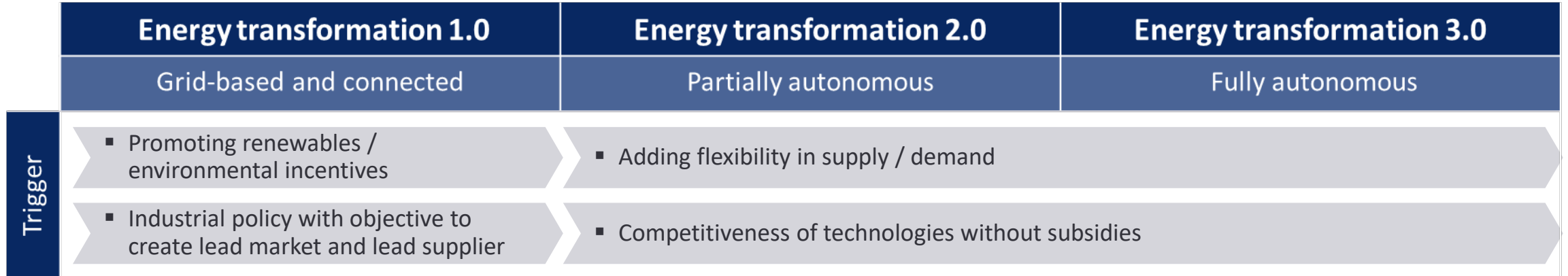From electricity access to appliances to impacts on development
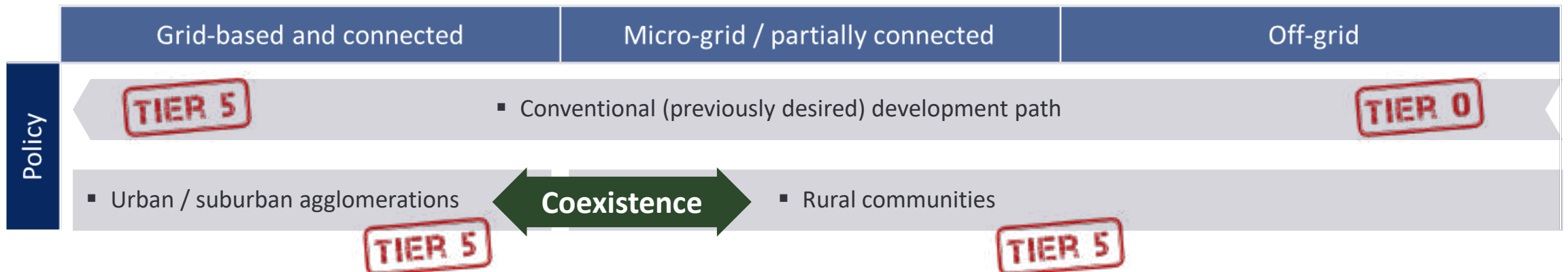
A taxonomy of business models along the Multi-Tier Framework

Energy transformation 1.0 – 3.0: Triggers and regulatory framework

Industrialized countries

Energy transformation 1.0	Energy transformation 2.0	Energy transformation 3.0
Grid-based and connected	Partially autonomous	Fully autonomous

Trigger

- Promoting renewables / environmental incentives
- Industrial policy with objective to create lead market and lead supplier

- Adding flexibility in supply / demand
- Competitiveness of technologies without subsidies

Developing countries

Grid-based and connected	Micro-grid / partially connected	Off-grid

Policy

TIER 5 ■ Conventional (previously desired) development path TIER 0

- Urban / suburban agglomerations
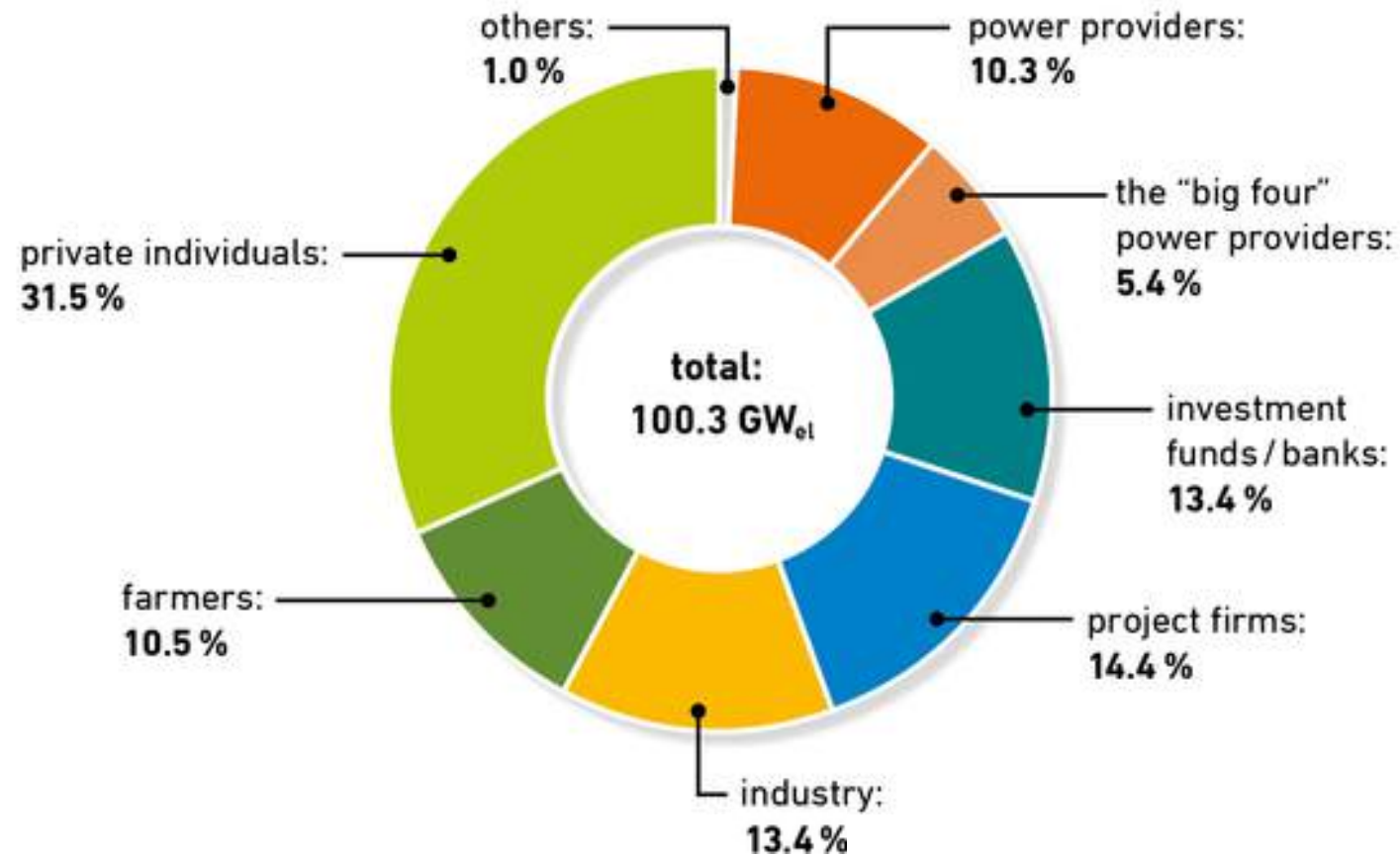**Coexistence**
- Rural communities

TIER 5   TIER 5

Energy transformation 1.0 – 3.0: Evolution of business models

Energy transformation 1.0	Energy transformation 2.0	Energy transformation 3.0
Grid-based and connected	Partially autonomous	Fully autonomous

Business models

New asset ownership models

**New service & operating models**

New platform models

"Civic" power is the market leader in renewable energies – German energy incumbents have entered the market too late

Ownership of renewable energy capacity (2016)

others: 1.0 %

power providers: 10.3 %

the "big four" power providers: 5.4 %

investment funds / banks: 13.4 %

project firms: 14.4 %

industry: 13.4 %

farmers: 10.5 %

private individuals: 31.5 %

total: 100.3 GW$_{el}$

*Source: trend:research (12/2017)

As of 30 September 2019, there are over 2.2 million PV installations in Australia, with a combined capacity of over 13.9 gigawatts

