The Opportunities of Blockchain for Renwable Energy Technologies

#REMforum, June 1, 2018

Dr. Christoph Sutter | Head Division New Energies, Member Executive Board Axpo Power AG, Chairman elblox AG

```
func (e *Elblox) init() error {
	log.Println("Initializing the Elblox platform...")
	// check if account file exists and skip smart contract deployment then
	if e.p.Addr == nil {
		// deploy smart contract if not already deployed
		addr, err := e.deploy()
		if err != nil {
			return err
		}
		log.Printf("Elblox smart contract address: %v", addr.Hex())
		// write smart contract addr to file
		if err := e.p.SetSmartContractAddress(addr); err != nil {
			return err
		}
		// register the smart contract account
		if err := e.p.Register(addr.Hex()); err != nil {
			return err
		}
		return nil
	}
	// bind to the already deployed smart contract
	var err error
	log.Printf("[%v] Elblox binding to already deployed smart contract %v", e.p.ID, e.p.Addr.Hex())
	sc, err := contract.NewElblox(*e.p.Addr, backends.NewRPCBackend(e.p.c.Eth()))
	e.session = &contract.ElbloxSession{
		Contract: sc,
		CallOpts: bind.CallOpts{
			Pending: true,
		},
		TransactOpts: bind.TransactOpts{
			From:   e.p.c.Auth().From,
			Signer: e.p.c.Auth().Signer,
		},
	}
```

With what type of electricity did you charge your mobile phone last night?

