



DISTRIBUTED LEDGER IN RENEWABLE ENERGY TRANSACTIONS

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AGENDA

- I. Developments in Renewable Energies
- II. Distributed Ledger Technology in Energy
- III. Transaction process – efficiency and risk

PÖYRY IS AN INTERNATIONAL CONSULTING AND ENGINEERING COMPANY



ENERGY

Thermal Power & Renewable Energy,
Hydropower, Transmission &
Distribution, Nuclear Energy

Ranked

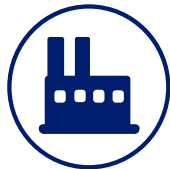
(Source ENR 2018)

Top 10

in power generation in the world

25+ countries

rely upon Pöyry's energy management consulting



INDUSTRY

Forest Industry
Chemicals & Biorefining
Mining & Metals

Ranked

(Source ENR 2018)

#1

in Pulp, Paper
& Board

#6

in Industrial
Engineering

Delivered projects for

(Source ENR 2018)

90%

of the world's pulp and paper companies



INFRASTRUCTURE, WATER & ENVIRONMENT

Rail, roads, traffic planning, tunnels &
urban development, Water lifecycle
services, Environmental services
(strategy to operations)

More than

1,000 km

of transportation tunnels in
the last decade

Environmental

3,000+

due diligences
in last decade

Water

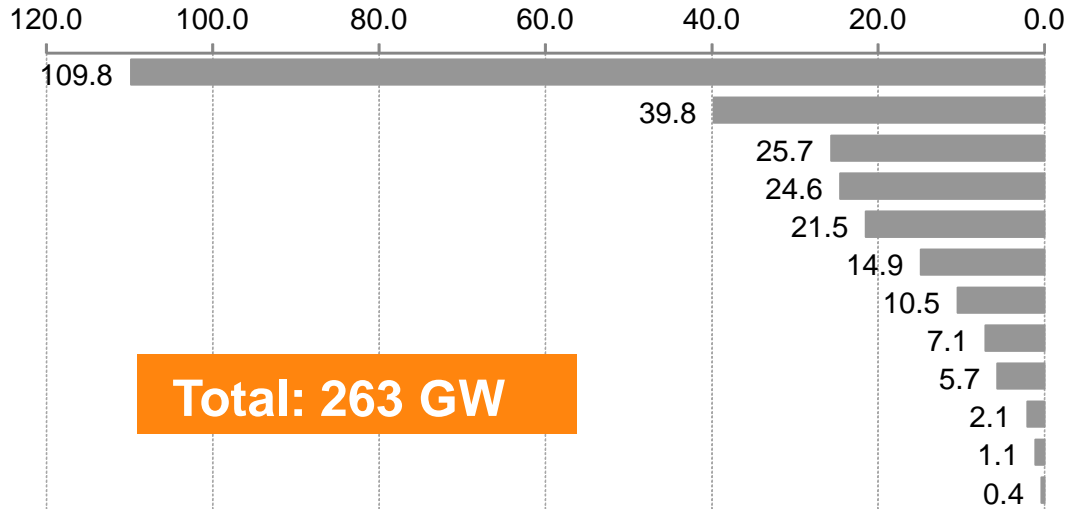
20M

people benefiting
from cleaner water in
Europe and Middle East

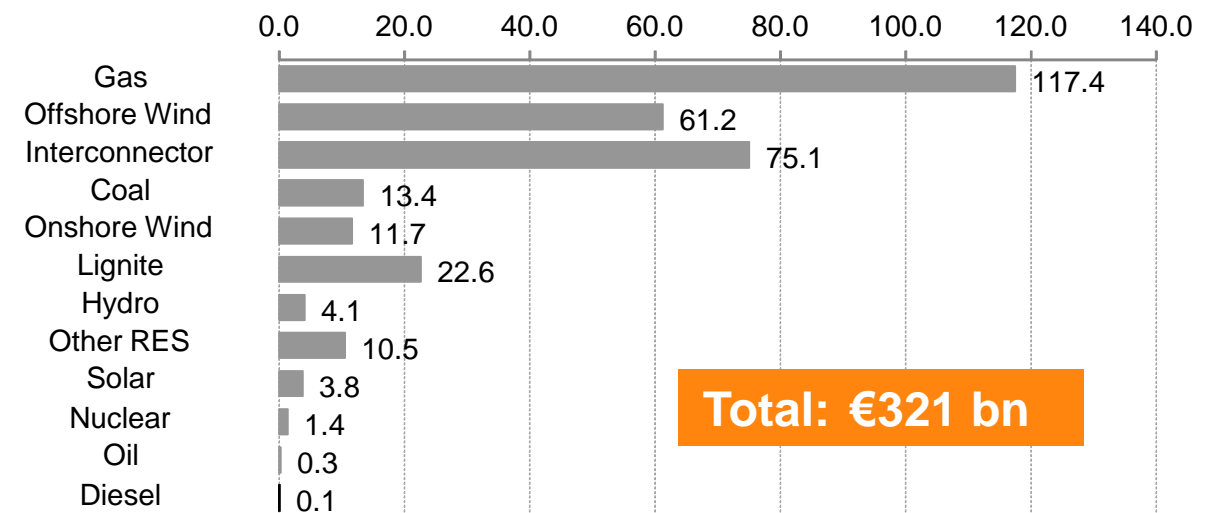
OUR TRACK RECORD

Since 2008, Pöyry experts have valued ~263 GW of Electricity Generation capacity across Europe, MENA and the Americas with a combined value of around €322 bn*

SUM OF PROJECT CAPACITY (GW)



SUM OF PROJECT VALUE (€BN)