Australian PV installations since April 2001: total capacity (kW)
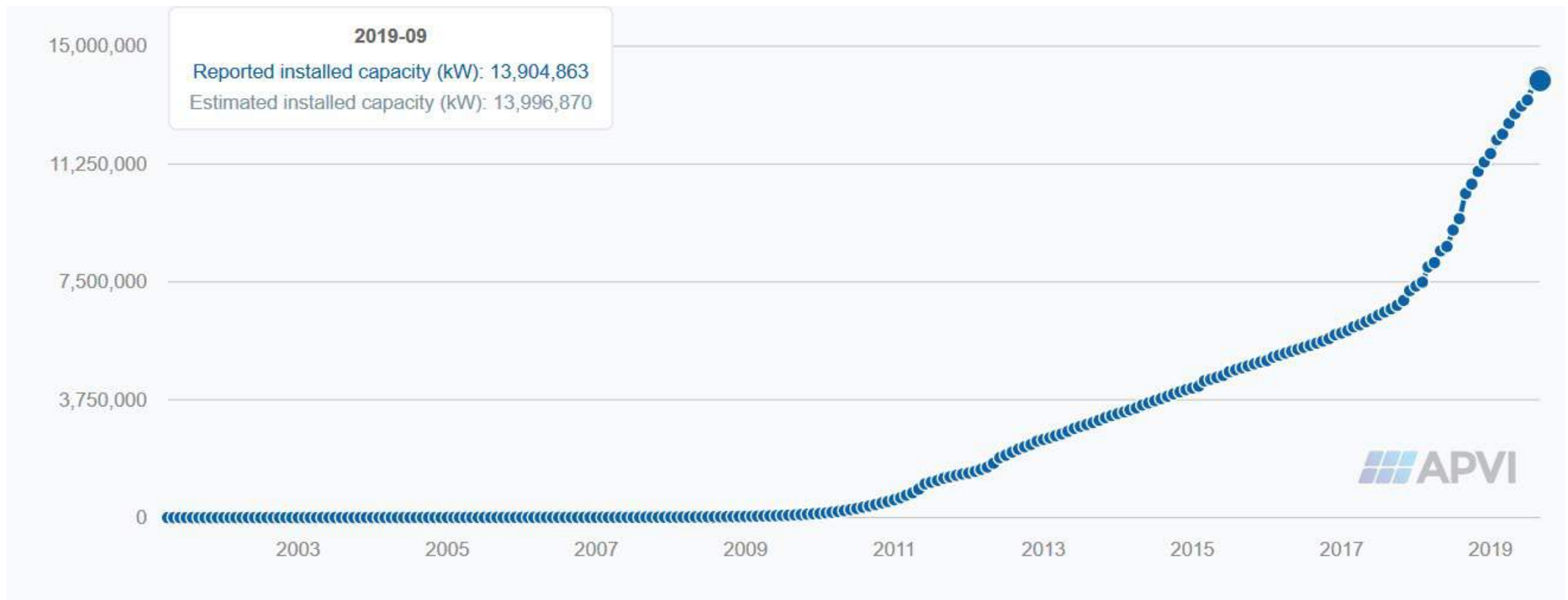
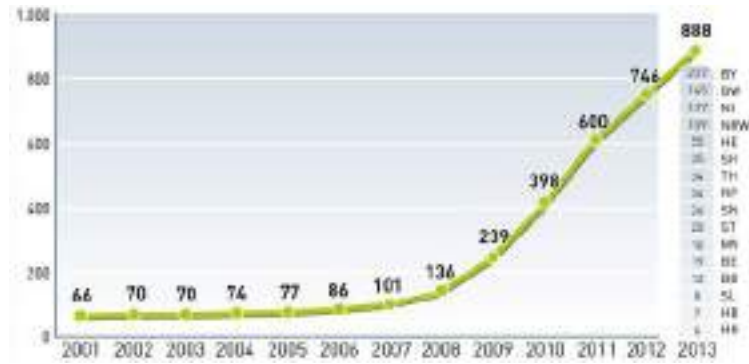The transformation of the energy system

As of 30 September 2019, there are over 2.2 million PV installations in Australia, with a combined capacity of over 13.9 gigawatts
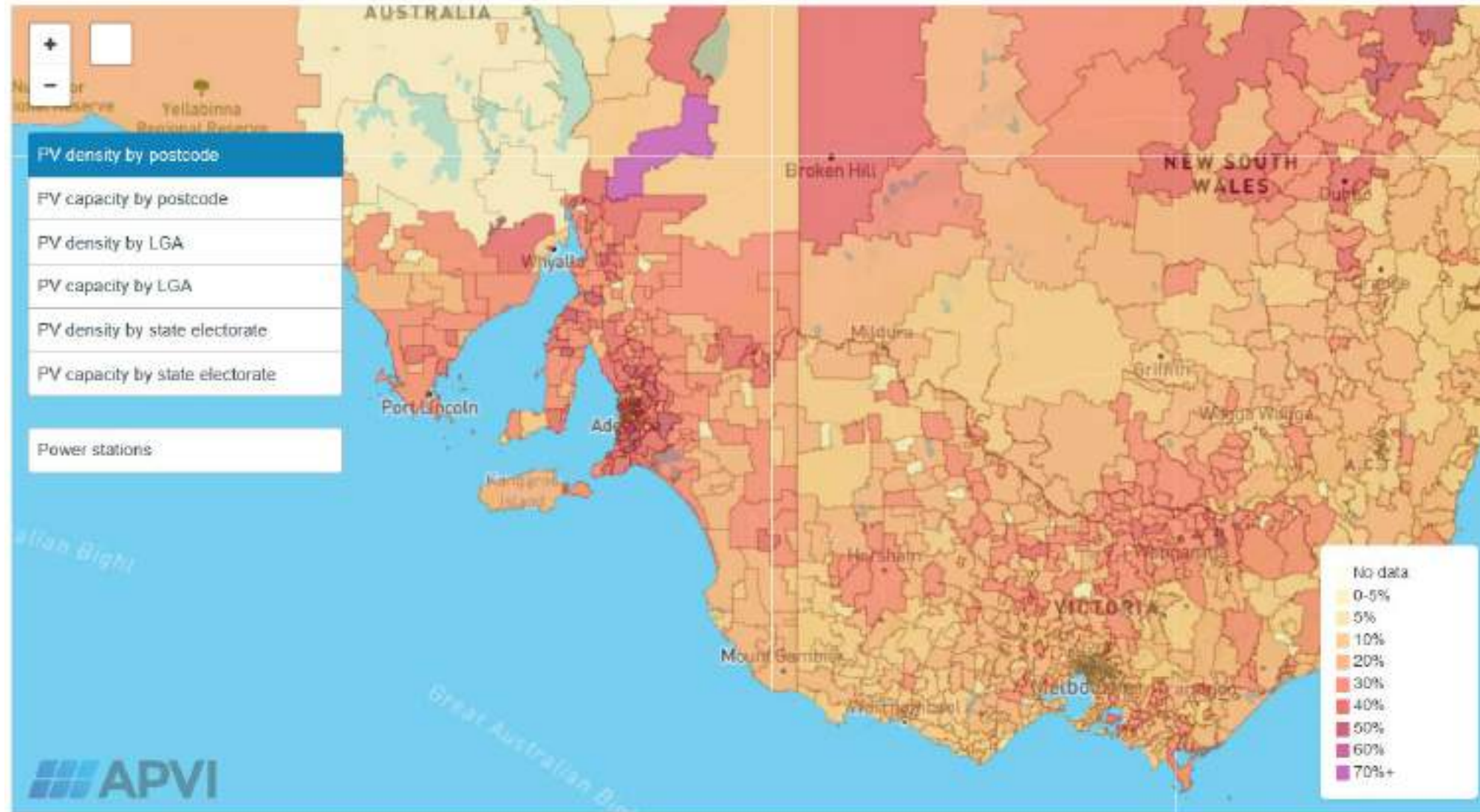
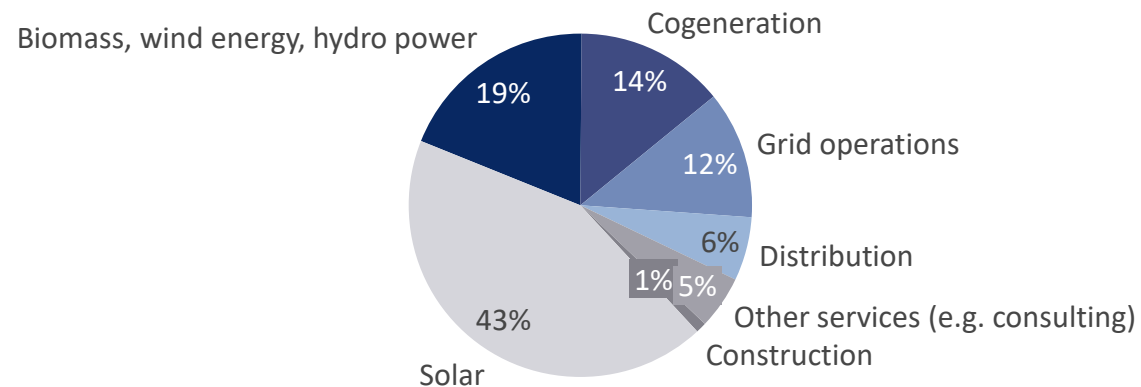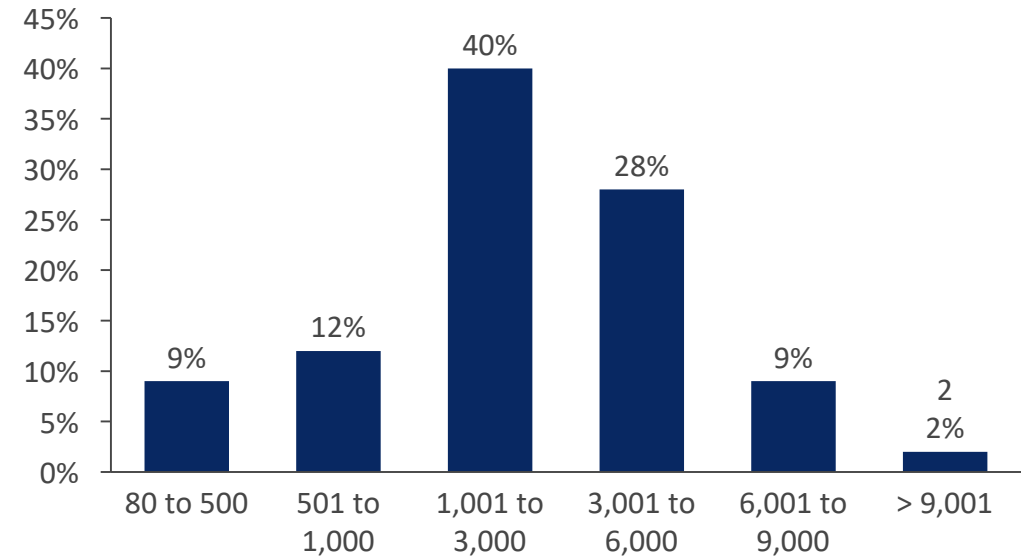# Energy cooperatives leveraged subsidies and invested around €1.2 bnin community power plants