VIDEO
PHOTO
SQUARE

ELBLOX PLATFORM. THE REGIONAL P2P ENERGY MARKET

Driving Innovation Across the Energy Sector

Elblox: Vision

INTELLIGENT ALLOCATION OF PRODUCTION TO CONSUMPTION

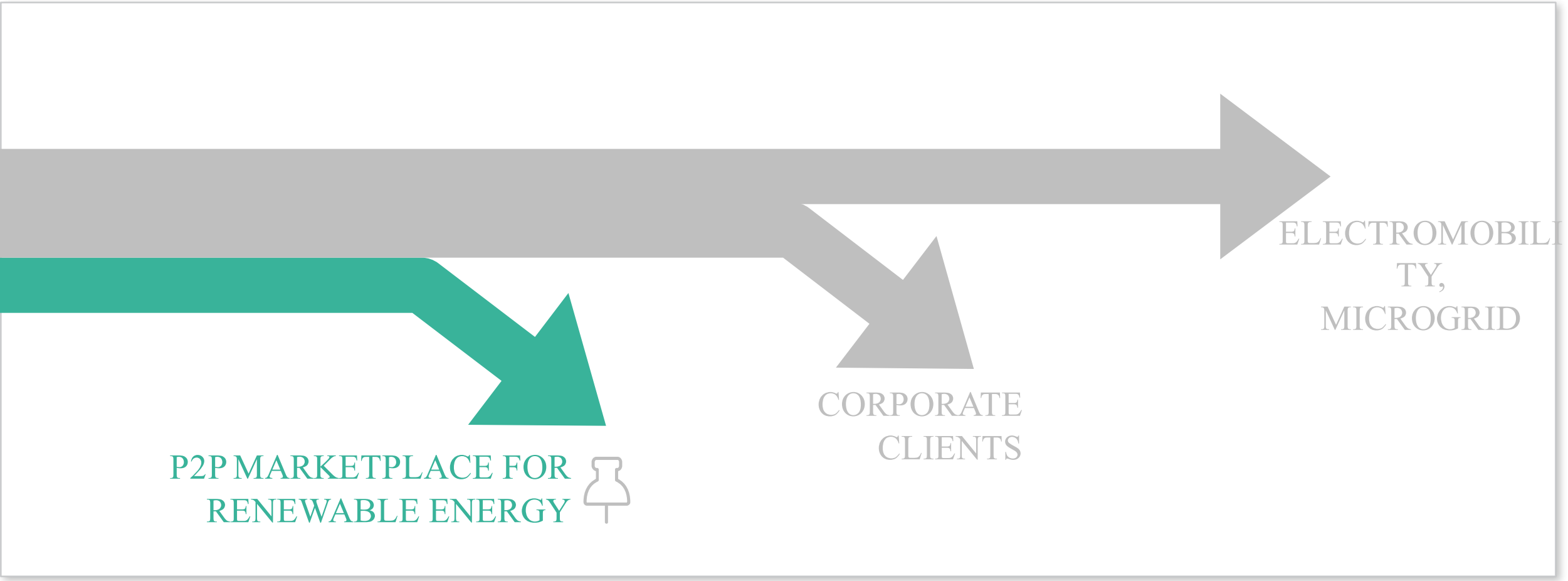
DOCUMENTED ON A CONSORTIUM BLOCKCHAIN

MARKET-BASED PRICING DEPENDING ON SUPPLY AND DEMAND

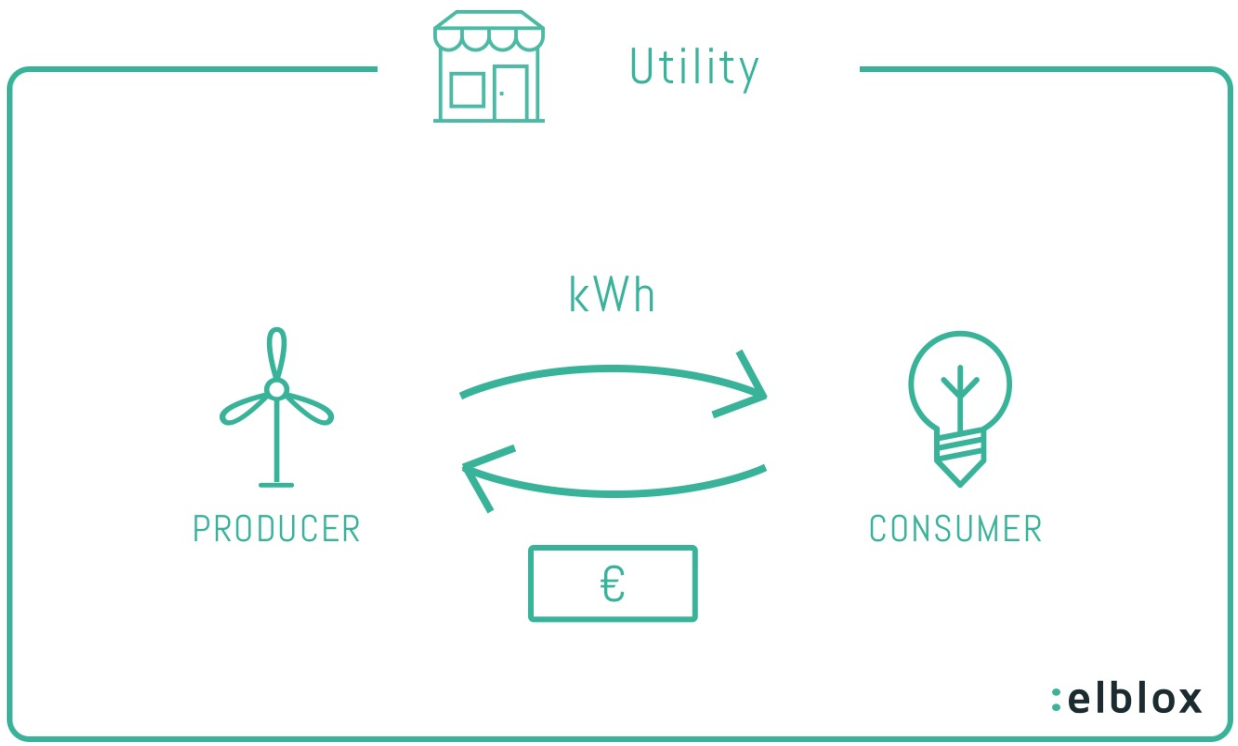
