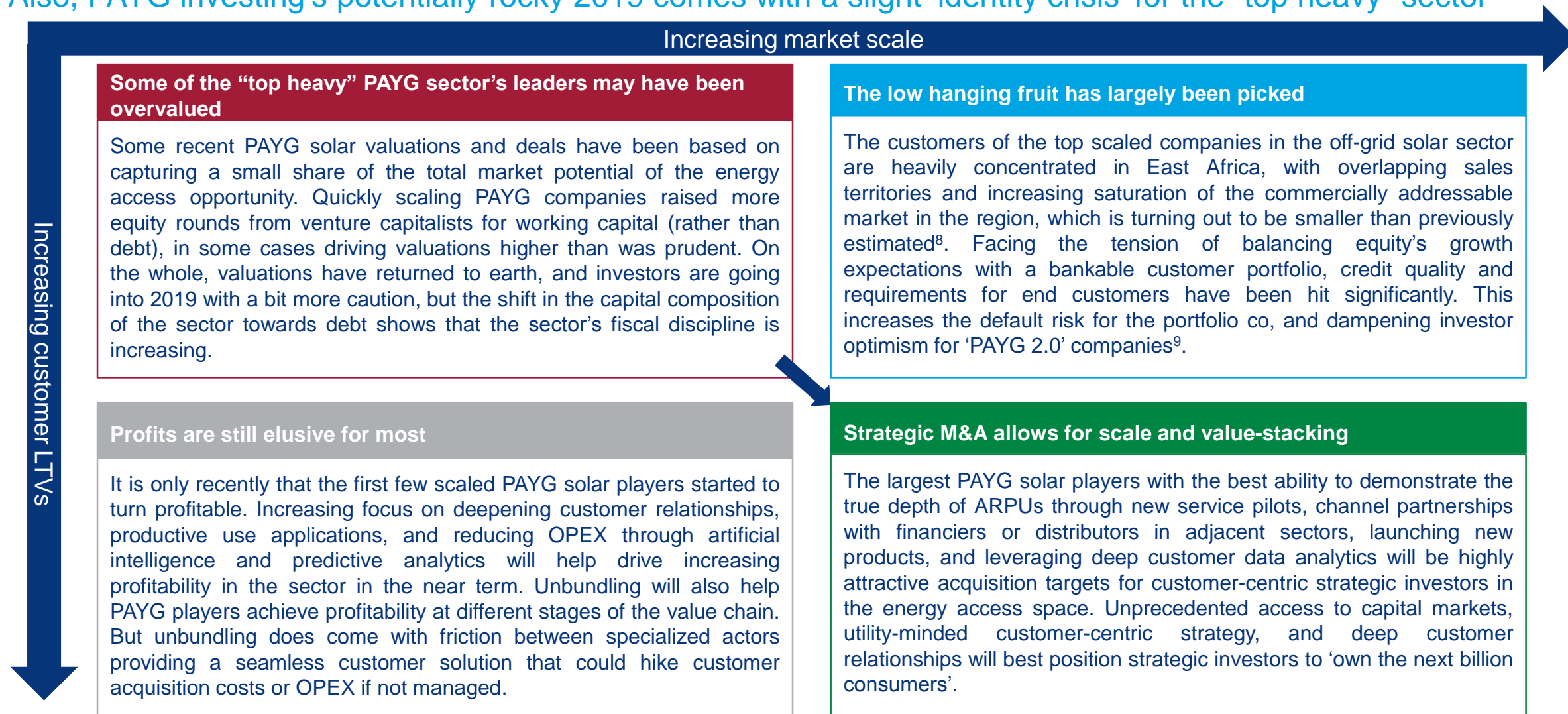
“Going Deep”: Value-stacking on top of basic electricity connections





Going deep vs going wide: Strategic M&A is the best way to do both

Also, PAYG investing's potentially rocky 2019 comes with a slight 'identity crisis' for the "top heavy" sector





Findings: Strategic interests go past providing basic electricity connections

Strategic interests in sector are mostly commercial, and are not limited to providing basic electricity connections

- 75% of all strategic activity in the off-grid energy access is commercial in nature, and falls into two primary categories, depending on the customer.

