

BOSON ENERGY

THE IMBY COMPANY

Modular Solutions for Thermal Treatment of Waste

Israel annual
recycling conference

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The world is suffering EPIC transition stress



EMOBILITY



**PROSPERITY
& WASTE**



ICT



COOLING

- **EMOBILITY** drives energy demand and grid stress.
Private cars in Israel alone 14 TWhe
- **PROSPERITY & WASTE**
A 5 billion people global middle class of consumers by 2030 – 2/3rds in Asia and mostly urban
- **ICT** 20% of the world's electricity already by 2025
- **COOLING** from luxury to necessity for health, life, and productivity. A/C alone = India and China combined by 2050

Key Managers and Expert Advisors



CEO and co-founder Jan Grimbrandt
Experienced serial entrepreneur with
**25+ years in industrial clean-tech
hardware and execution**



CTO and BE Israel Head Liran Dor
15+ years in the international waste
industry within technology, execution,
and commercialisation



COO Frank Scheuch
30+ years in the the plant
engineering/construction
and machinery industry
within energy and clean-tech



**Global Head of Commercial
Operations Thomas Türk**
25 years in senior commercial roles
in industrial high-tech, energy, and
clean-tech



**Global Head of HSE &
Permits Linda Westers**
10 years in process engineering
HSE, HAZOP, Risk Analysis,
and Permitting within energy



BE UK Head Bill Elliott 30+
years in the waste mgmt and
waste to energy sectors in the
UK. 15 years as Development
Director for SITA UK (Suez)



Head of Asia Aditya Sharma
25+ years in strategic market
development in Asia/Europe with
focus on risk, energy, metals and
commodities



**Co-founder Prof Wlodzimierz
Blasiak** 40+ years of applied
thermochemical research and
development experience in
close cooperation with industry



Peter Karlsson 40 years
in the waste industry incl.
**building and operating
the largest and most
efficient single-line waste
incinerator in the world**



Edward Krisiunas
30+ years in health care
waste management
providing expert advice
to WHO, GIZ, ADB, IFC,
USAID, UNDP, etc



Johan Karlberg
25+ years of advisory in
SCM and transformation
focused on automotive,
engineered products,
and industry,



Robert Schweich entrepreneur
with 35+ years in engineering
and adv. manufacturing for high
temp. applications – mainly
steel industry

EXPERT
ADVISORS

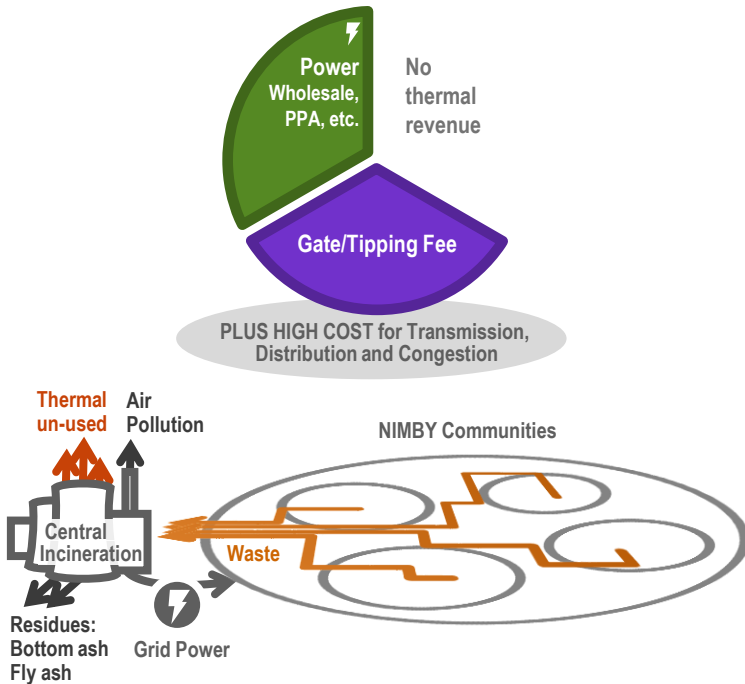
BUSINESS MODEL

BOSON's WASTE 4.0 1000 tpd solution outperforms Incineration and Landfill/Dumpsite on all key aspects – at same or lower CAPEX and OPEX