HIGH-RESOLUTION DOCUMENTATION OF THE ORIGIN OF ELECTRICITY

REAL-TIME SETTLEMENT ALGORITHM

Elblox: Use Cases

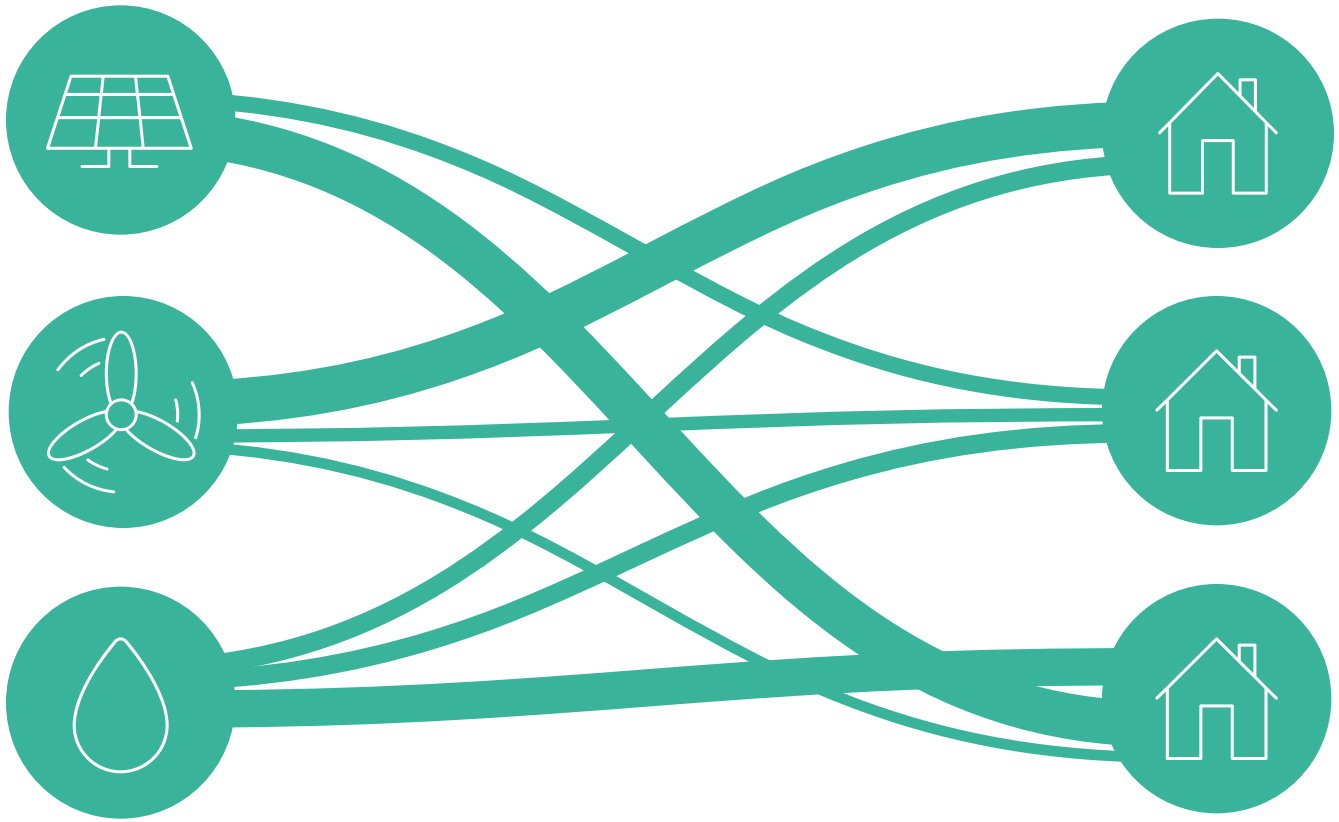


Elblox Platform: The regional P2P Energy Market



- Personalization of electricity
- Peer-2-peer business relationship
- Digitalization of the supply chain
- Low marketing and transaction costs
- Proof of origin based on blockchain technology