Understand the customer (B2C): Value-stacking "Utility 3.0" services

- Utilities, ESCOs, IPPs, and utility-minded majors want to conduct blank-slate, controlled customer experiments. The understanding of the end customer is the unifying theme, with deep long-term commercial outlooks.
- The next generation rural utilities and DESCOs of the future are customer-centric, decentralized, interoperable, flexible service providers that can own the entire customer value chain beyond a basic electricity connection.
- However, the myriad regulatory risks of value stacking and linking different sectors are still very unknown and untested.

Open the market (B2B): New markets entry or exploration

- Simply, OEMs and equipment or component vendors and suppliers looking for go-to-market channels in future growth markets
- First mover advantage and market share gains using off-grid focused entities

4. Looking ahead



Looking ahead, the energy access sector could see some choppy waters in the near term

In the face of the risk and reward of unbundling, the PAYG energy access sector in general and the SHS sector in particular may face a slight “identity crisis” in the near term. Are they energy service providers or utilities? Are they consumer finance institutions? Retail product sales? All of the above? Some leading SHS players are moving toward a “rural service provider” model that focuses on meeting and financing household demand for adjacent services.

The unbundling of the PAYG value chain is a huge opportunity for the sector in terms of profitability and scaling of symbiotic industries, but it also opens a lot of questions around future investment, consumer behaviour, customer acquisition costs, and more. As the sector unbundles, a diversification of investment flows may follow.

Additionally, an investment “cliff” could be looming in the short-term future of the sector. Investment and risk is highly concentrated in a few highly-capitalized companies, some of which may be overvalued, operating in adjacent and overlapping geographies, seeking to meet aggressive growth expectations from VCs, and mostly prioritizing market share over profitability.

As they start to run up against the limits of their low-cost addressable market, they will continue to face this question of “going deep vs going wide,” where they need to balance growing market share (acquiring customers) and getting profitable (cutting OPEX, boosting repayment rates, tightening credit requirements, and deepening customer value). Sector leaders are currently experimenting to determine and demonstrate the true depth of customer values to their investors through stacking value on top of existing customer relationships through partnerships and value-add services.

With few successful exits to date, private investors may exhibit more short term caution, leading to a dip in 2019 deployments, alongside some value chain segmentation. Investors are increasingly interested in the so-called ‘PAYG 2.0’ wave of startups, particularly those that are unbundled.

However, there are hundreds of millions of public dollars waiting in the wings for the sector, particularly for mini-grids. We expect public sector capital to make significant contributions to the sector in 2019, but the sector’s capital gap likely isn’t going away in 2019, and in fact may structurally actually grow a bit, even if more capital is flowing.



Going forward, what is the future role of strategic investors in energy access markets?

At a high level, strategic investors have so far committed to electrify **214 million people by 2030** (100 million from Shell alone), so it seems very likely that they will play a fundamental role in energy access markets. But the question remains: how committed are they? So far, they're still just dipping their toes, but there's no question they're changing the trajectory of the market as a whole.

In the near term, commercial participation from strategic investors imparts legitimacy to a maturing sector and has been welcomed, but their long-term role or the impact of their involvement is not yet known.

Because strategic participation is much broader than equity investments, they can go to market using any avenue they wish. Possible future roles for strategic investors include:

- Unlocking debt and equity markets
- Balance sheet financing receivables for SHS portfolio companies
- Buying SHS or mini-grid portfolios or securities (allowing more agile companies to turnover early-stage capital that has already entered the market)
- Leveraging scale farther up the supply chain to streamline costs and get wholesale prices
- Providing human capital resources and support, branding, and networks



Some questions for further research

How do customers stand to gain or lose from strategic investments into their service providers?

Will strategic investments disrupt the flow of capital from other sources of private capital (commercial debt markets, private equity and venture capital, etc)? Will private equity be willing to follow-on from strategic investments despite their relative price inelasticity?