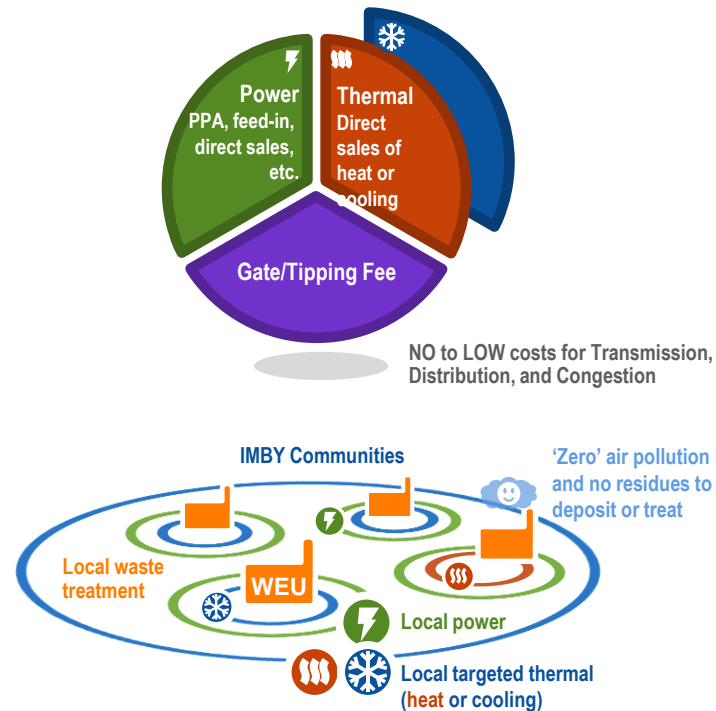
<i>Over 30 years</i>	Landfill/Dumpsite (2.0)	Incineration (3.0)	BOSON WEU (4.0)
Waste volume (million tons)	10 million	10 million	10 million
Toxic residue (million tons)	10 million tons of waste leaking into environment over 200 years	>1 million tons of toxic ash <i>(500 Olympic pools)</i>	0
Value added material (million tons)	0	0	0.6 million tons of IMBY Rock
Power for use (million tons of coal equivalent)	0	3 million tons	3 million tons
Thermal cooling for use (million tons of coal equivalent)	0	0	1.4 million tons
Avoided CO2e from coal generation (ex Landfill)	0	6 million tons	10 million tons
Avoided cost of CO2e (at €15/ton)	0	90 million euro	150 million euro
Avoided transportation cost and road stress	0	0	>80%

A distributed model can generate twice the revenues AND reduce congestion, pollution, residues, and social resistance – at same or lower system CAPEX

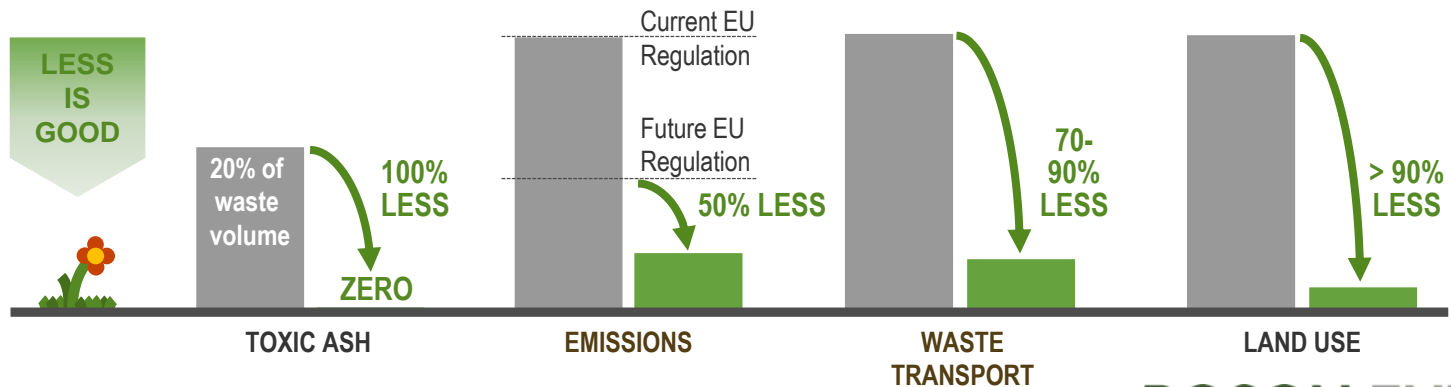
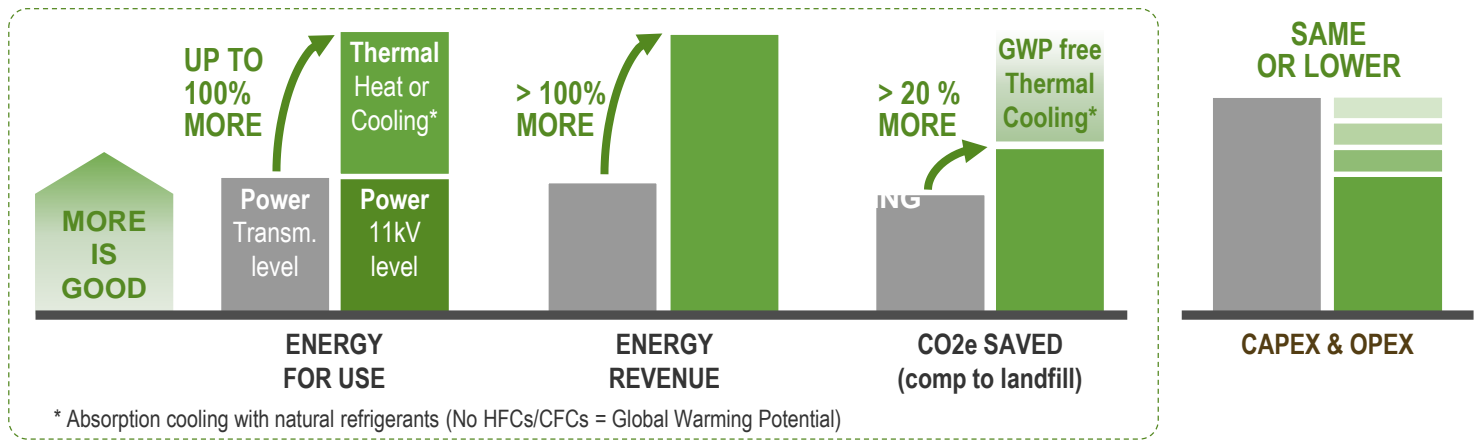
Centralised Model – Yesterday