* Period covered: 2008 to April 2018

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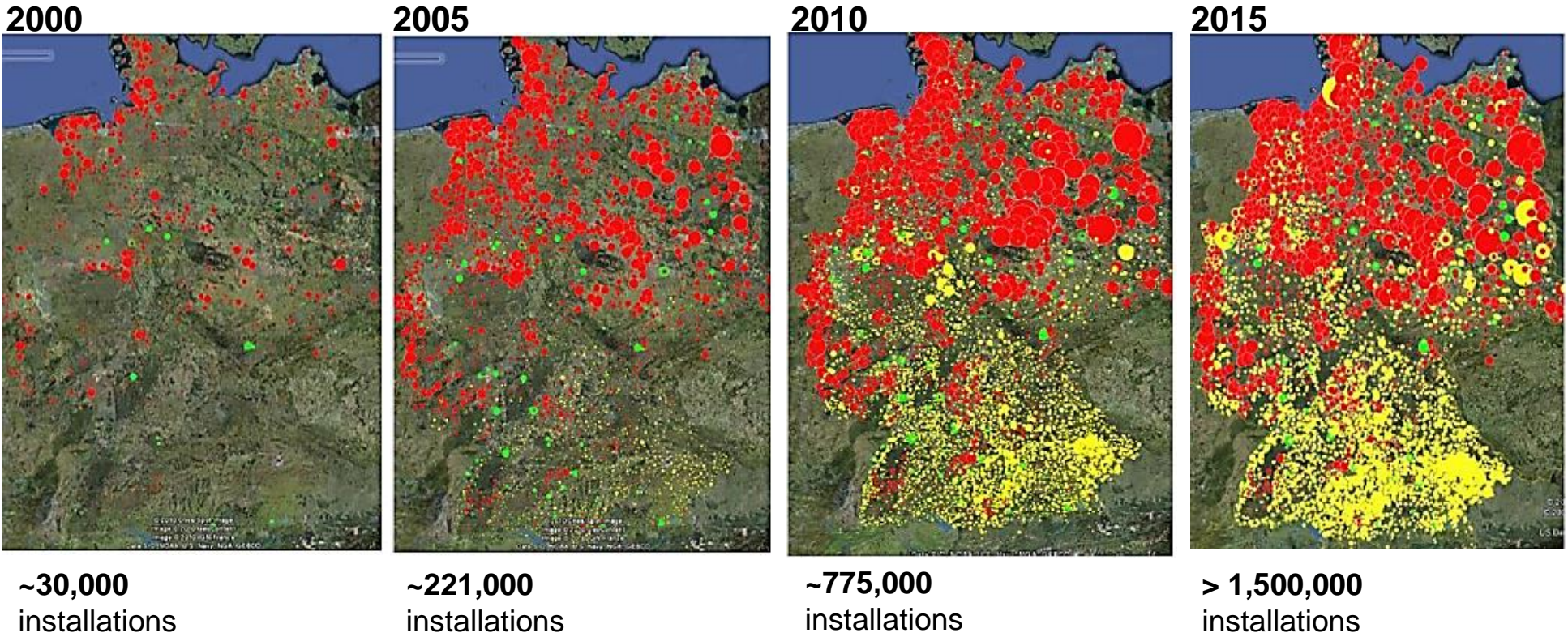
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THE GERMAN EXAMPLE

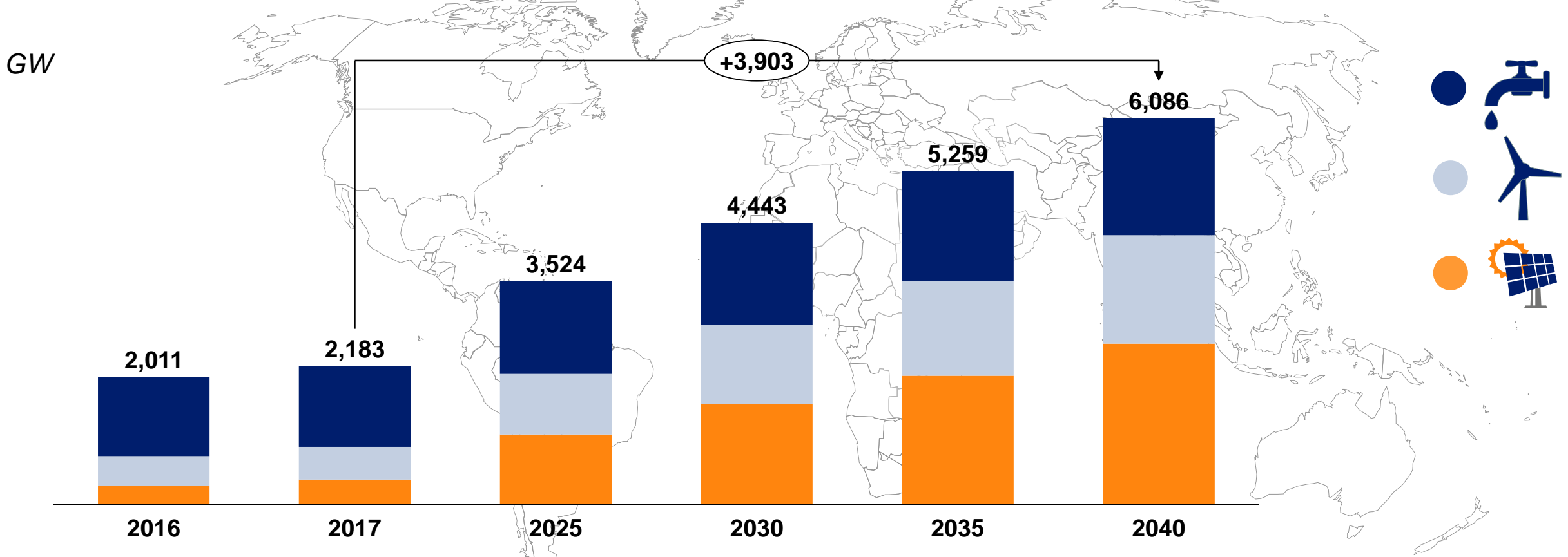
The new energy world will be highly decentralized with billions of new assets - the number of asset valuation is increasing steadily, for transactions and financing