888 energy cooperatives in Germany (2013)

Biomass, wind energy, hydro power — 19%
Cogeneration — 14%
Grid operations — 12%
Distribution — 6%
Other services (e.g. consulting) — 5%
Construction — 1%
Solar — 43%

Distribution of actual shareholdings per member (€)

Range	Percentage
80 to 500	9%
501 to 1,000	12%
1,001 to 3,000	40%
3,001 to 6,000	28%
6,001 to 9,000	9%
> 9,001	2%

- More than 130,000 members – 90 percent of them private citizens
- Community power plants meet the annual electricity needs of 160,000 households

Home   **Projekte**   So funktioniert's   Partner   Kontakt

ID:004 Wüsteney

Photovoltaik / Dachanlage / 30kWp

Diese kleine aber attraktive Pv-Anlage (29,58 kWp) wurde im Mai 2011 in Wüsteney bei Greifswald (Mecklenburg-Vorpommern) errichtet. Sie wird voraussichtlich zu 100% mit Eigenkapital finanziert

38 Investoren	Fundingvolumen: 59 000€	100 %	Noch	59 000€
	Standort: Nähe Greifswald	gefundet	0 Tage	investiert

ID:003 EUREF Green Garage

Photovoltaik / Dachanlage / 20kWp

Das Projekt Green Garage wird bis Juli 2013 auf dem EUREF Campus auf dem Coworking-Büro der Klimainitiative "Climate KIC" errichtet. Die 19,74 kW-Anlage wird zu 100 % mit Eigenkapital finanziert.

11 Investoren	Fundingvolumen: 18 000€	100 %	Noch	18 000€
	Standort: Berlin	gefundet	0 Tage	investiert

ID:002 Finowfurt Alte Mühle

Photovoltaik / Dachanlage / 11.3kWp

Im schönen Finowfurt, einem Ortsteil von Schorfheide bei Eberswalde in Brandenburg steht die Alte Mühle, die in den Jahren 2010 und 2011 saniert und mit insgesamt vier Solaranlagen ausgestattet ist.

34 Investoren	Fundingvolumen: 65 000€	100 %	Noch	65 000€
	Standort:	gefundet	0 Tage	investiert

Sortieren nach: Restlaufzeit
Reihenfolge: absteigend

Anwenden

News

- 5 Fragen an Daniel Uphaus, SolarGrid eG
- Solarlichter für Tansania: Vorstellung der African Solar Rise e.V.

Newsletter

- Newsletter abonnieren

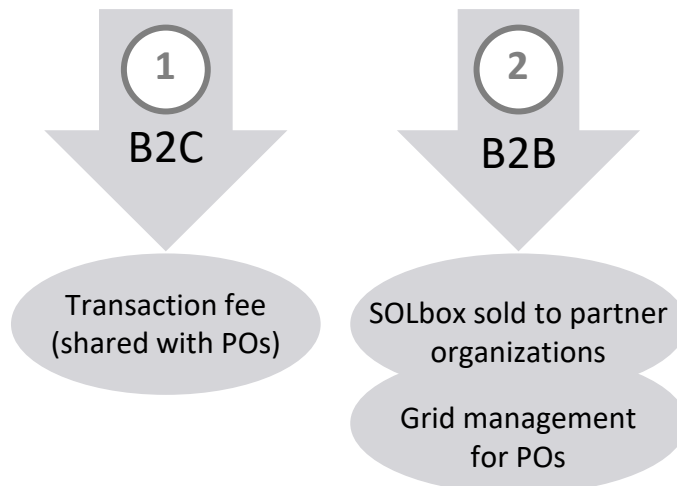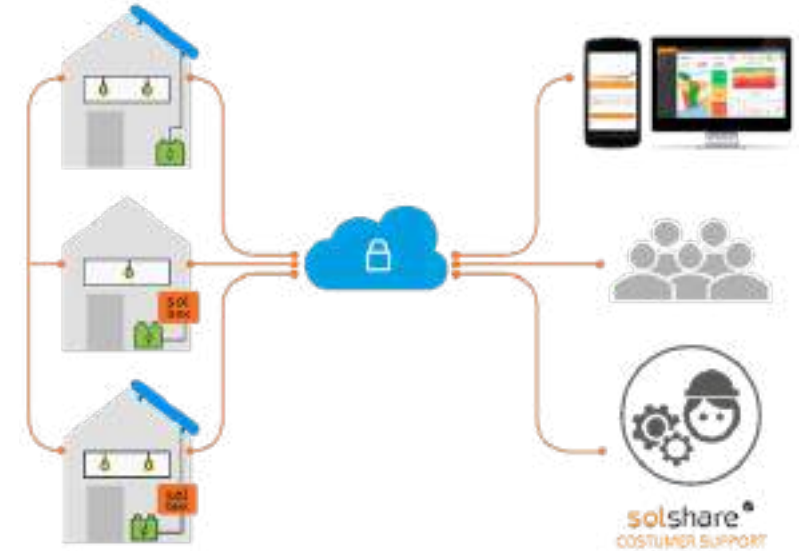# Renewable energy crowd-funding enables bottom-up participation

= Platform   = Project   = Countries with renewable crowdfunding

SOLshare: Enabling energy access with micro-grids in Bangladesh

Dr. Sebastian Groh

solshare

The SOLbox

1	2
B2C	**B2B**
Transaction fee (shared with POs)	SOLbox sold to partner organizations
	Grid management for POs