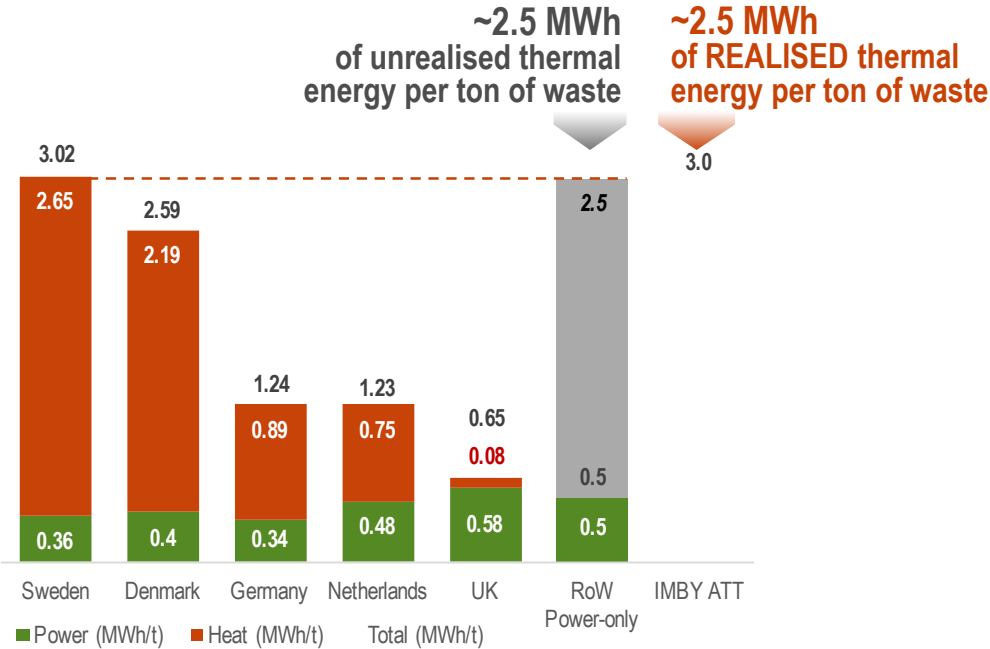
Distributed Model – Today and future



BOSON's solutions outperforms large scale incineration on all critical areas – financial, environmental and social