Source: Arbeitsgemeinschaft Energiebilanzen, Pöyry

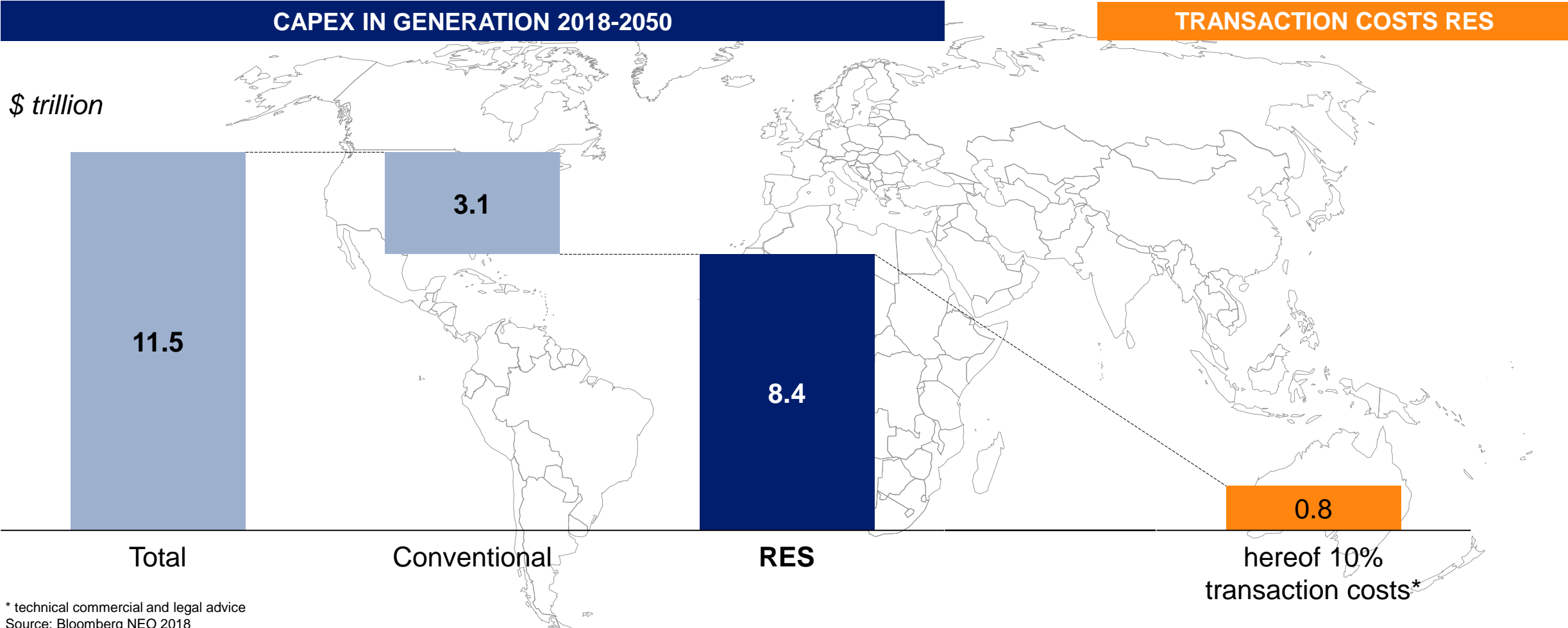
ADDITIONAL ~4,000 GW HYDRO, WIND AND SOLAR GENERATION EXPECTED TO BE INSTALLED GLOBALLY UNTIL 2040

GLOBAL INSTALLATION IN WIND, SOLAR AND HYDRO 2018-2040



* Outlook according to: IEA, New Policies Scenario
Source: IEA 2018, Pöyry

\$8.4 TRILLION BEING INVESTED FROM 2018 TO 2050 GLOBALLY IN RES GENERATION CAPACITY



* technical commercial and legal advice
Source: Bloomberg NEO 2018

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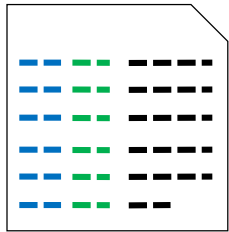
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BLOCKCHAIN - DISTRIBUTED LEDGER TECHNOLOGY (DLT)

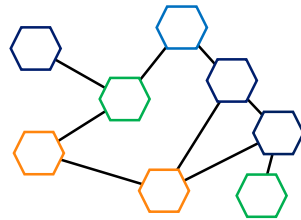
*“...an **incorruptible** digital ledger of economic transactions that can be programmed to **record** not just financial transactions but virtually **everything of value and importance** ... and anything else that can be **expressed in code.**”*

Don Tapscott, 3/2015



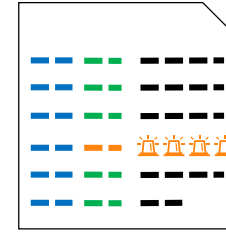
LEDGER

- Registry or decentral database of (sequential) transactions



DISTRIBUTED

- Not held by a central authority
- Spread amongst peers (nodes)



IMMUTABLE

- Indelible and unalterable
- Confirmed transactions cannot* be overwritten by anyone

```
011011011-ONLY
00111100101010
SOME-DATA-0001
11010110001110
CAN-BE-SEEN-01
11011100010101
0101-BY-YOU-11
```