How will strategic CSR's role as an incubator, enabler, or financier change? How do foundations and their associated corporate entities interact? Can they fully operate independently? Can they give exits to each other?

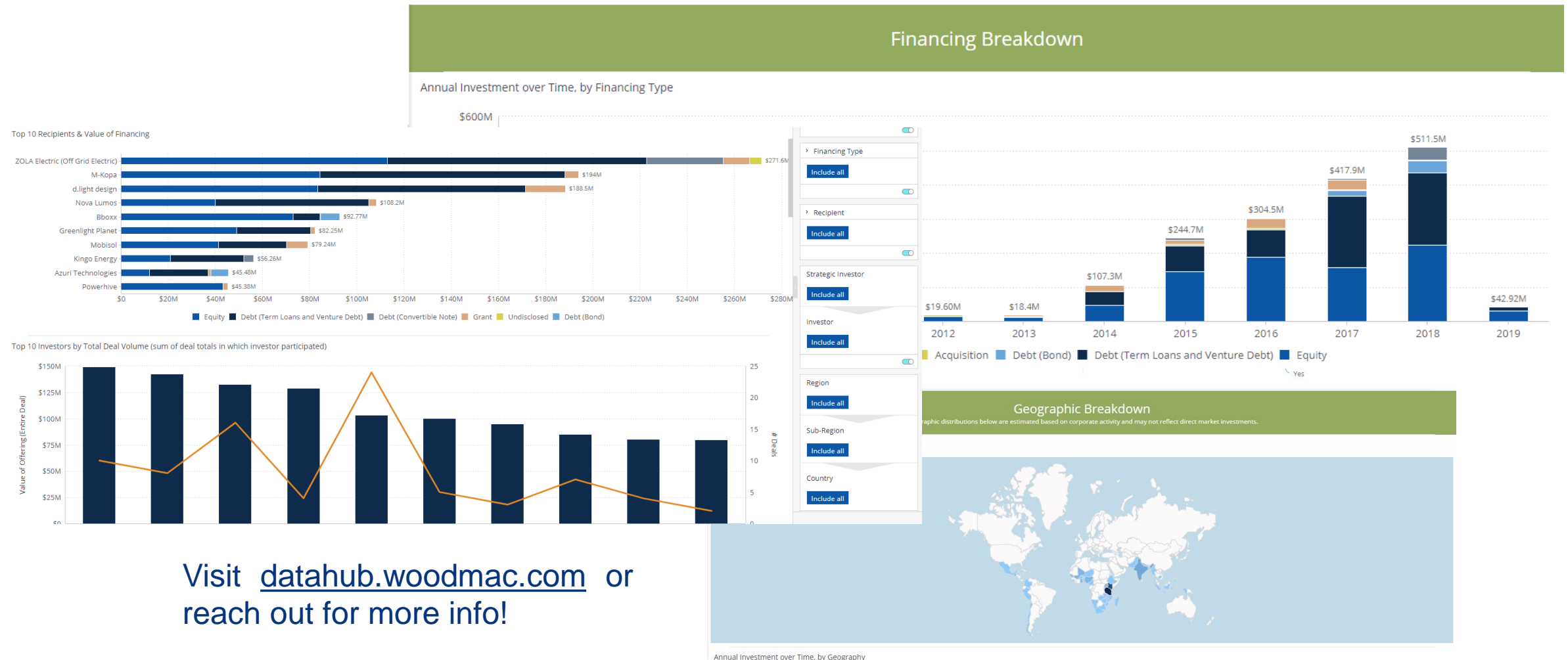
How might larger market forces, such as the E.ON-RWE merger or energy transition trends towards decentralization in developed power markets impact Strategics' interest in the off-grid sector?

Beyond technical integration bottleneck, why haven't telecom providers and their obvious operational synergies make good channel partners for SHS companies?

Which strategic peers are yet to participate? Exxon, Eni, Amazon, Nestle, Pepsi, other Japanese trading houses, Chinese institutional investors, etc. Why not?