Elblox Platform



REGIONALITY

Regional price signal strengthens investments close to the consumer

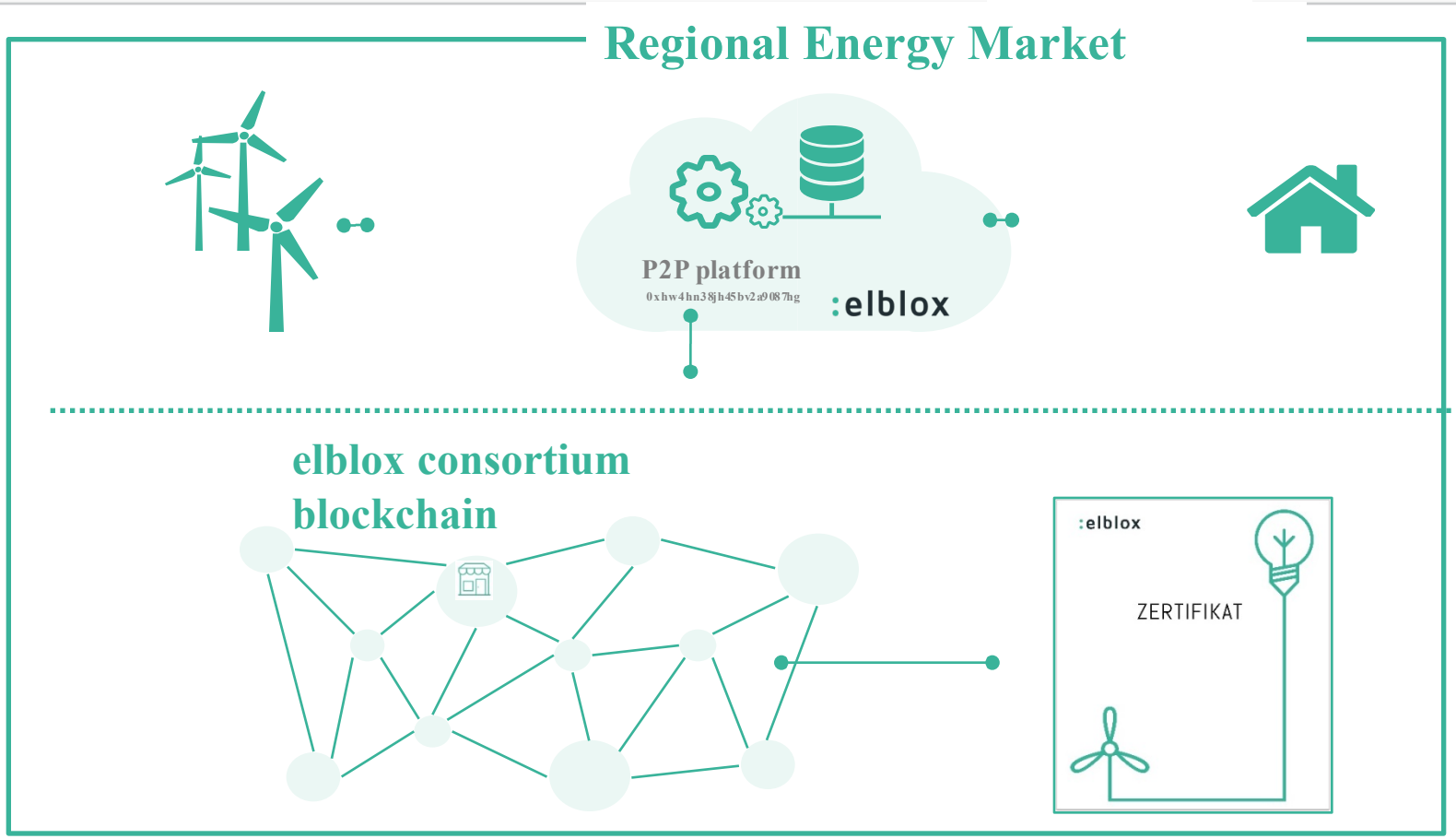
SIMULTANEITY

Fluctuating electricity production generates price signal for flexibility in the respective marketplace

NO STATE SUBSIDY

Platform allows renewable plants to earn a premium even after the subsidy schemes have expired

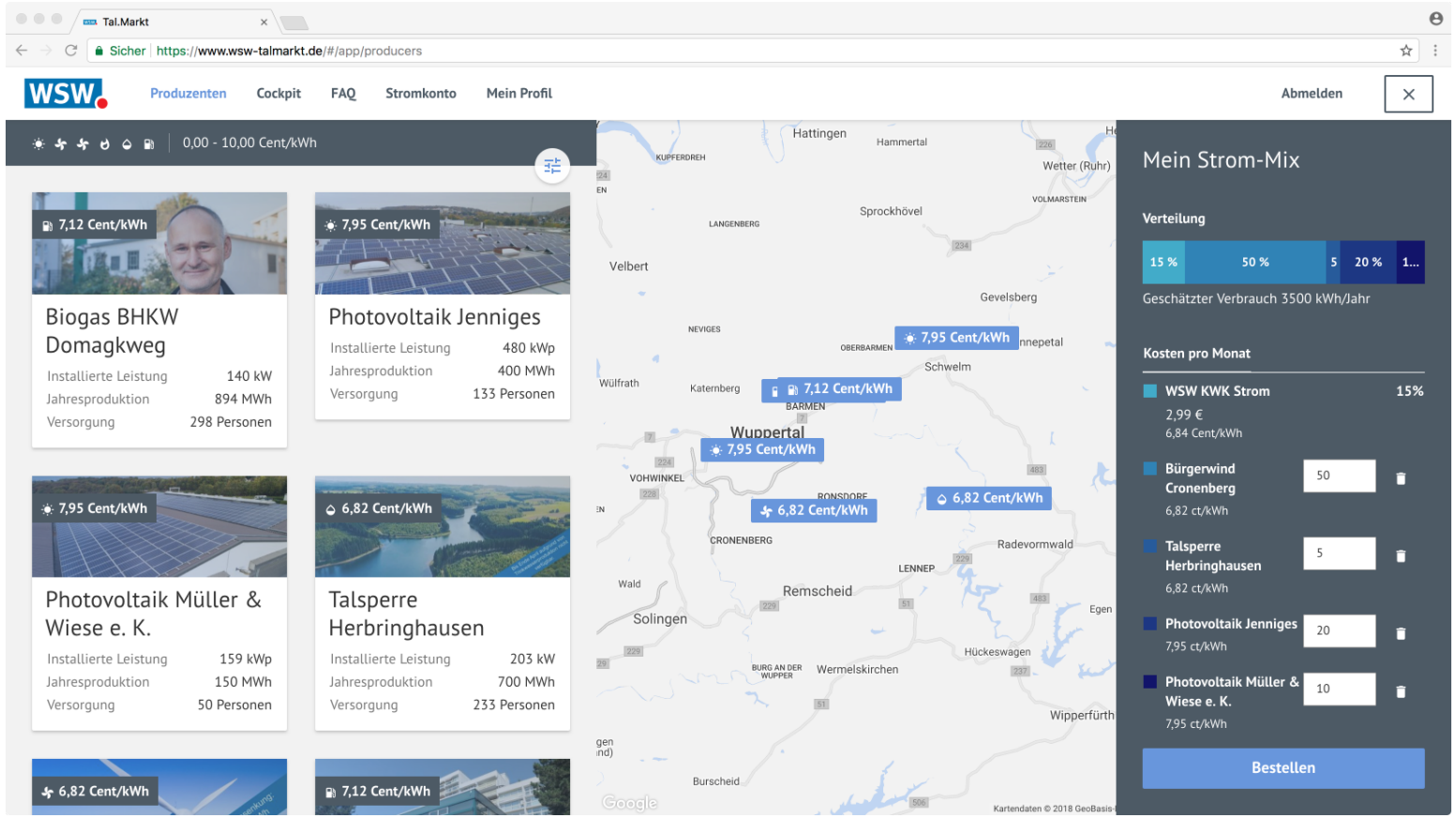
On/off chain architecture of the regional energy market elblox