SECURE*

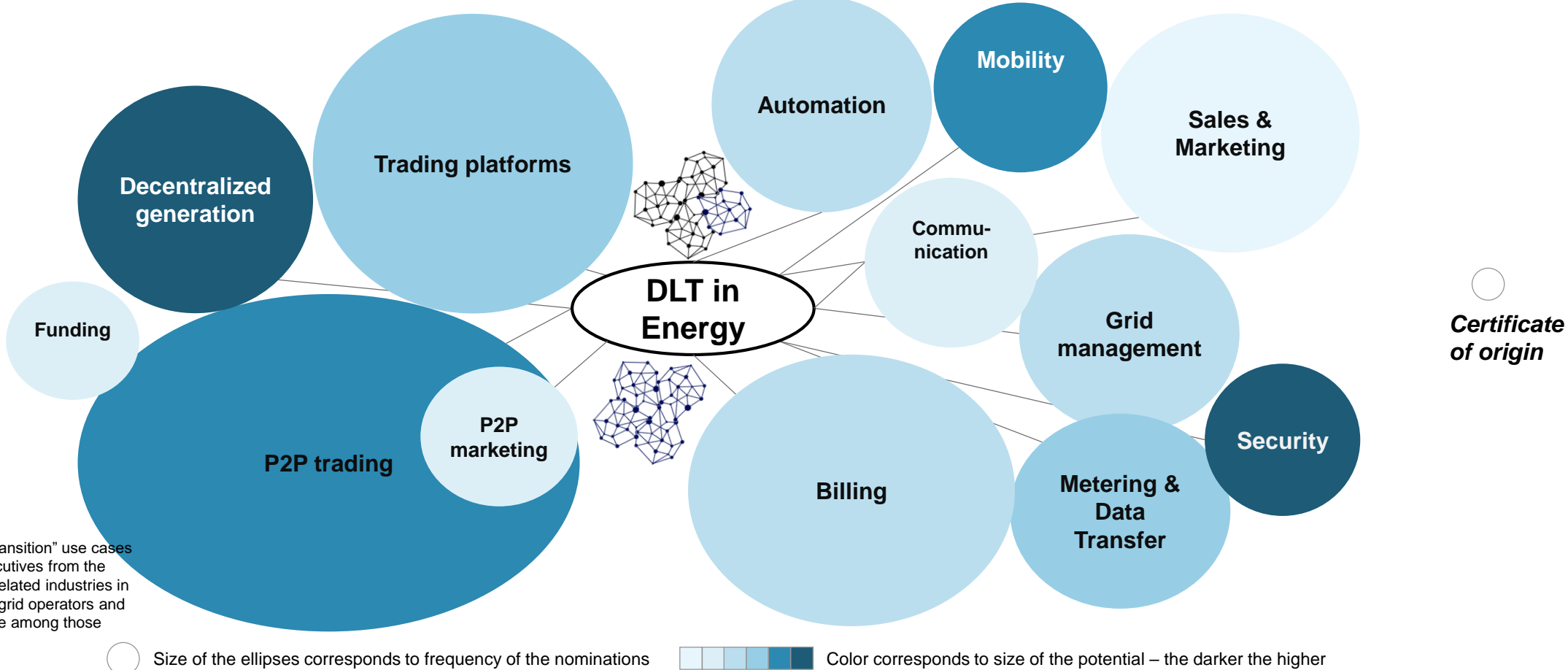
- Usually implemented using public key cryptography
- Designed to be resistant to attack and fraud

* Whilst it is mathematically possible to break these features, it is essentially impossible because of the computation power/time needed

DLT WITH POTENTIAL FOR MANY USE CASES* IN THE ENERGY, FOCUSED ON PLATFORM AND PROCESSES

PLATFORM-BASED APPLICATIONS

PROCESS-BASED APPLICATIONS

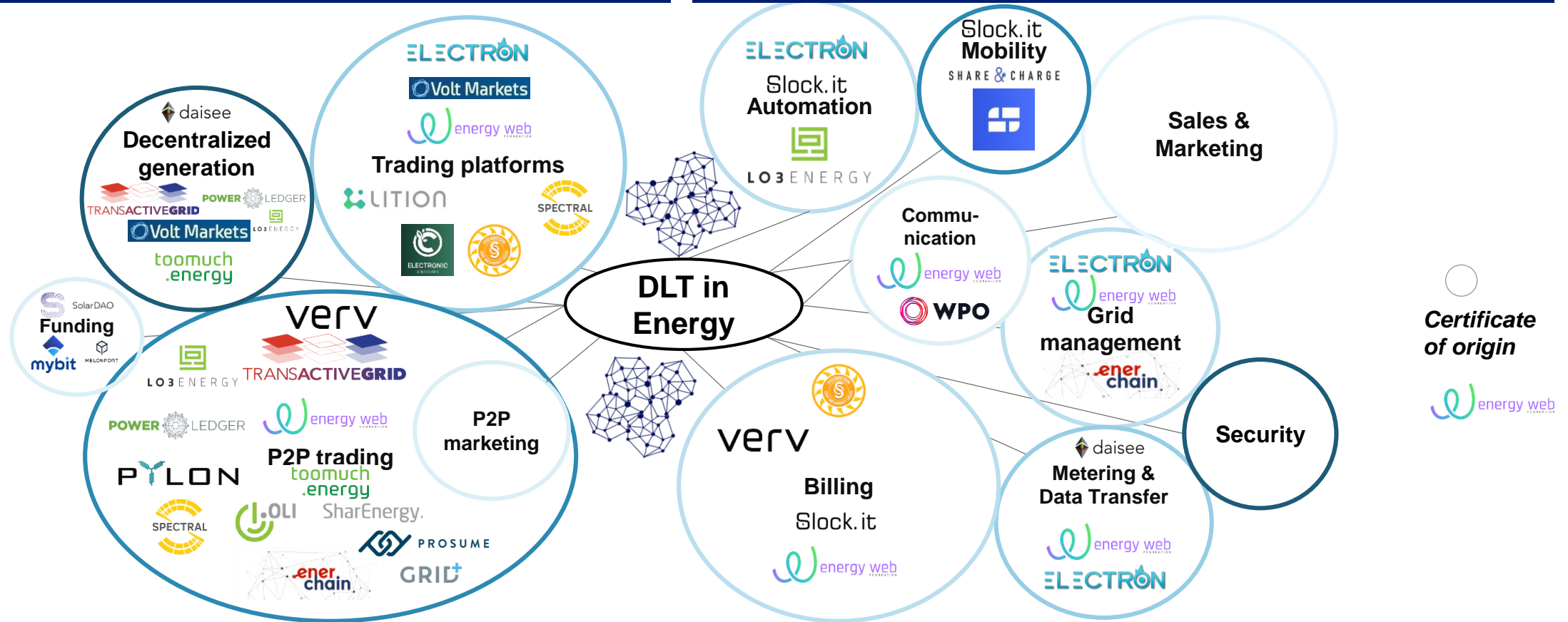


* "Blockchain in the energy transition" use cases based on a survey of 70 executives from the energy industry and energy-related industries in Germany. Energy providers, grid operators and energy service providers were among those represented.
Source: dena, ESMT, Pöyry