Local production facilities in Dhaka, Bangladesh

Local field operations team providing technical support

SOLshare: Leveraging solar home systems to create a bottom-up grid

Dr. Sebastian Groh

solshare

1 Micro-grids

Plug-and-play technology of the SOLbox allows the trading network to grow dynamically from the 'bottom-up' as more users connect over time
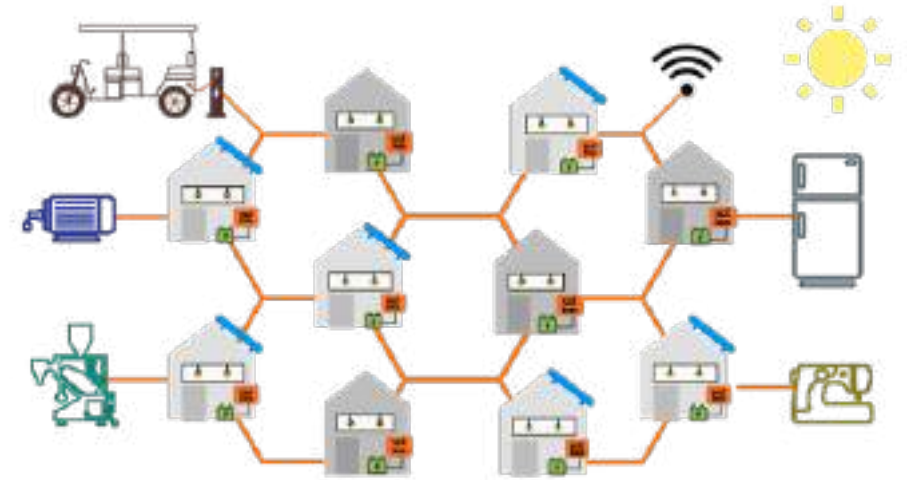
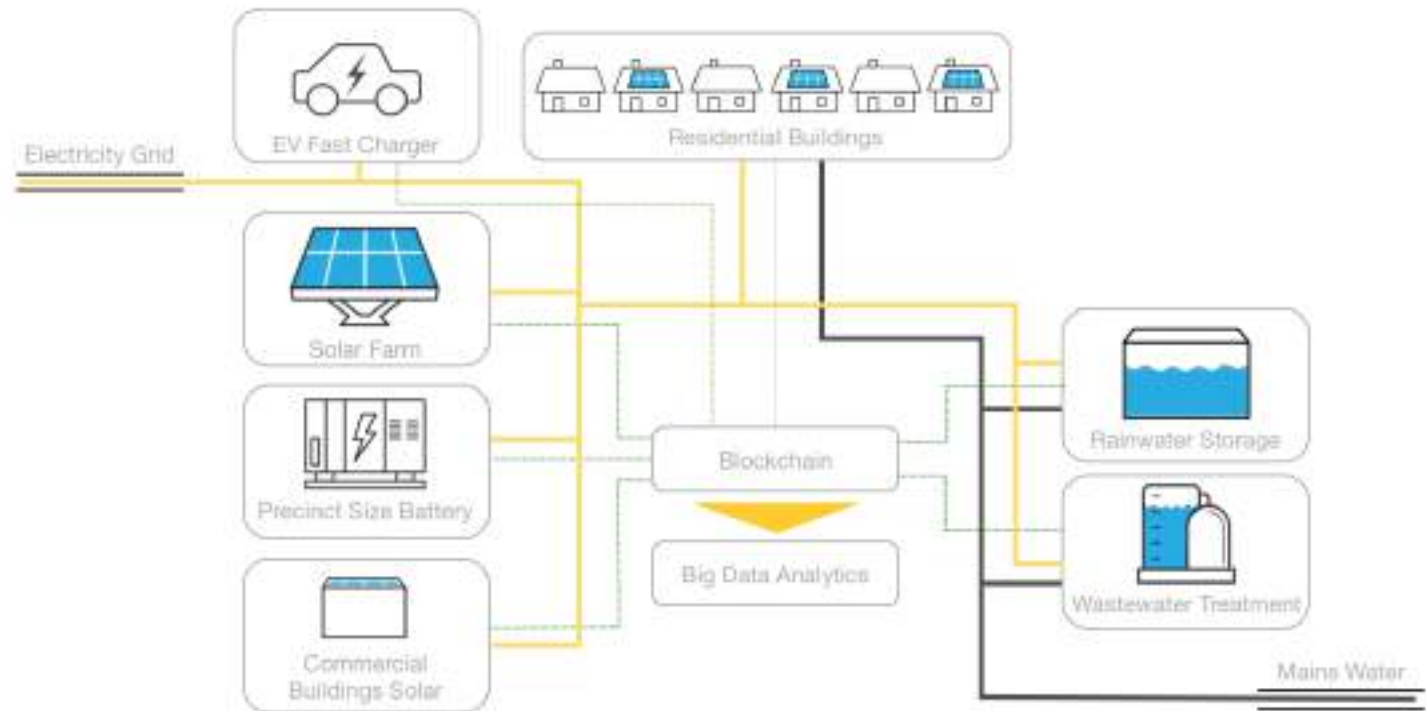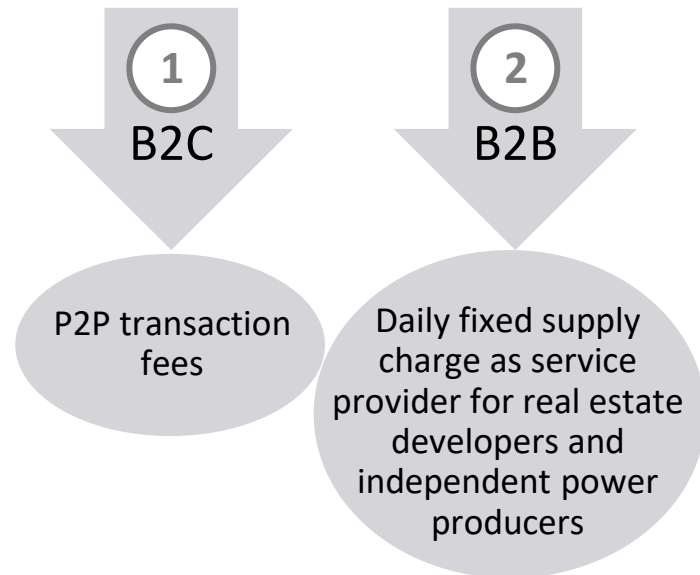### 2 Integration with the rural electricity grid

Last-mile power distribution infrastructure, metered at a single, central location, operating in island mode when the grid is unavailable

Source: SOLshare (2018)
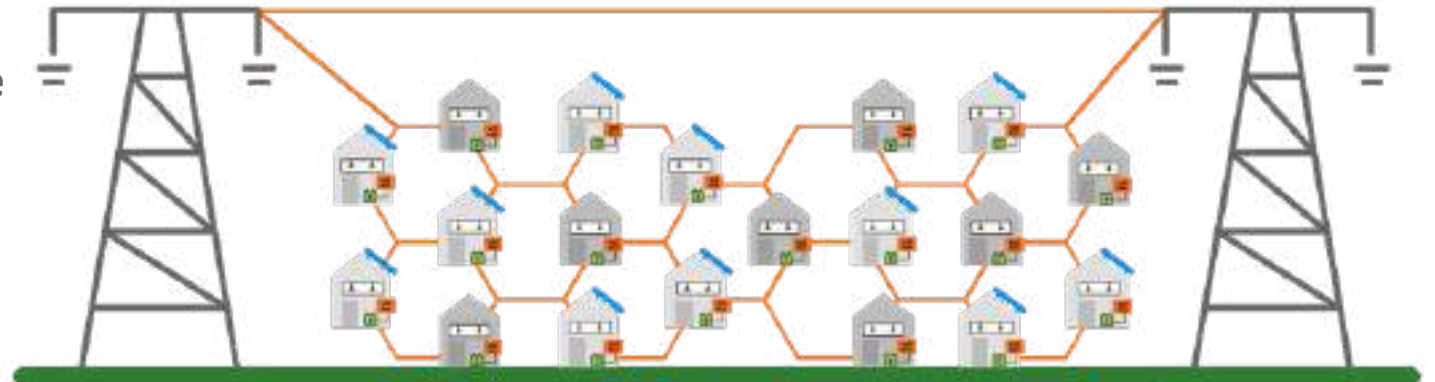
Power Ledger: Peer-to-peer trading with Blockchain as decentralized transaction technology

Dr. Jemma Green

POWER LEDGER

(1) **B2C**

P2P transaction fees

(2) **B2B**

Daily fixed supply charge as service provider for real estate developers and independent power producers

Gen Y Housing Project

City of Fremantle

With Power Ledger, the first energy token sale took place

Energy transformation 1.0 – 3.0: Evolution of business models

Energy transformation 1.0	Energy transformation 2.0	Energy transformation 3.0
Grid-based and connected	Partially autonomous	Fully autonomous