- Bilateral trade relations
- Real-time load measurement
- Real-time energy settlement

- Provenance documented by 15min
- Tamper-proof storage in blockchain
- Certificates directly accessible

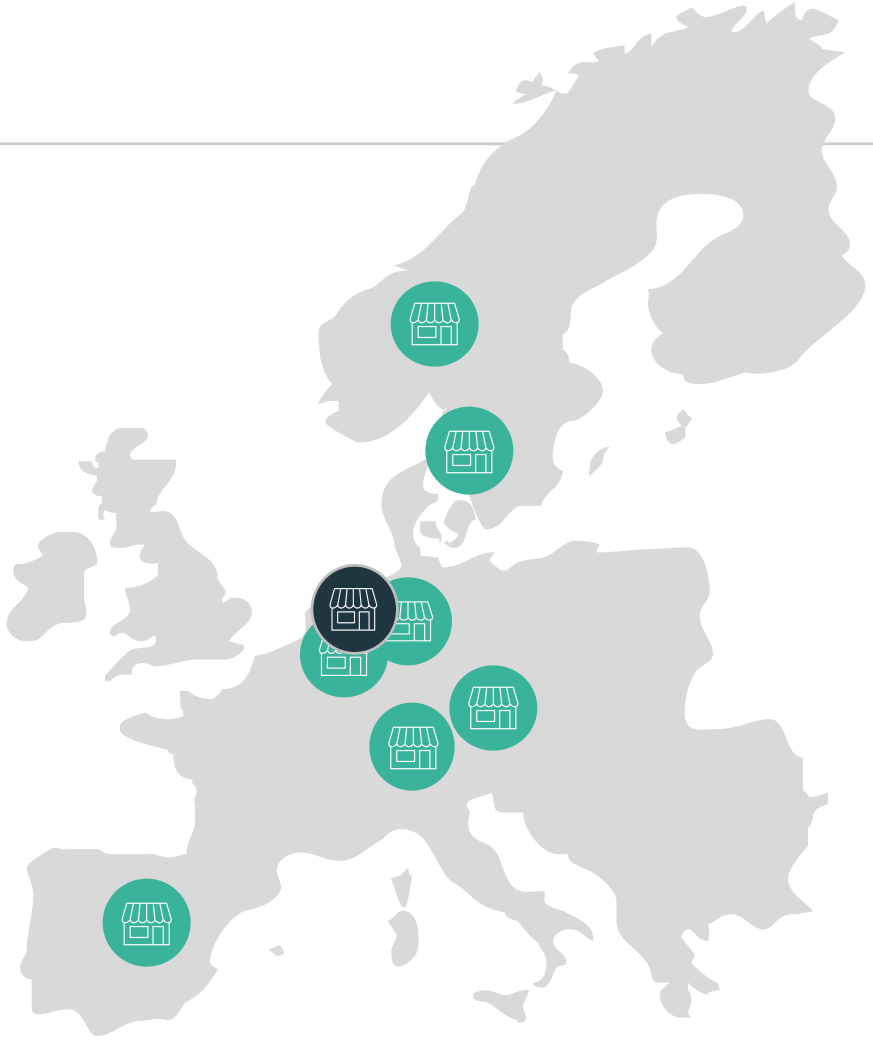
Real life pilot in German city (in cooperation with Stadtwerke Wuppertal)