PILOTS ARE BEING EXPLORED GLOBALLY AND NEW BLOCKCHAIN-ENERGY-START-UPS ARE EMERGING

PLATFORM-BASED APPLICATIONS

PROCESS-BASED APPLICATIONS



Source: public information, dena, ESMT, Pöyry

Size of the ellipses corresponds to frequency of the nominations

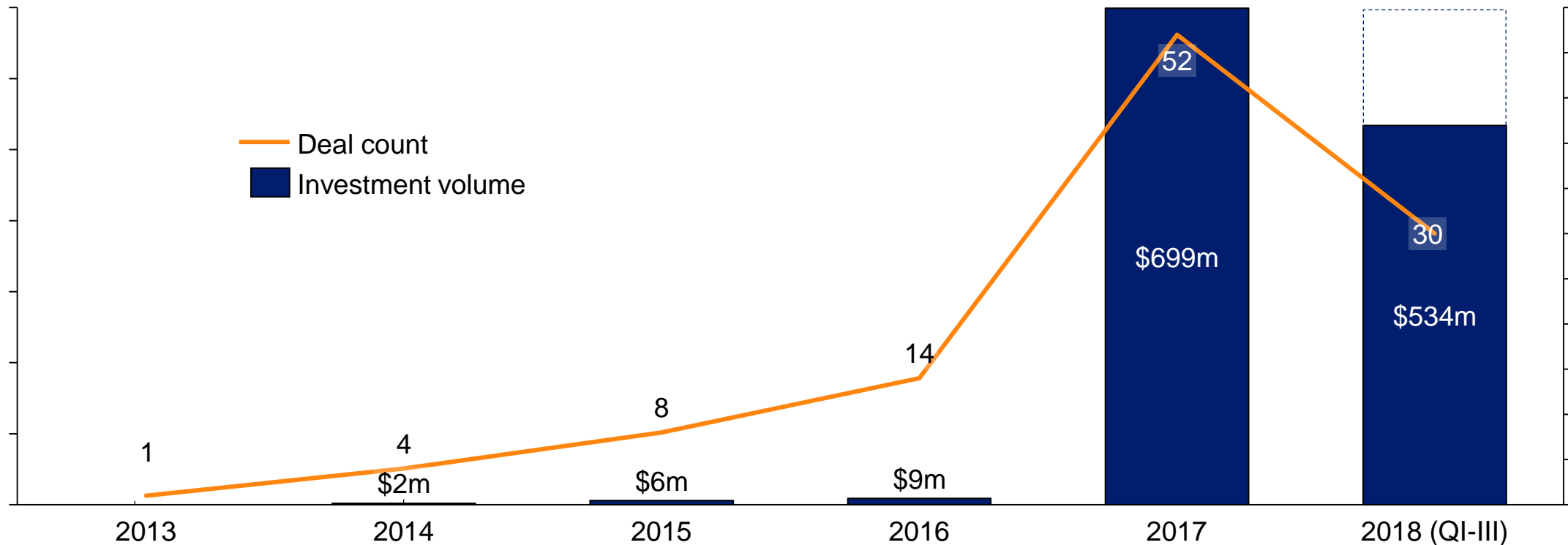


Color corresponds to size of the potential – the darker the higher

INVESTMENTS IN DLT IN THE LAST COUPLE OF YEARS MIGHT BE CONSIDERED TO HAVE PEAKED LAST TWO YEARS

INVESTMENTS IN ENERGY AND RELATED DLT PROJECTS, STARTUPS AND NUMBER OF DEALS 2013-2018

\$ million



Source: clean tech group 9/2018, Pöyry

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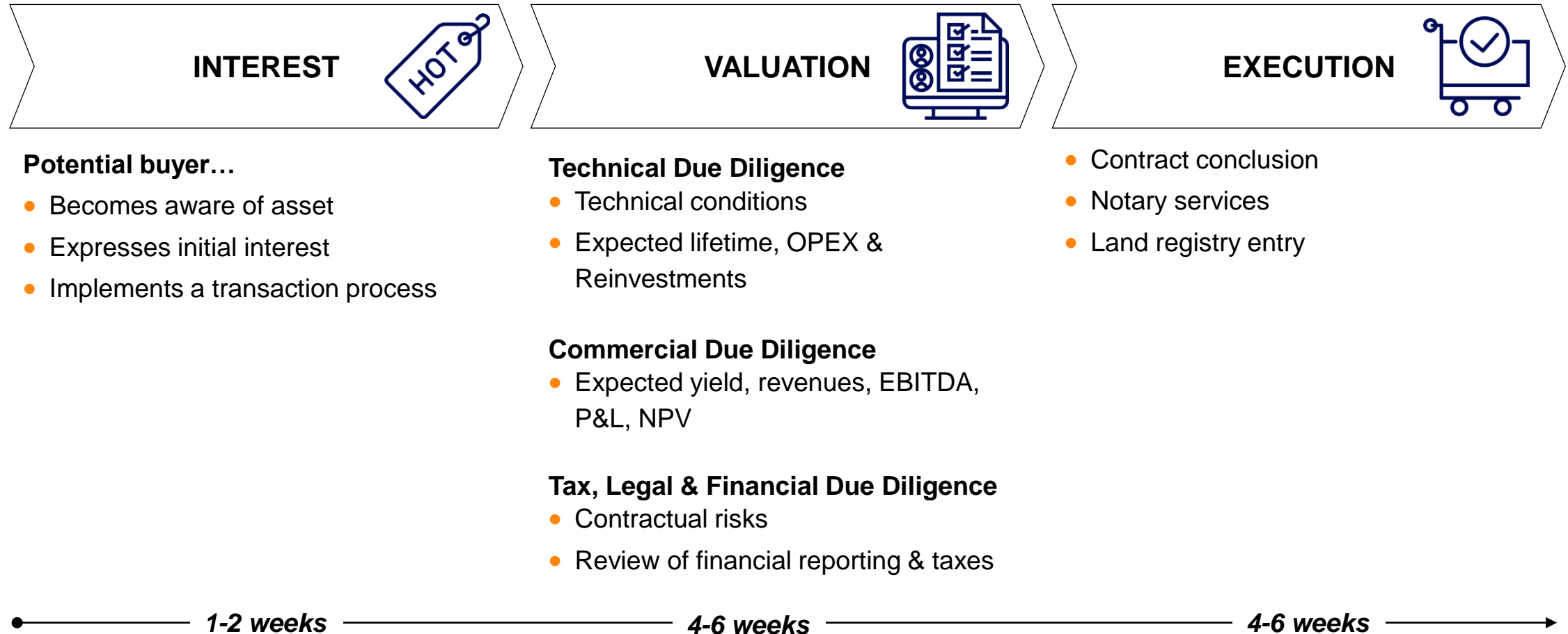
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PROBLEM – TRANSACTION PROCESS