New asset ownership models: From central to crowdfunding

Financed by subsidies
- Individuals (prosumers)
- Energy associations

Financed by market-based mechanisms
- Online crowdfunding

Financed by ICOs
(Initial Coin Offerings)
- Cryptocurrencies

New service & operating models

Business models

Envio Systems: A low-cost solution for retrofitting commercial buildings

Reza Alaghehband
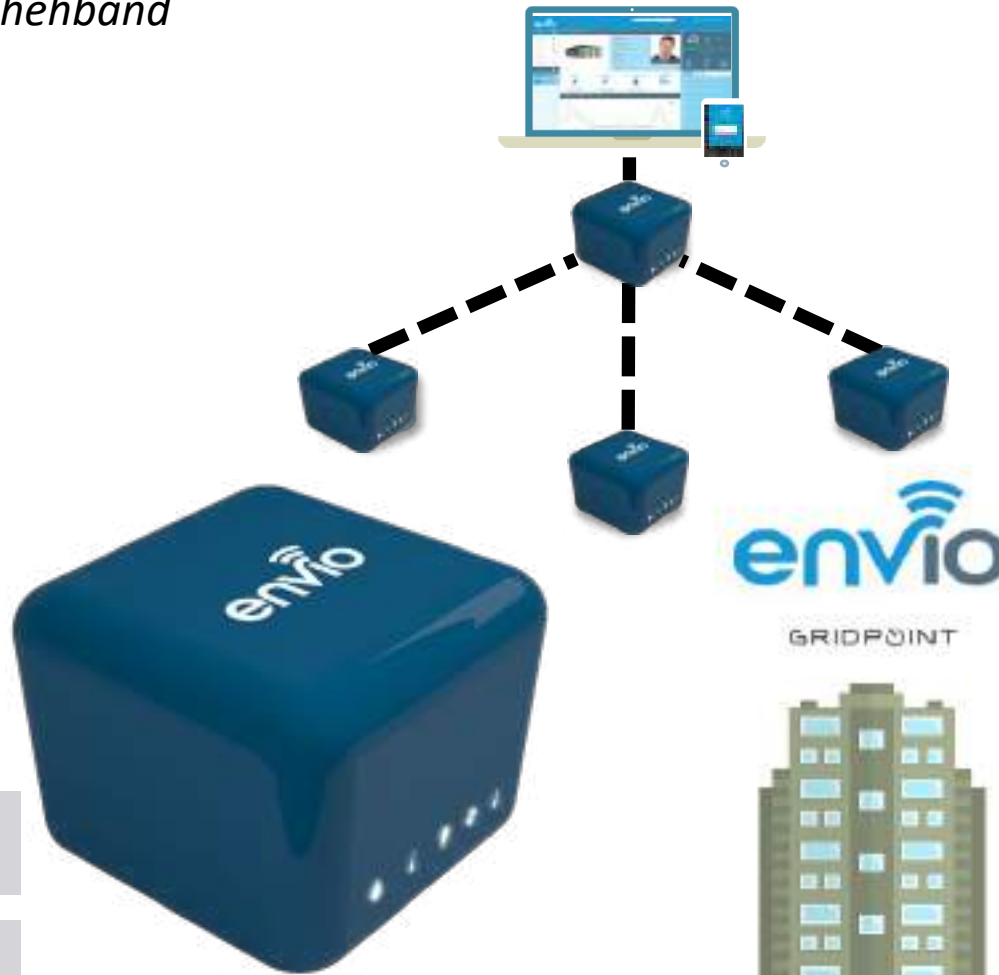
1. ~~Shared savings~~

2. Hardware-as-a-service model

envio

GRIDPOINT

Johnson Controls
SIEMENS
Schneider Electric
Honeywell

MARKET SIZE (Buildings Europe & North America)   10.600.000   600.000

Timo Leukefeld offers an autonomous residential house in Germany

Prof. Timo Leukefeld

PV collector (58 m²)

Solar thermal collector (46 m²)

9.3 m³ long-term storage tank

162 m² living space

Electric battery (56 kWh, Lead, cost ~€250/kWh)

Leasing contract for electric vehicle, incl. charging
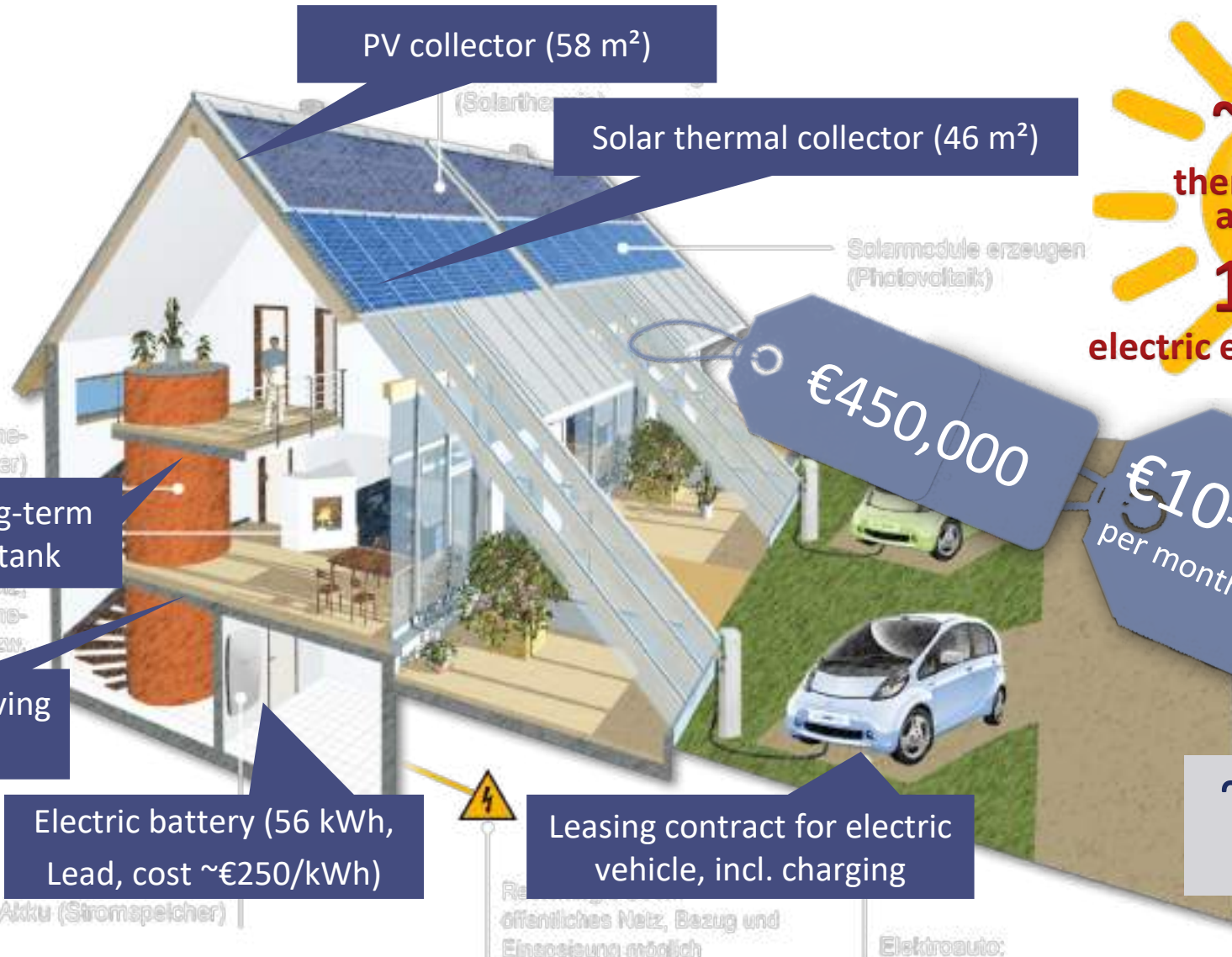
~70% thermal energy autonomy

100% electric energy autonomy

€450,000

€10-15/m² per month (all incl.)