White label product of local utilty WSW

https://wsw-talmarkt.de

Wuppertal was only the beginning



:elblox retail clients

- Digital billing and invoicing
- Virtual energy storage
- Interfacing smart home
- E-mobility solution

:elblox corporate clients

- Documentation of energy supply chain
- Transparence through dashboard
- Data exchange through DLT

:elblox e-mobility

Elblox: a Spin-off of Axpo, an energy utility active in 26 Euopean countries

Sales **CHF 5.57 billion**	Employees **4,222**
Total assets **CHF 19 billion**	Renewables **8,942 million kWh**

Spin-off

- Early mover in P2P power trading; platform developed since 2015
- Entrepreneurial Spin-off incorporated April 2018

3 Key Innovation Themes in Energy & Blockhain

P2P trading of renewable energy

:elblox

POWER LEDGER

Back-end optimisation wholesale trading

Optimising investments in renewable energy

theSunExchange

we power

Enerchain: Wholesale Energy Trading on Blockchain

- Decentralised infrastructure for bilateral trading of physical power and gas according to wholesale market rules
- Open API to connect trading screens, algos and third-party services to the distributed order book
- Deal-confirmation and regulatory reporting via blockchain simplify back-office processes
- Easy access and massively reduced transaction costs are attractive for big & small market players

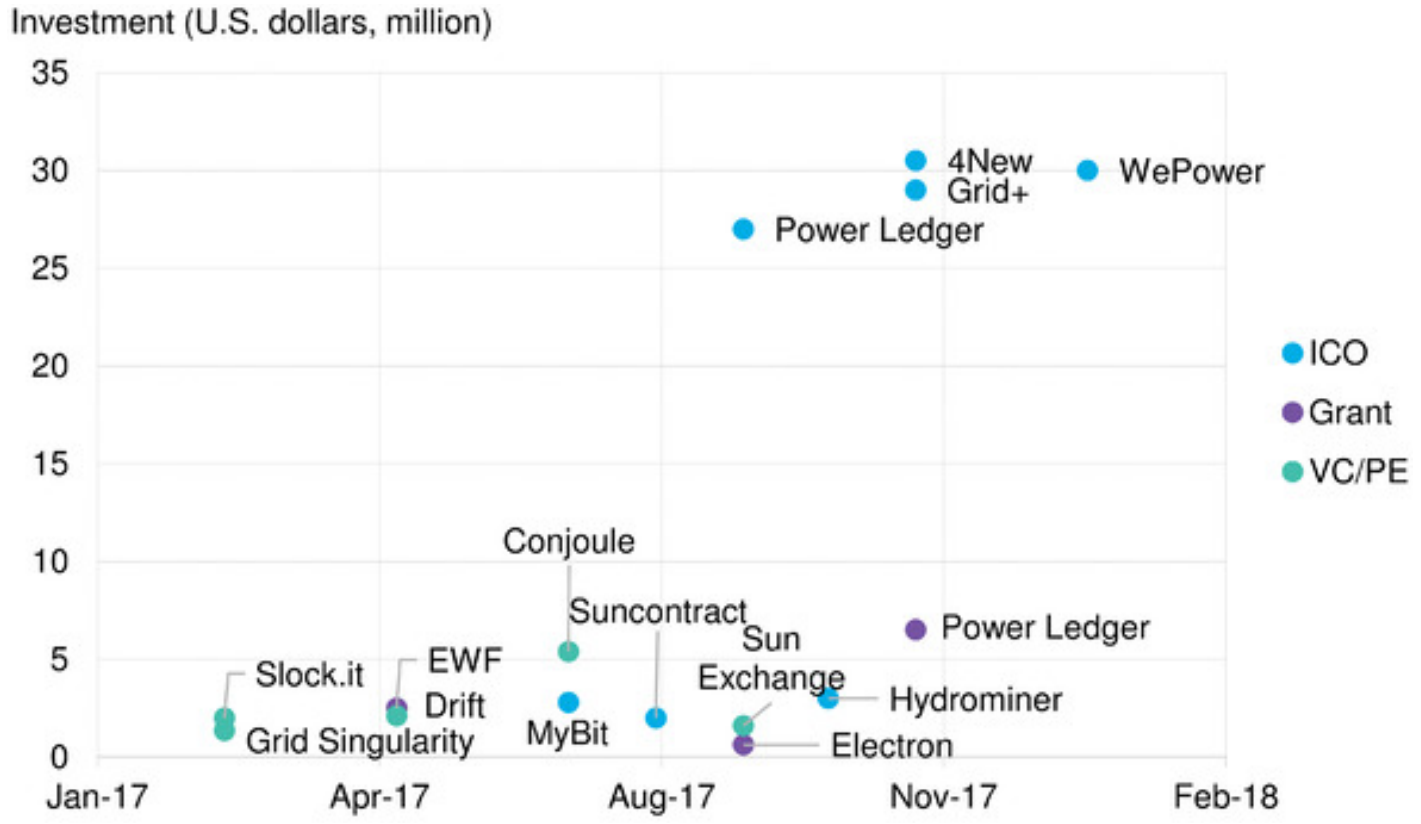
Project Initiation — April 2017
- Workshops with interested Energy Trading Companies
- Agreement on project goals
- Financing round for POC