Process
Efficiency

Risk
Mitigation

Solar transaction process takes 2-3 months, is suitable for large installations / utility scale



PROBLEM – ASSET VALUATION

Process
Efficiency

Risk
Mitigation

Asset valuation is expensive, ineffective and unsuitable for a new decentral energy world

HIGH TRANSACTION COSTS

- Transaction costs today are high and individual
- Site visits of tech. experts are necessary
- Cost for technical / commercial Due Diligence in a range ~1-2% of deal value
- Typically vendor and several potential investors conduct own analysis per deal



INEFFECTIVE METHODS

- Lack of digitized automated methods, each vendor is using his own, proprietary solution
- Existing valuation methods are designed for large scale
- Inappropriate for growing number of small and medium assets



COMPLEX FUNDING

- Risk premium for debt finance
- End of feed-in-tariffs leads to cash flow related lending



ERROR-PRONE

- Missing input data (from operations)
- Misinterpretation
- Merchant assets require real-time visibility



PROBLEM – ASSET FUNDING

Process
Efficiency

Risk
Mitigation

RES go merchant, financing requirements are increasing - low interest loans won't be enough

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TYPICAL RISKS AND UNCERTAINTIES IN PROJECTS

Process
Efficiency

Risk
Mitigation

PLANNING / DESIGN

CONSTRUCTION / BUILT

OPERATION

Addressed with DLT / analytics
in RES operation

Technical & management
(Local experience, technological maturity, ...)

Financing

(Supporting policies facilitating financing of upfront investment and leverage of capital)

Grid access risk

(Access, grid connection costs, priority dispatch,...)

Sudden policy change

(Sudden, retroactive or unexpected changes made in support schemes, quota, caps, ...)

Country

(Political stability, capital markets, economic development, legal system, corruption, ...)