~ €2000/ month

Sources: Timo Leukefeld (2016), http://www.solarthermalworld.org/content/germany-independent-energy-utilities (2011), Michael Löwa/FAZ (2011); Sonnenhaus-Institut (2016)

Solarkiosk: Social enterprise with a grid-independent off-the-shelf architecture solution

Lars Krückeberg

SOLAR KIOSK

Solar panels

Batteries

Steel walls with integrated ventilation

4-6 AC sockets

SHIP FLAT-PACKED WITH 3 MONTHS LEAD-TIME

IMPLEMENTED IN 3 DAYS BY 4 PEOPLE ANYWHERE IN THE WORLD

LOW MAINTENACE

PORTABLE DESIGN FOR RELOCATION WHENEVER NECESSARY

Business hub and water purification
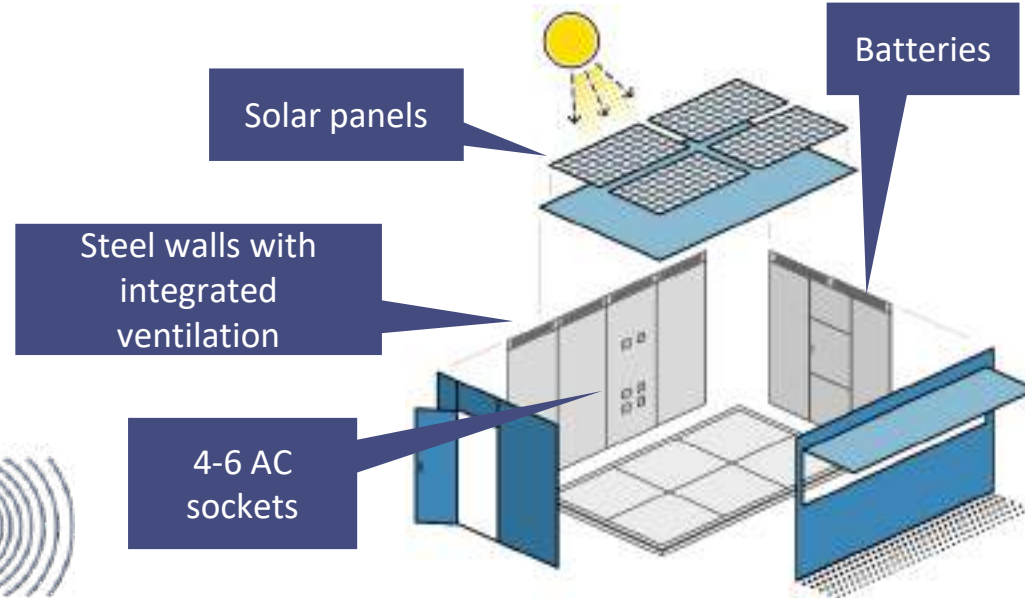
Refugee camp
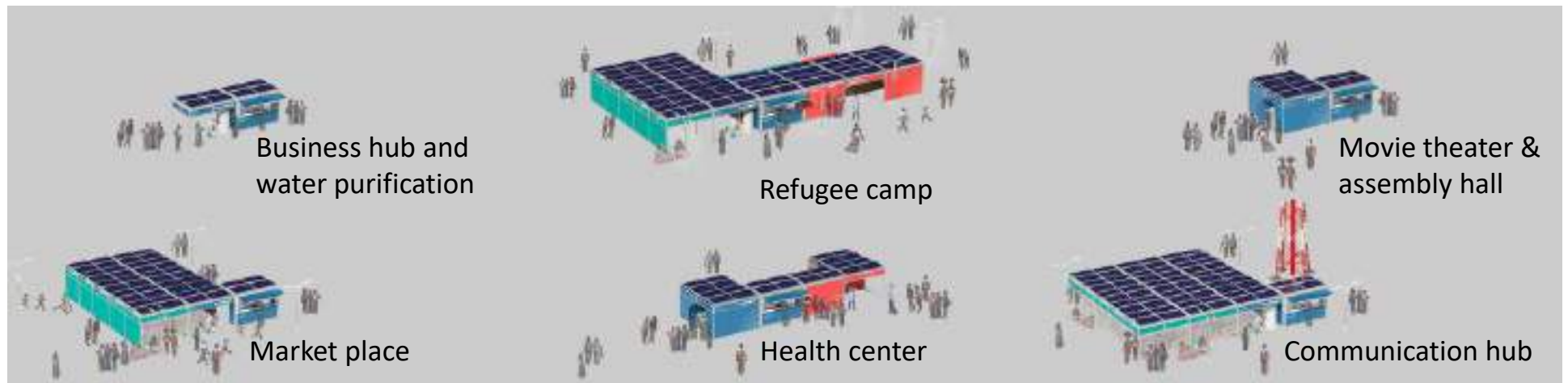
Movie theater & assembly hall

Market place

Health center

Communication hub

Solarkiosk: Social enterprise with a grid-independent off-the-shelf architecture solution

Lars Krückeberg

SOLAR KIOSK

1 B2B → Rented to local operators

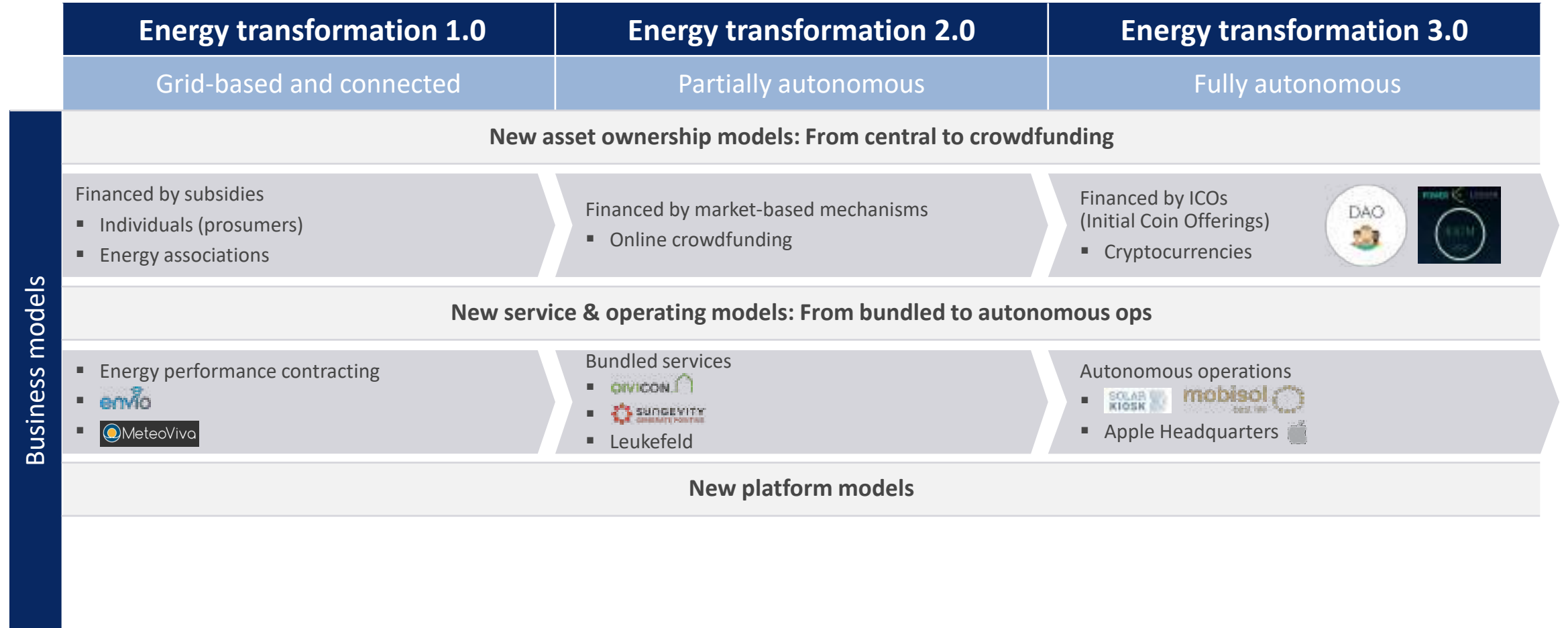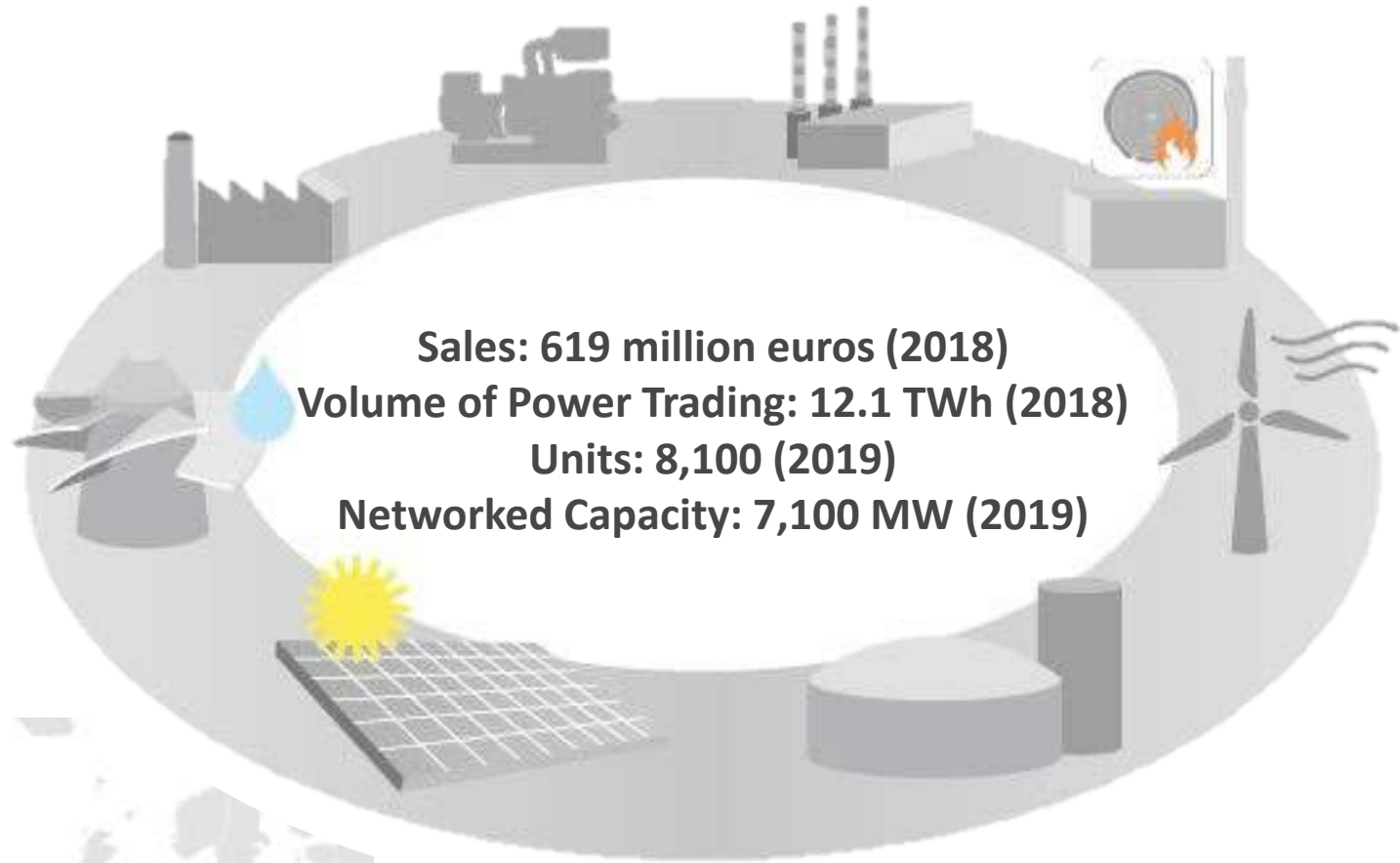**2** B2B → Sold to or co-branded with corporate partners