Proof of Concept — April 2018
- Development of the prototype
- Alignment with Regulators
- Performance testing and live trading demos

Interim Phase — 2019
- Implementation of Governance
- Foundation of new LE
- Regulatory approval
- Development of MVP

Operational Phase
- 24/7 Operations
- Opening the platform for other market participants

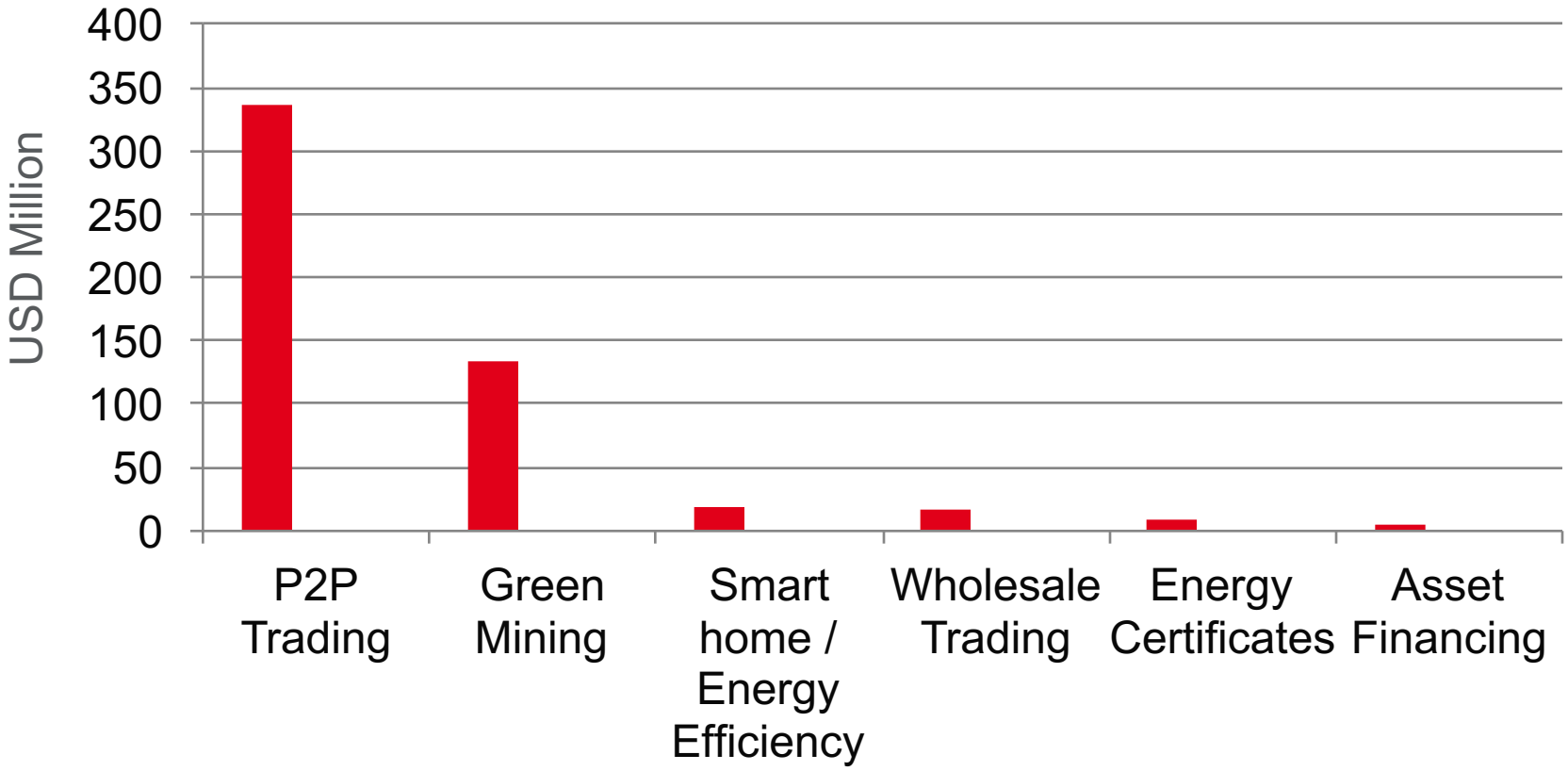
> 100 million USD invested in blockchain start-ups during the last 12 months



Bloomberg New Energy Finance has tracked a total of $143 million invested in blockchain start-ups active in energy since 2017. Over 85% of funding was raised in mostly double-digit ICOs.