For more insights: Introducing the Global Off-Grid Renewables Investment Datahub

Wood Mackenzie Power & Renewables clients can now manipulate & download the data analyzed in this report



Visit datahub.woodmac.com or reach out for more info!

More Wood Mackenzie Power & Renewables Off-Grid Energy Access Coverage

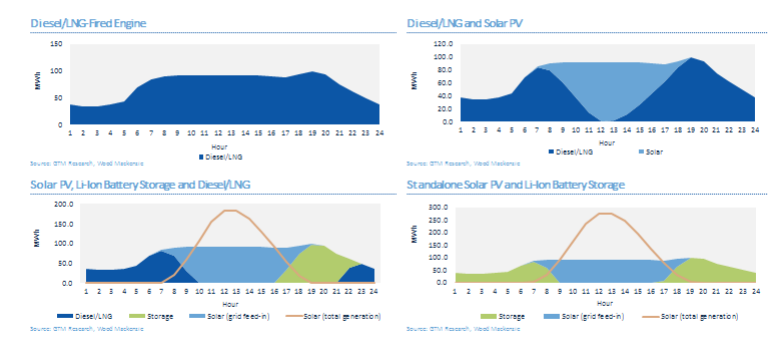
Some Recent Research, Articles, and Wood Mackenzie/Greentech Media Coverage of Off-Grid Energy Access:

- [4 Ways the Mini-Grid Market Can Avoid the Cleantech Sector’s Early Failures](#)
- [\[Paywall\] Future Power Supply Options for Island Markets](#)
- [Distributed Models for Grid Extension Could Save African Utilities Billions of Dollars](#)
- [Living Under the Grid: 110 Million of Africa’s Unconnected Customers Represent a Massive Opportunity](#)
- [How Deregulation Could Improve Reliability for Cash-Strapped African Utilities](#)
- [How Blockchain Can Help Connect Billions to Electricity and Financial Services](#)
- [Decentralization Is the Cheapest Way to Expand Energy Access in India, Says IEA](#)
- [Can India Lead the Global Minigrad Market Like China Did With Solar PV?](#)
- [Engie’s Fenix Acquisition Gives a Major Boost to Energy Access Efforts](#)
- [Unlocking an Energy Revolution in Ethiopia With Lessons From the Black Market](#)
- [How Many Puerto Ricans Have Power? No One Really Knows](#)
- [How C&I Projects Are Driving Growth in Kenya’s Small but Promising Solar Market](#)
- [How Big Dollars Are Catalyzing India’s Small-Scale Solar Market](#)
- [Pay-As-You-Go Transactions in Off-Grid Solar Top \\$41M in Late 2016](#)



RESEARCH SPOTLIGHT
4 Ways the Mini-Grid Market Can Avoid the Cleantech Sector’s Early Failures
 Investment in mini-grids is on the rise, but the burgeoning space risks falling victim to the same issues that plagued early investments in the broader cleantech sector.
 BENJAMIN ATTIA AND JUSTIN GUAY | JUNE 06, 2018

Modeled Average Daily Power Supply Profiles



Future Power Supply Options for Island Markets		gtmresearch		17	
Uganda	Kumasi-Bolgatanga	Budget (USD): \$165 million	Length: 550 km	0.91	[6]
	Kawanda-Masaka	Budget (USD): \$110 million	Length: 137 km	3.65	[7]
	Karuma-Kawanda	Budget (USD): \$250 million	Length: 248 km	2.92	[8]
	Kawanda-Kasana	Budget (USD): \$39 million	Length: 54 km	5.47	[9]

Look out for more forthcoming research on energy access topics, and please get in touch with us if you have feedback, specific intelligence needs, or ideas for future research collaboration!

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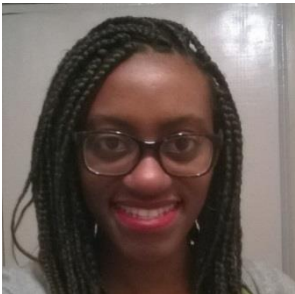


Thanks to our Energy 4 Impact Partners



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