Botswana

Kenya

Tanzania

Energy transformation 1.0 – 3.0: Evolution of business models

Energy transformation 1.0	Energy transformation 2.0	Energy transformation 3.0
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New asset ownership models: From central to crowdfunding

Financed by subsidies	Financed by market-based mechanisms	Financed by ICOs (Initial Coin Offerings)
▪ Individuals (prosumers)	▪ Online crowdfunding	▪ Cryptocurrencies
▪ Energy associations		

New service & operating models: From bundled to autonomous ops

Energy performance contracting	Bundled services	Autonomous operations
▪ envio	▪ aivicon	▪ SOLAR KIOSK mobisol
▪ MeteoViva	▪ SUNGEVITY	▪ Apple Headquarters
	▪ Leukefeld	

New platform models

Business models

Next Kraftwerke operates a platform for demand response and virtual power plants

NEXT BOX

Sales: 619 million euros (2018)
Volume of Power Trading: 12.1 TWh (2018)
Units: 8,100 (2019)
Networked Capacity: 7,100 MW (2019)
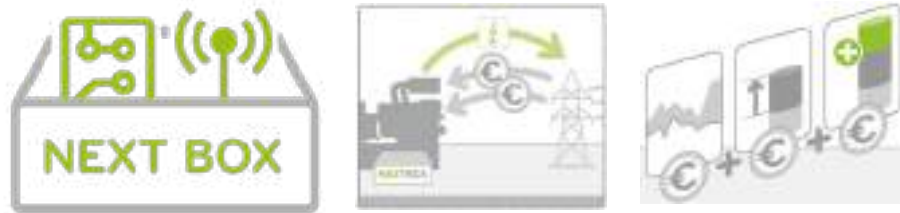
With 3,100 MW, Next Kraftwerke is the largest trader of solar power in Germany

Source: Next Kraftwerke (2019)

Energy platform models based on Blockchain: EWF and ETIBLOGG

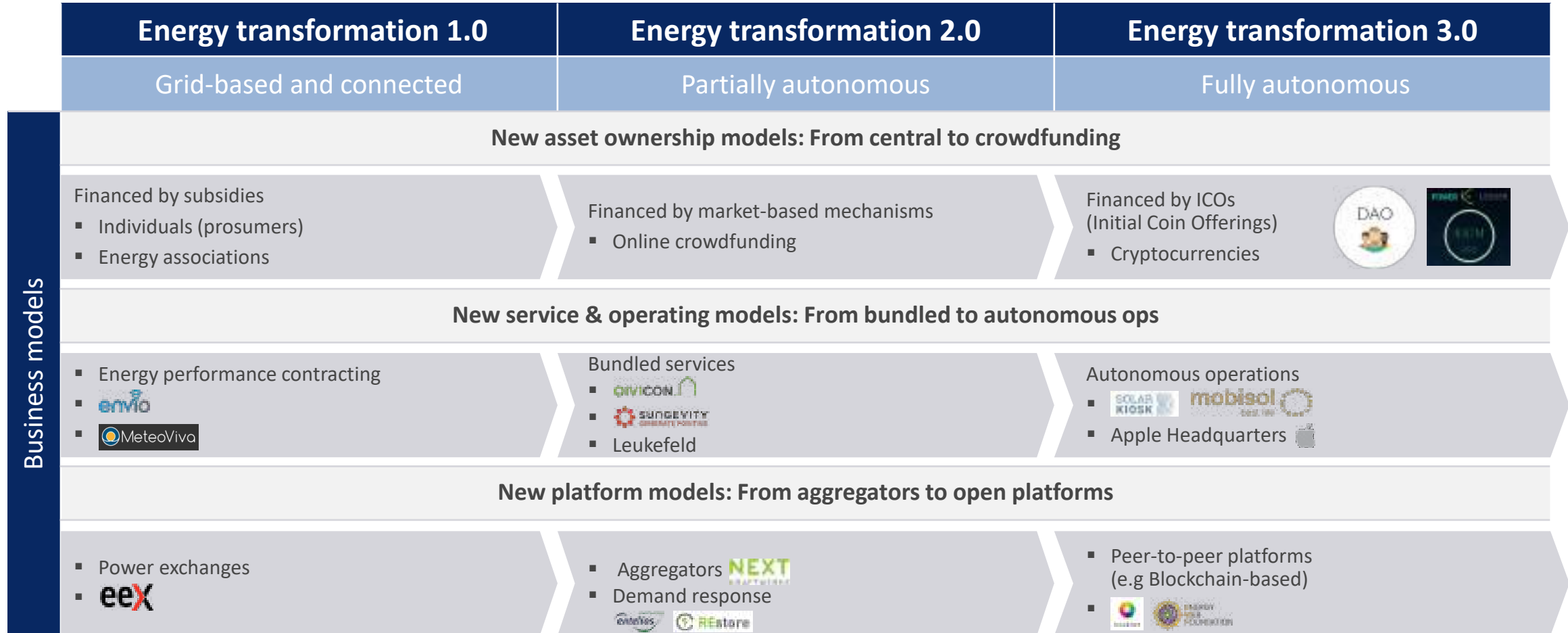**EWF - Blockchain platform for energy services**