Source: Bloomberg New Energy Finance

Distribution of 2017 investments in blockchain & energy



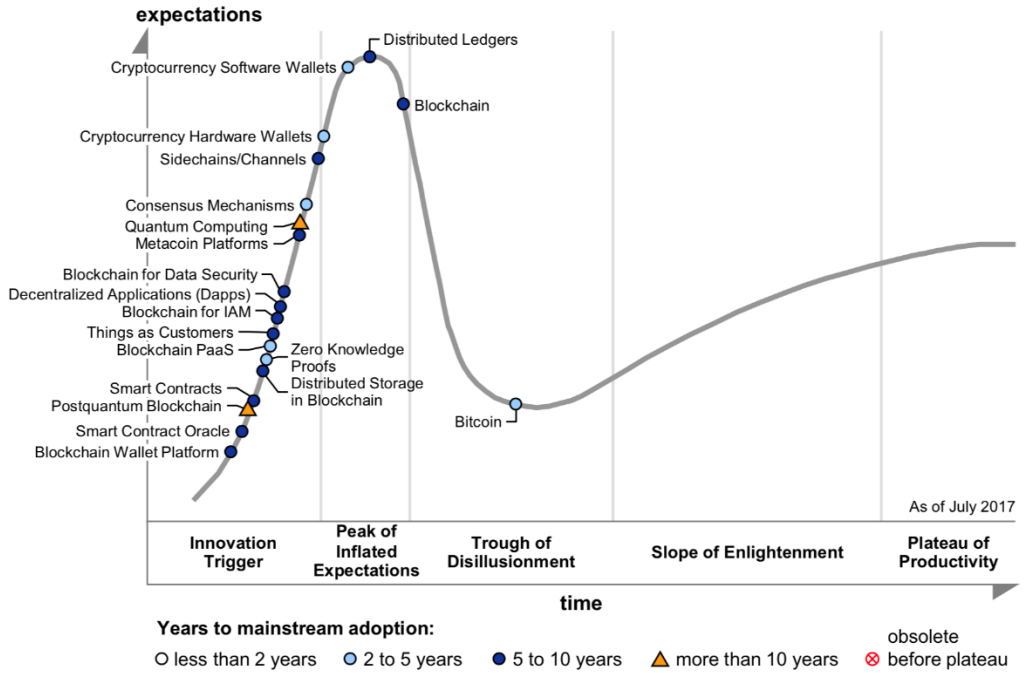
Source: Cleantech Group

State of the market / trends 2018/19

- **Investments in the space have sky-rocketed from 2016 >> 2017 to hundreds of million USD**
- Still moderate given the total annual investments in energy (> 1.5 trillion USD/a; renewable energy investments > 200 billion USD/a)
- **Big majority of investments through ICOs**
- Shift from investments in US companies to European companies; Europe is now leading (Global reach of ICO makes access to capital easier regardless regional location)
- **Expected trends 2018/19:**
    - **Less «blockchain companies», more companies that use blockchain technologies in the energy sector**
    - **Less financing through ICOs , more financing through traditional means of finance (VC, corporate finance) - in relative terms.**

External view on blockchain technology - Gartner

Blockchain Immaturity Creates Many Risks



From "Hype Cycle for Blockchain Technologies, 2017," 31 July 2017 (G00332627)

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Conclusions

- The energy sector became very active in the past 18 months exploring the potential of blockchain to innovate/optimize the sector
- 3 key themes can be observed:
    i. P2P trading of renewable energy
    ii. Back-end optimisation of wholesale trading
    iii. Optimising investments in renewable energy
- Main players are currenty start-ups but many energy incumbents are becoming active – directly or through subsidiaries/spin-offs
- Axpo started real-life pilots in the fields of i) wholesale trading and ii) P2P trading of renewable energy through its spin-off elblox

>> www.elblox.org

Full of energy for strong ideas

christoph.sutter@axpo.com

Axpo Holding AG | Parkstrasse 23 | CH-5401 Baden

Driving Innovation Across the Energy Sector