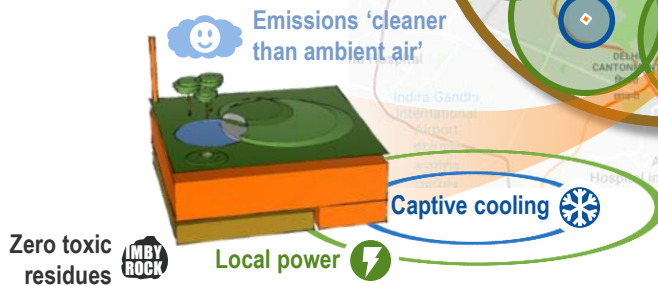
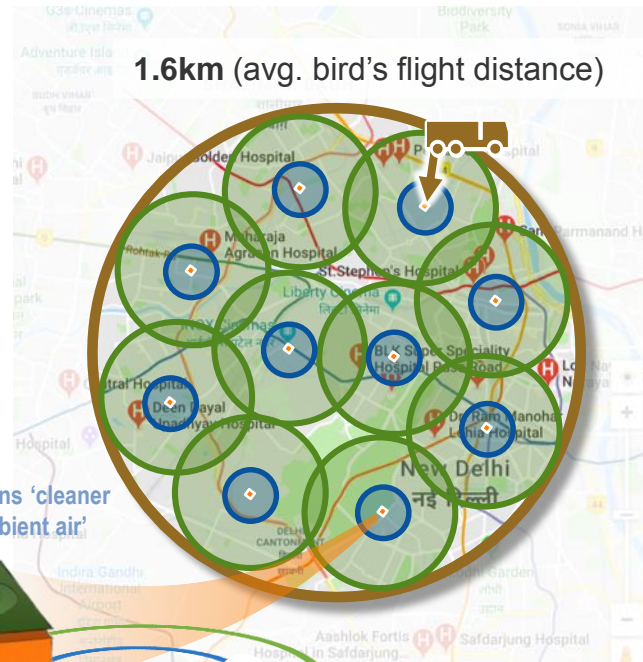
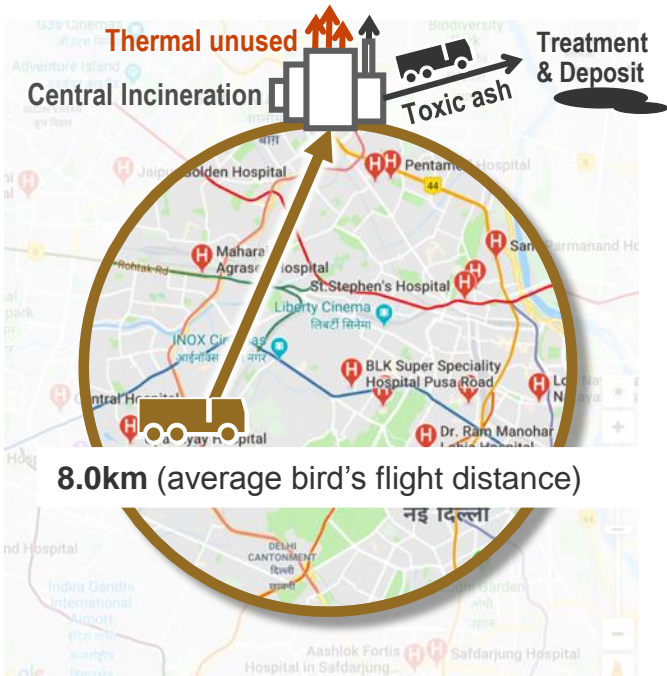
The final energy model



- Large-scale cogeneration only possible with large district heating/cooling networks
- Poor final energy efficiency in power-only installations
- Weakens business case and creates subsidy dependence

Energy Export per ton input (Tolvik 2018, RoW value by BOSON)

First Mile Solution – Waste 4.0 for Delhi by BOSON: 10 units of 200 TPD producing low-voltage power AND Cooling for local use



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• First Mile Solution – Waste 4.0

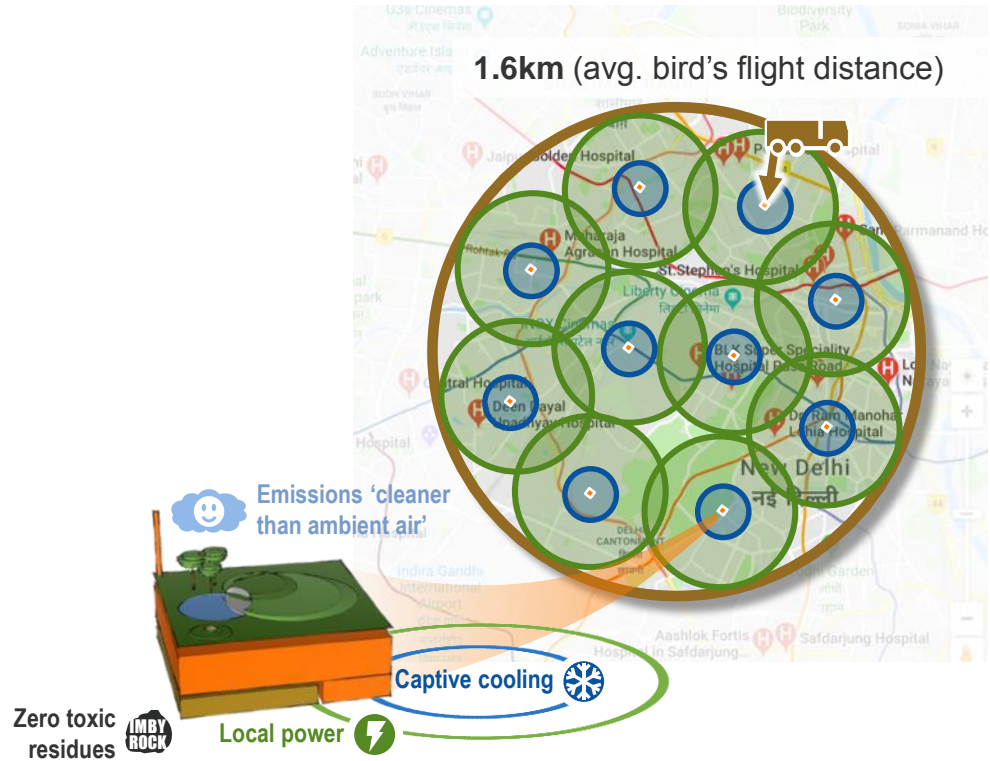
- SDG 17 compliance
- CO_{2e} – GHG life cycle
 - Thermal cooling no CFC/HCFC
- High degree of sorting and recycling
- High Project IRR and ROE