Social acceptance

Policy design risks

Administrative

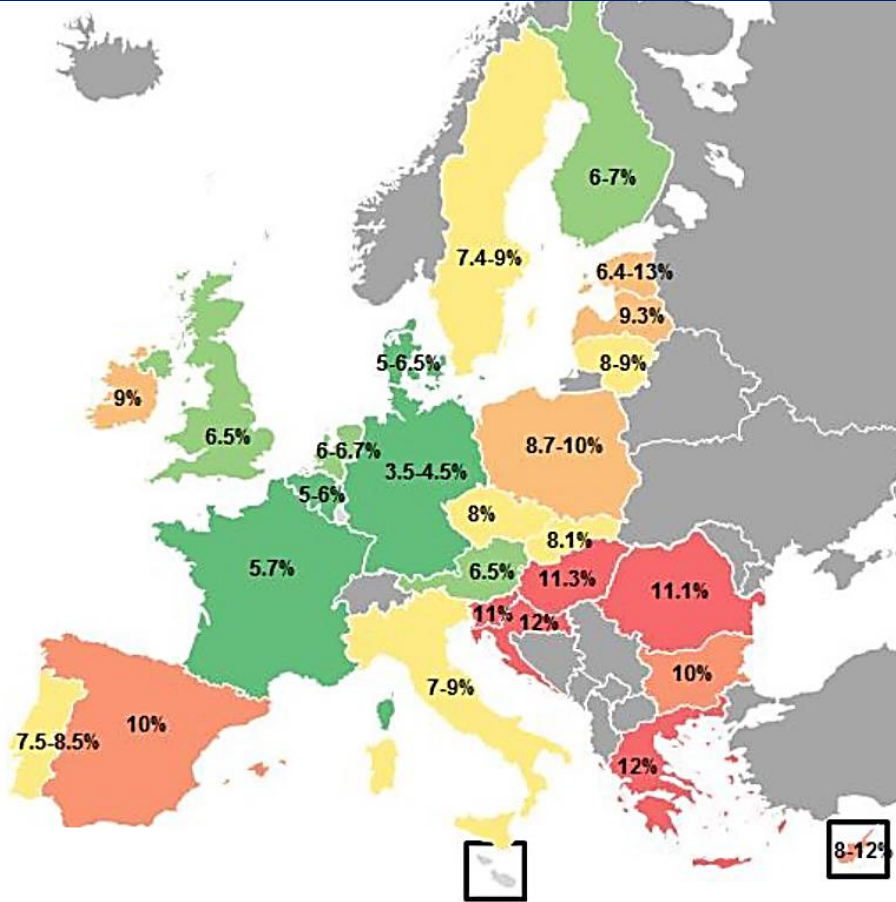
Market design & regulatory risk

WACC AND D/E RATIO FOR ONSHORE WIND

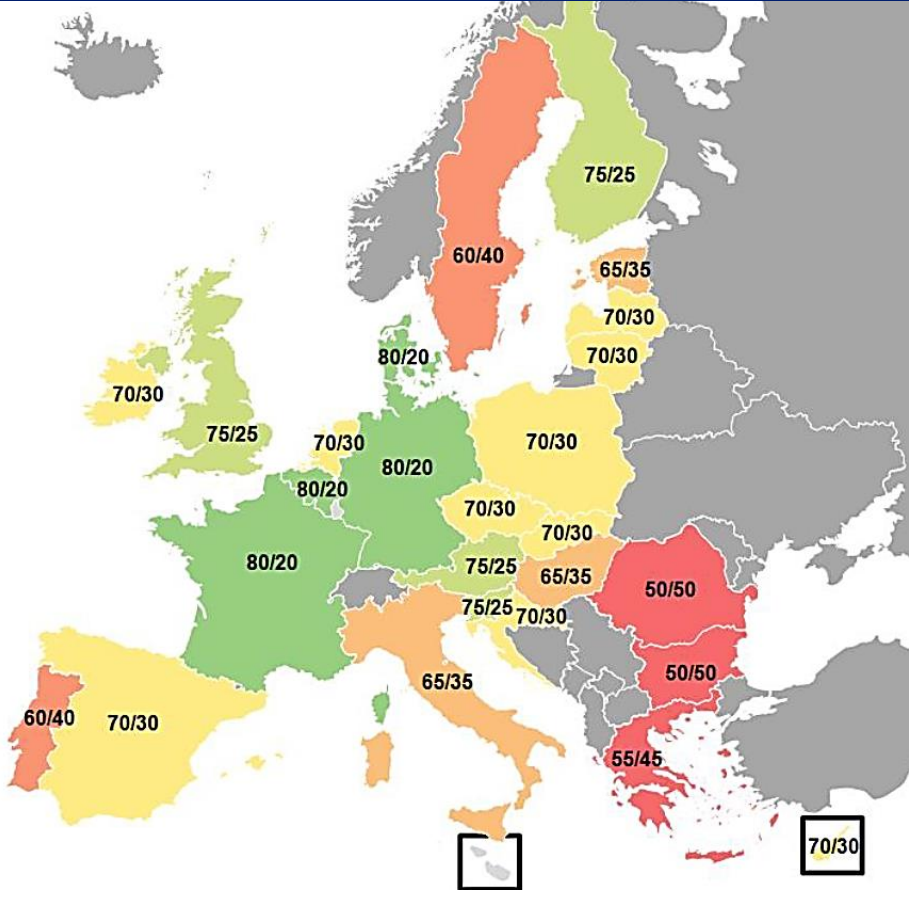
Process Efficiency

Risk Mitigation

WACC ONSHORE WIND (%)



DEBT/EQUITY RATIO ONSHORE WIND (%)