ETIBLOGG - Energy Trading vIa Blockchain-Technology in the LOcal Green Grid
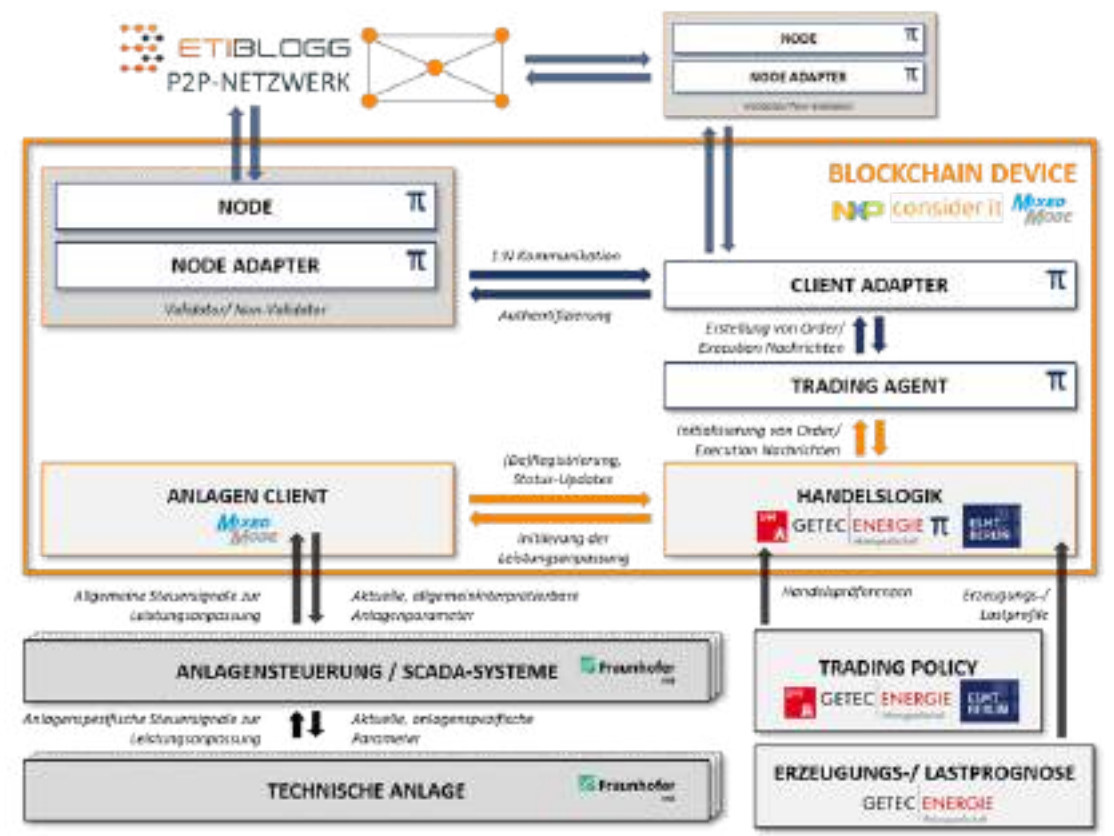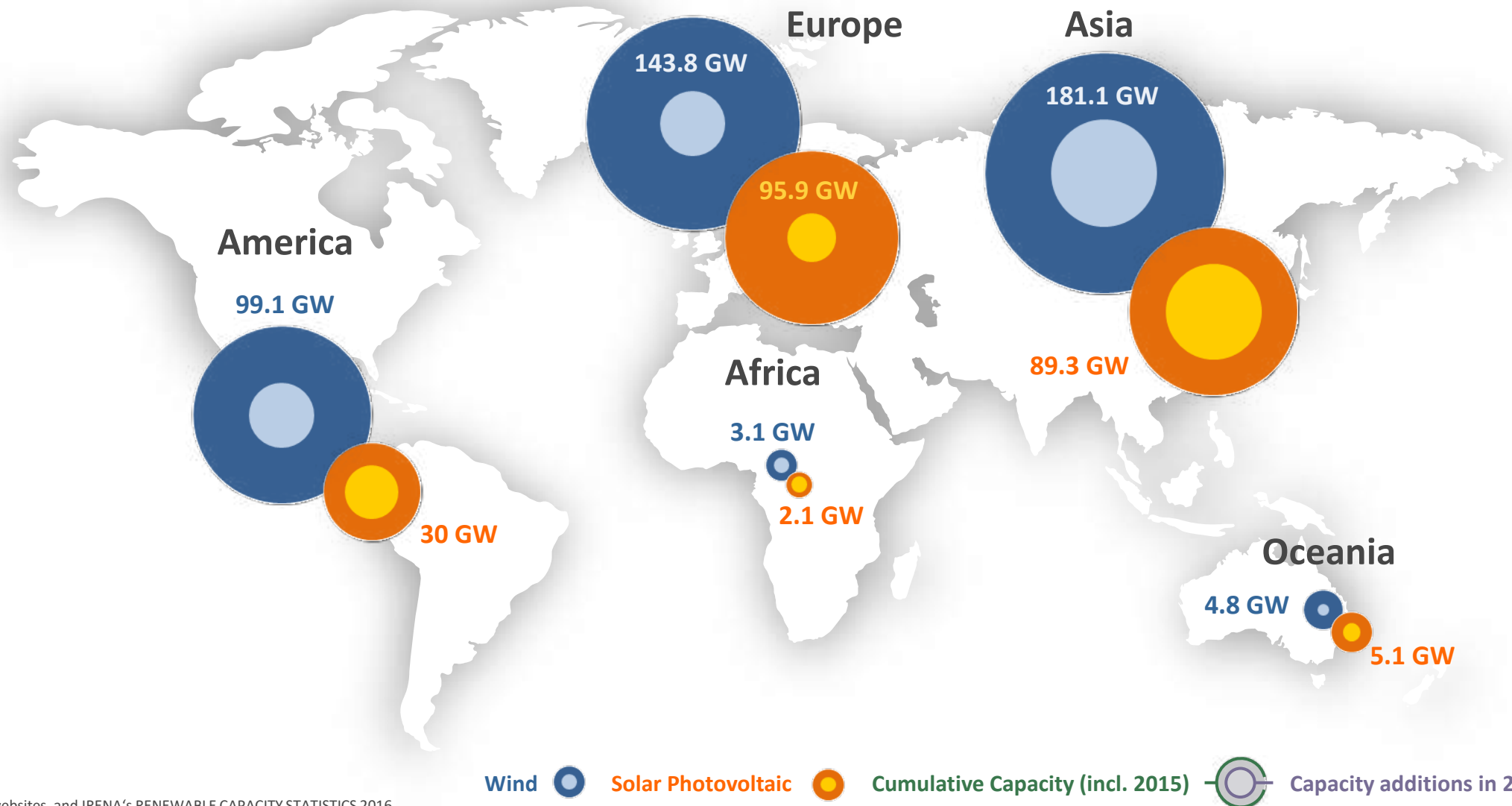
Energy transformation 1.0 – 3.0: Evolution of business models – what competencies are needed?

Energy transformation 1.0	Energy transformation 2.0	Energy transformation 3.0
Grid-based and connected	Partially autonomous	Fully autonomous
New asset ownership models: From central to crowdfunding		
Financed by subsidies ▪ Individuals (prosumers) ▪ Energy associations	Financed by market-based mechanisms ▪ Online crowdfunding	Financed by ICOs (Initial Coin Offerings) ▪ Cryptocurrencies
New service & operating models: From bundled to autonomous ops		
▪ Energy performance contracting ▪ envio ▪ MeteoViva	Bundled services ▪ envicon ▪ SUNGEVITY ▪ Leukefeld	Autonomous operations ▪ SOLAR KIOSK, mobisol ▪ Apple Headquarters
New platform models: From aggregators to open platforms		
▪ Power exchanges ▪ eeX	▪ Aggregators NEXT ▪ Demand response	▪ Peer-to-peer platforms (e.g Blockchain-based)

Business models

Business models of energy transformation 2.0 and 3.0 are introduced with more and more momentum

Europe
143.8 GW
95.9 GW

Asia
181.1 GW
89.3 GW

America
99.1 GW
30 GW

Africa
3.1 GW
2.1 GW

Oceania
4.8 GW
5.1 GW

Wind   Solar Photovoltaic   Cumulative Capacity (incl. 2015)   Capacity additions in 2015

ESMT BERLIN

Business models of energy transformation 2.0 and 3.0 are introduced with more and more momentum

Europe 143.8 GW / 95.9 GW

Asia 181.1 GW / 89.3 GW

America 99.1 GW / 30 GW

Africa 3.1 GW / 2.1 GW

Oceania 4.8 GW / 5.1 GW

Wind — Solar Photovoltaic — Cumulative Capacity (incl. 2015) — Capacity additions in 2015

Analysis: Six core characteristics of new business models in the energy transformation

1 Expertise in digitalization

2 Customer-centricity

3 Financing and enabling of asset ownership

4 Technology leads and product innovation

5 Partnerships and bundled services

6 Platforms/ ecosystems

Upcoming book to analyze governance and business model innovation on a global scale
Free for download at ubiquity press

Contents

- Introduction: The rise of decentralized renewable energy generation

- Regulatory and policy incentives – establishing governance of decentralized energy systems

  - Country analysis: Australia, China, Denmark, Germany, India, Italy, California and New York

- Business models beyond subsidies – which core competencies are needed?

  - Case analysis: Envio Systems, Timo Leukefeld, Entelios, SOLshare, Mobisol, Solarkiosk, Power Ledger

- The three phases of the energy transformation – top-down and bottom-up

- Global game changer – leading the future

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