• Last Mile Elimination

- No ash for additional stress: Water, Air & Land
- BAT+ on stack emissions

• Impact from the 1st Mile SPV

- Double revenue: Power & Cooling
- 11 kV feeding
- 11 kV stress reduction from thermal cooling
- 80% reduction of km/ton for waste



Decentralised Waste 4.0 solution for Ganga-Yamuna Basin by BOSON: Zero waste plus low-voltage power AND thermal for local use

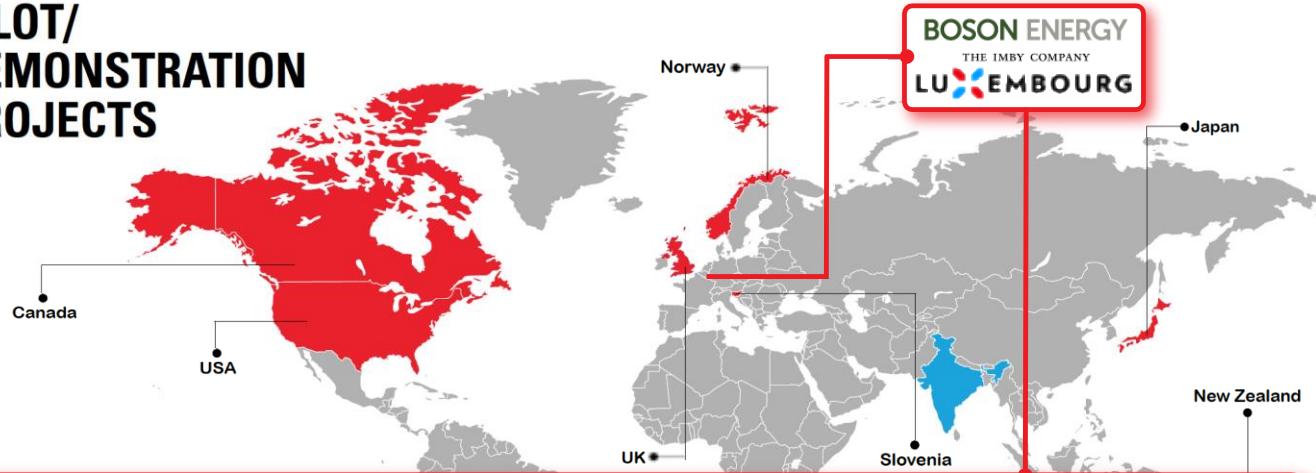
- Treating waste close to the source minimises leakage of plastic into the Ganges and the ocean
- No toxic ash polluting groundwater, soils, rivers, and ocean





BOSON's technology has been accepted for Environmental Technology Verification (ETV) by National Mission for Clean Ganga (NMCG)

PILOT/ DEMONSTRATION PROJECTS



TECHNOLOGY/SOLUTION

The clean Advanced Thermal Treatment technology treats complex solid waste streams to point of no residue, while efficiently harvesting sustainable power and heat or cooling matched to local needs. Less than 80x80 m² land is needed for treating 100-300 TPD. Only by-product is a future-safe vitrified construction material.