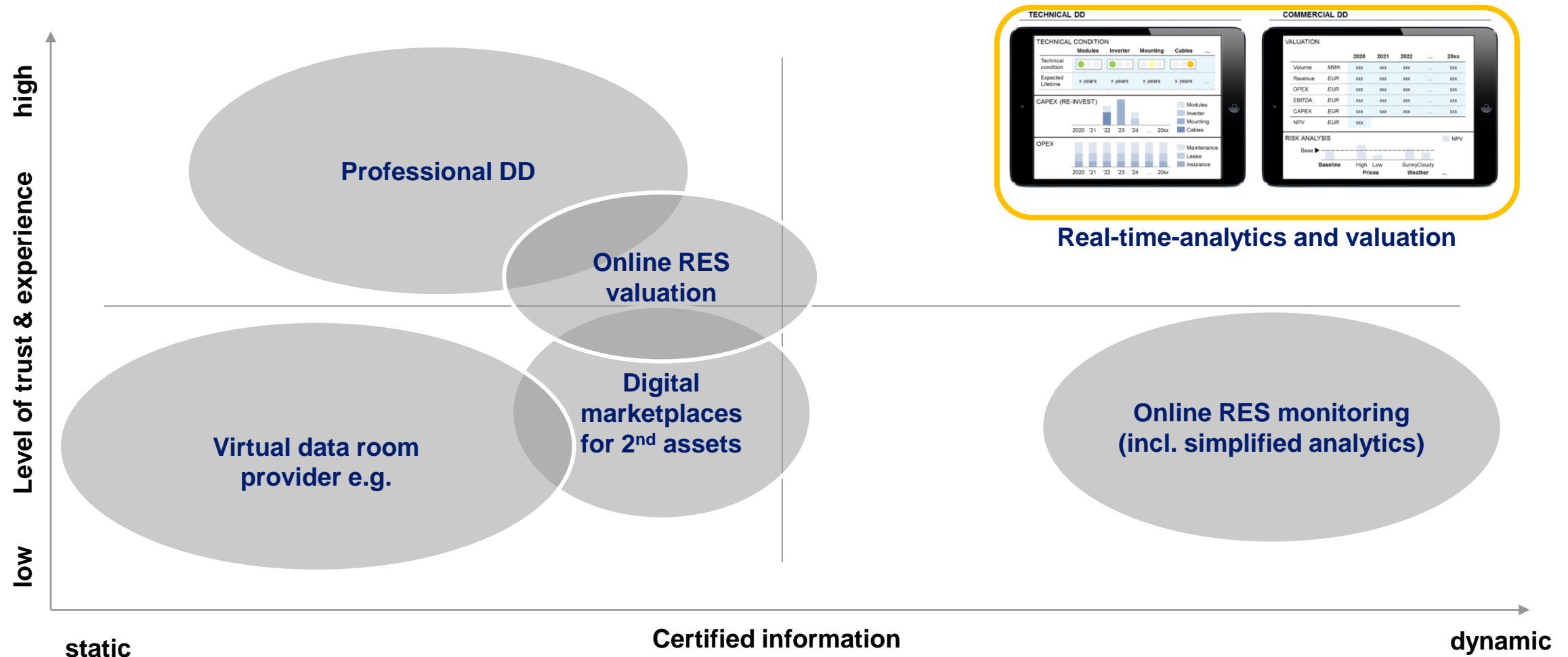


Source: DiaCore 2016, Pöyry

REAL TIME ANALYTICS AND DLT COULD BE MORE EFFICIENT, RELIABLE THAN CONVENTIONAL WITH STATIC INFORMATION






CURRENT SOLUTIONS DON'T COVER REAL-TIME ASPECTS

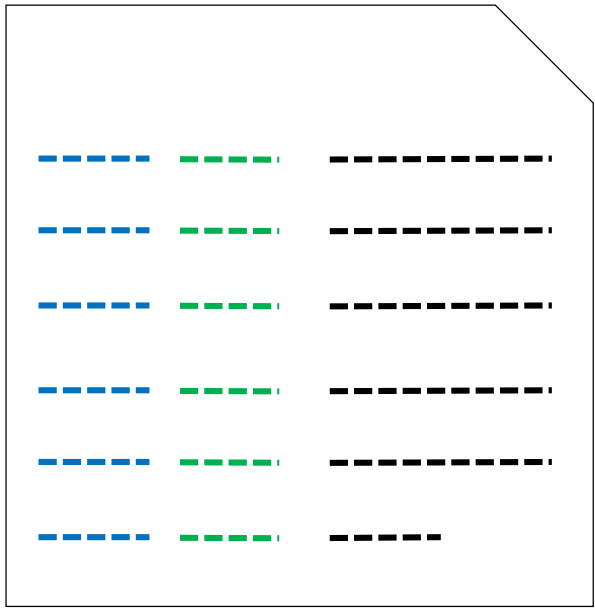


DYNAMIC VENDOR DATA AND ANALYSIS FOR INSTANT AND CERTIFIED ASSET INFORMATION TO ALL RES STAKEHOLDER

DATA FEED

- 
 - Historical and
 - 3rd party IO data
- 
 - Agreements
 - Financial reports
 - O&M contracts
 - ...
- 
 - Operational data (SCADA, ...)

DLT



- Characteristics:*
- Incorruptible, immutable
 - Authenticated
 - Secure

ANALYTIC & GUI

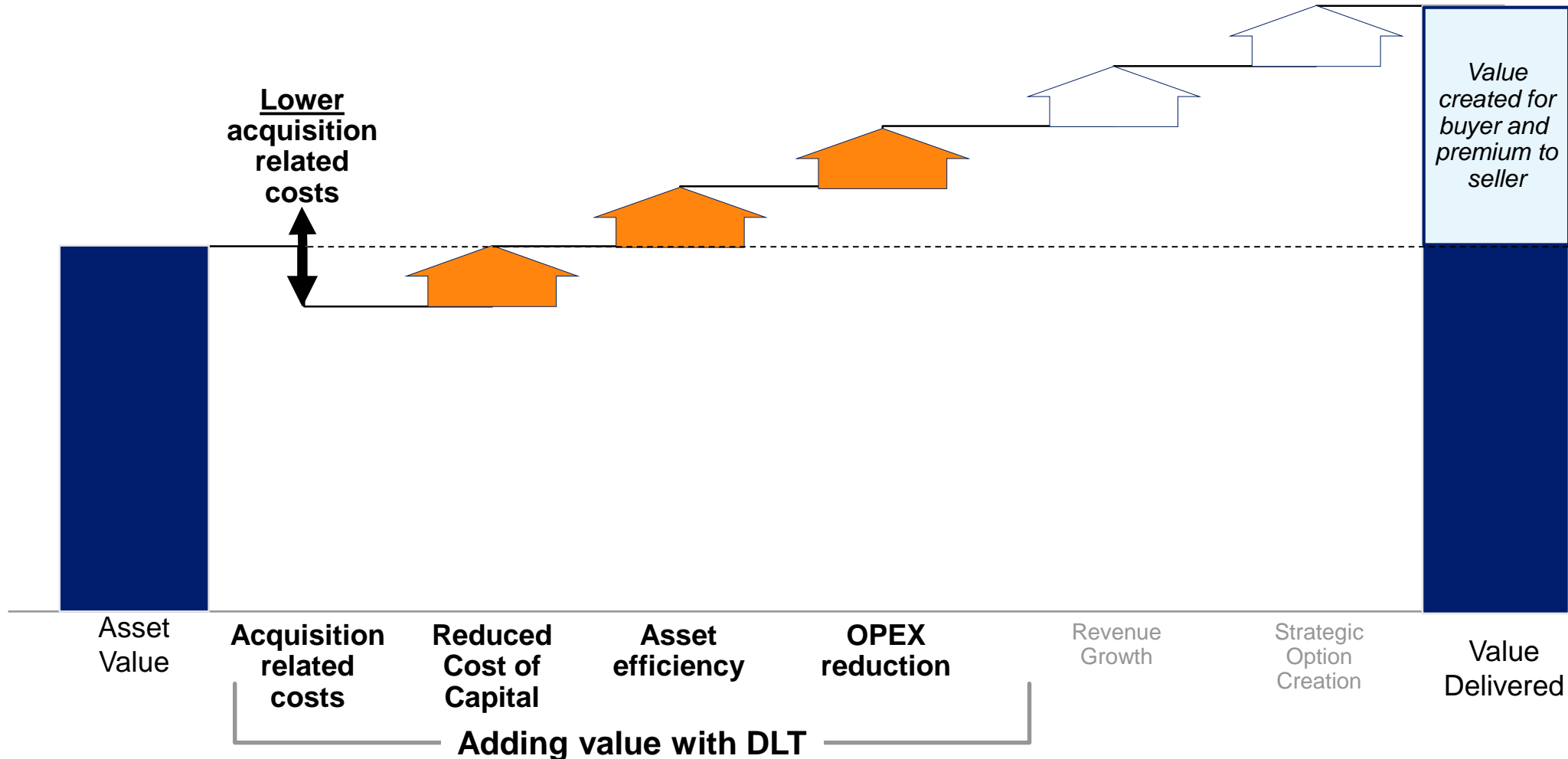
STAKEHOLDER

- Utilities
- OEMs
- Private Equity
- Insurance companies
- Pension funds
- Other financial Institutions
- Large asset holders
- FM and Service provider

REAL-TIME TRANSPARENCY IS VALUABLE IN THE NEW ENERGY WORLD

Process Efficiency

Risk Mitigation





THANK YOU!

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