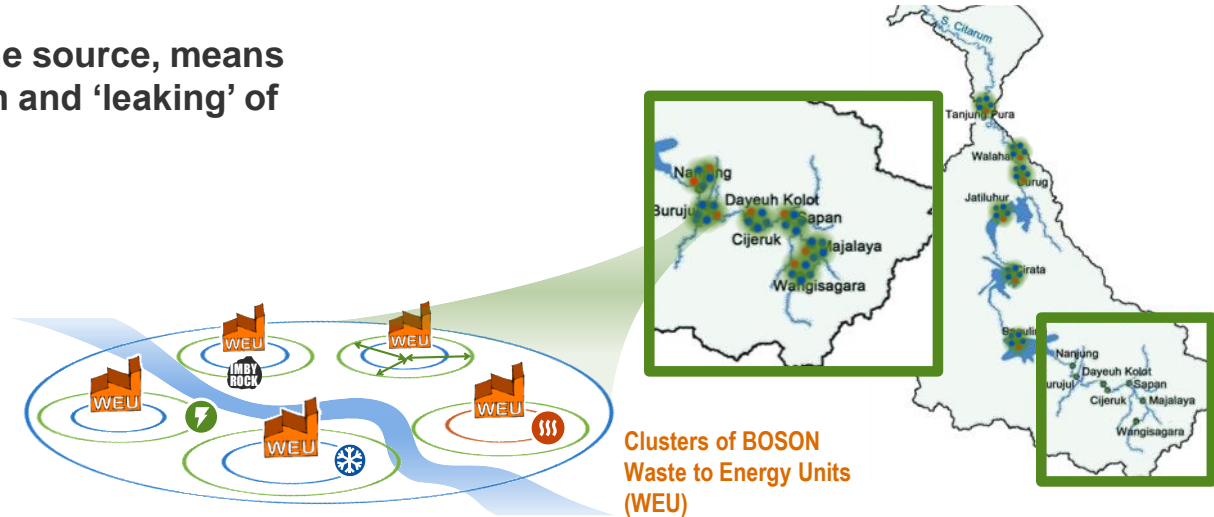
IMPACT ON GANGA

Clean and affordable decentralised waste treatment that efficiently captures and destroys solid waste close to the source. It eliminates waste before it reaches water bodies (drain, streams, rivers, ponds, etc.) and can also treat waste recovered from such water bodies. Zero toxic ash technology safeguards from further pollution and fully future-proofs a clean Ganga future.

Decentralised Waste 4.0 solution for Citarum River Basin

- Dramatic reduction of plastic waste flowing into to the ocean
- Zero toxic residues from waste means no leaching or pollution into the river
- Dealing with waste at the source, means minimum transportation and ‘leaking’ of waste from the system

- 20,000 tons of waste
- 25 million people depend on Citarum River
- Irrigates 400,000 hectares of rice fields.



BUSINESS MODEL: Unique Selling Points built on the combination of three core concepts

• LOCAL THERMAL MATCHING

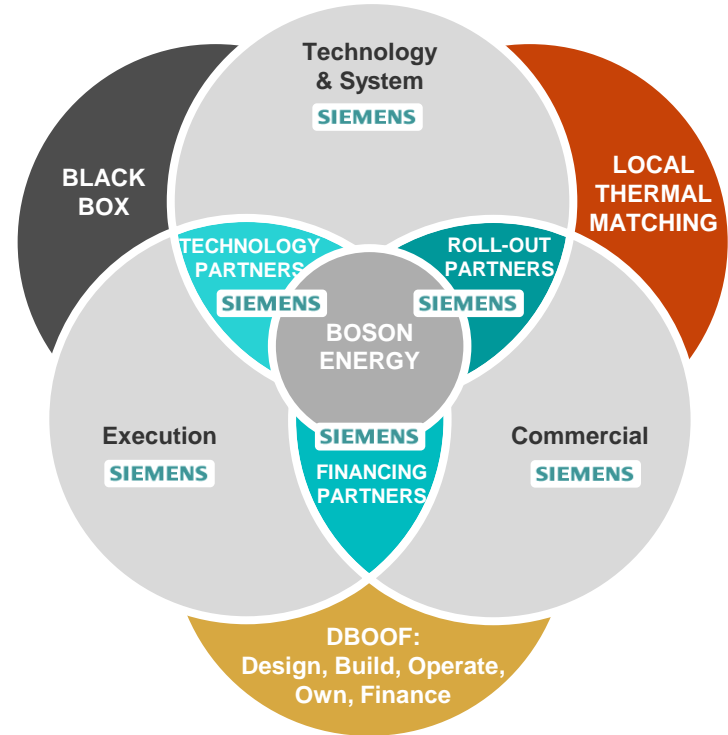
- Doubles energy efficiency and double revenues with distributed technology
- Major stress reduction (waste transportation, pollution, power grids, land-use)

• BLACK BOX setup

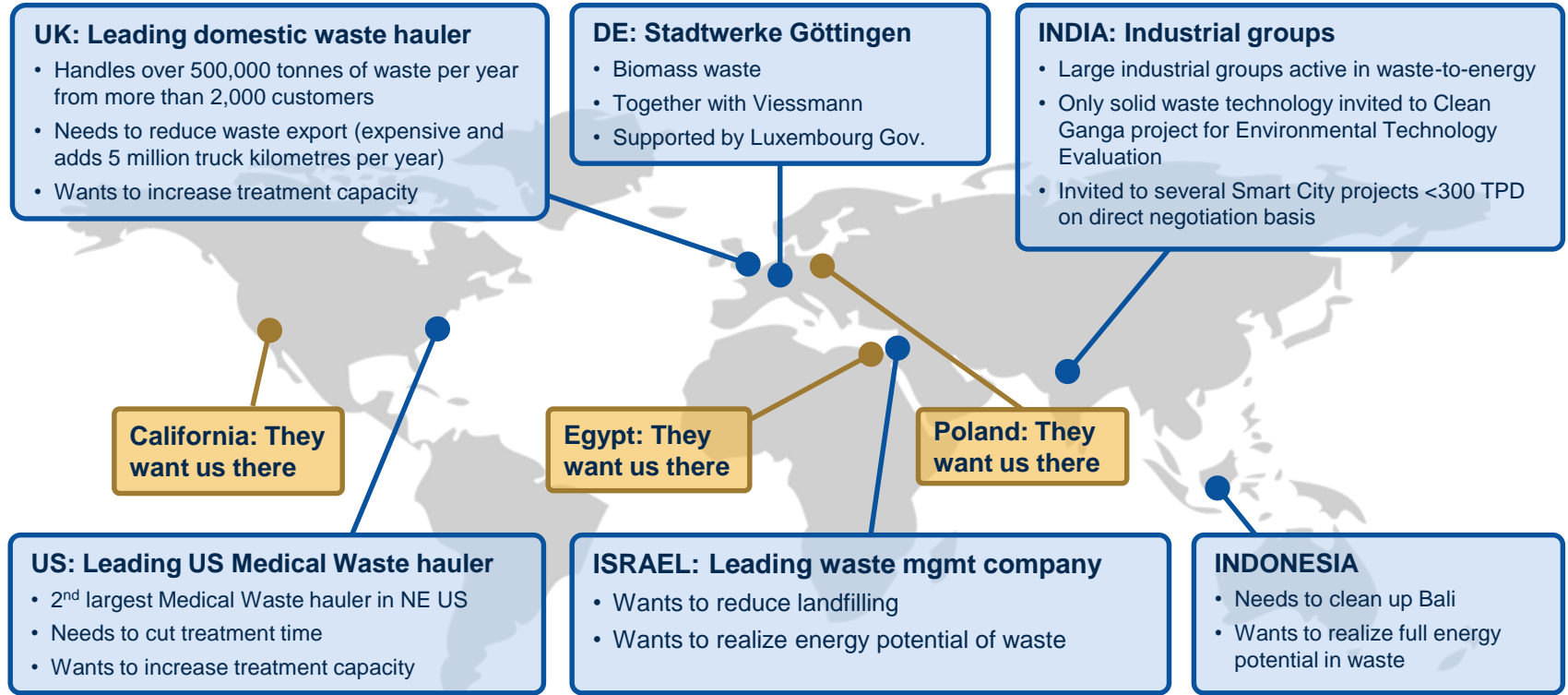
- Deploy and operate plants with efficiency and control
 - IoT, automation, deep learning
- Secure IP and long-term recurring revenues from operation – for all stakeholders

• Design, Build, Operate, Own, Finance

- Unlocks BAT+ for developing countries and waste stream owners
- Secures availability, stability and repeatability through standardisation, modularisation, and productisation

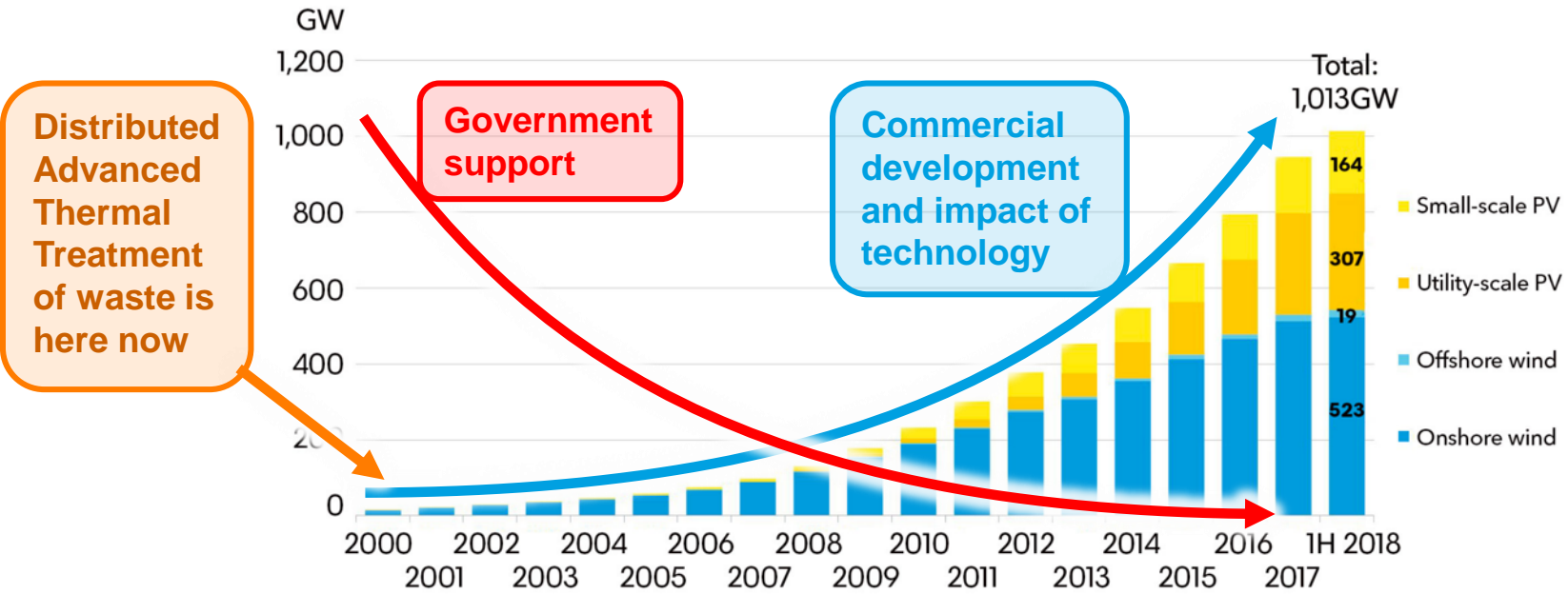


BOSON and partners global flagship installations



Government support has a role to play in commercial development

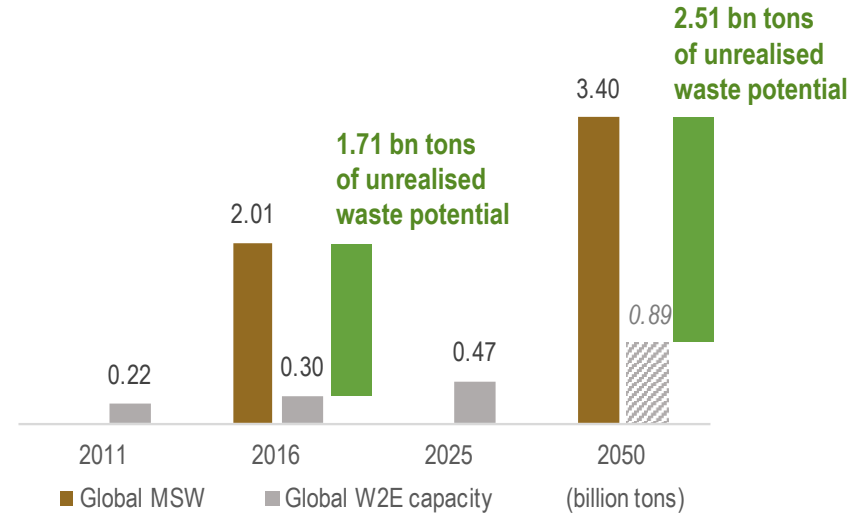
Global wind and solar installations, cumulative to June 30, 2018



Source: Bloomberg NEF. Note: 1H 2018 figures for onshore wind are based on a conservative estimate; the true figure will be higher. BNEF typically does not publish mid-year installation numbers.

More than 2.5 billion tons of unrealized waste potential by 2050: That is A LOT of squandered energy and unnecessary emissions

- Equal to 1 billion tons of coal producing 2 billion tons of CO2 emissions
- 2.5 billion tons of lifecycle CO2e emissions added per year from putting that waste on dumpsites and landfills
- 2.5 billion tons of waste polluting land, groundwater, surface water, coastal water, and oceans for future generations
- **PLUS 0.2 billion tons of toxic ash from the incineration that does happen**
- **Global large-scale incineration is failing miserably at solving waste**



Waste volumes from World Bank's What a Waste 2.0
W2E Capacity from Ecoprog's Market Report WtE 2016-2017

2050 WtE estimate mathematically estimated by BOSON from 2011-2025 Ecoprog datapoints

Affordable, Reliable, and Clean = Sustainable Prosperity and contribution to all 17 of the UN Sustainable Development Goals

- Inclusive Prosperity is a key driver of BOSON ENERGY's business
- We deliver clean and efficient waste treatment solutions that perform over complete lifecycle and create white-sector jobs at low and high skill levels
- We target key societal challenges of waste volume, sanitary waste practices, toxic residues, pollution and congestion, energy access, and climate-safe cooling



Rachel Kyte, CEO of Sustainable Energy for All