Commercialization of thermal energy harvesting solutions towards self-powered IoT sensors for industrial predictive maintenance

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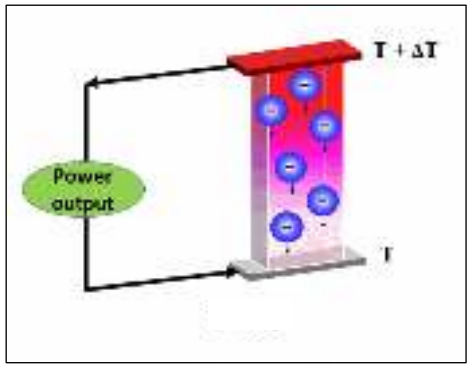
PRODUCT OVERVIEW

PDOTEG
PRINTED THERMOELECTRIC GENERATOR

3D printed Thermoelectric generators (TEGs) for battery-free IIoT sensors



THE PROBLEM

⚠ **98% of Businesses Report Productivity Loss from Downtimes**
(even a single hour of interruption can cost over **100K €** in lost output)

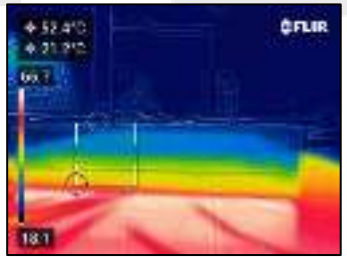
- Demand for power supply alternatives replacing battery-driven sensors
- More than 60% of the energy production globally diffuses as wasted thermal energy
- Waste heat to power the next generation of IIoT devices

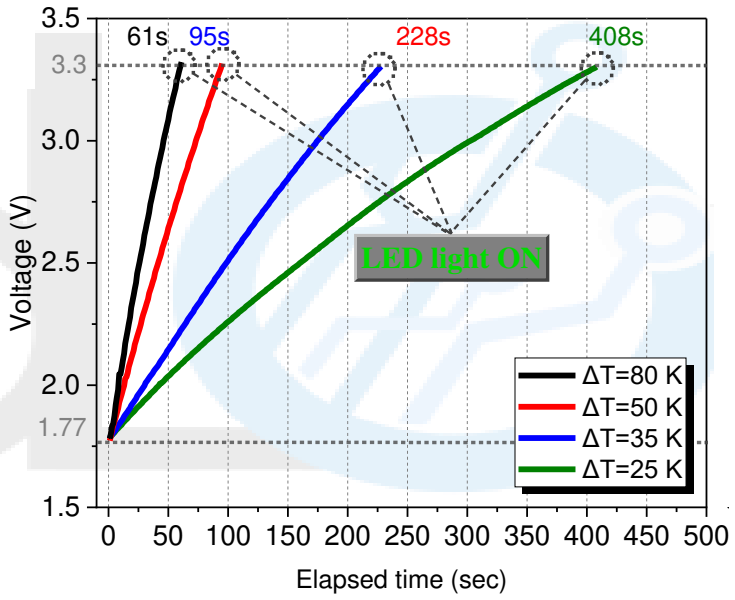
PRODUCT OVERVIEW

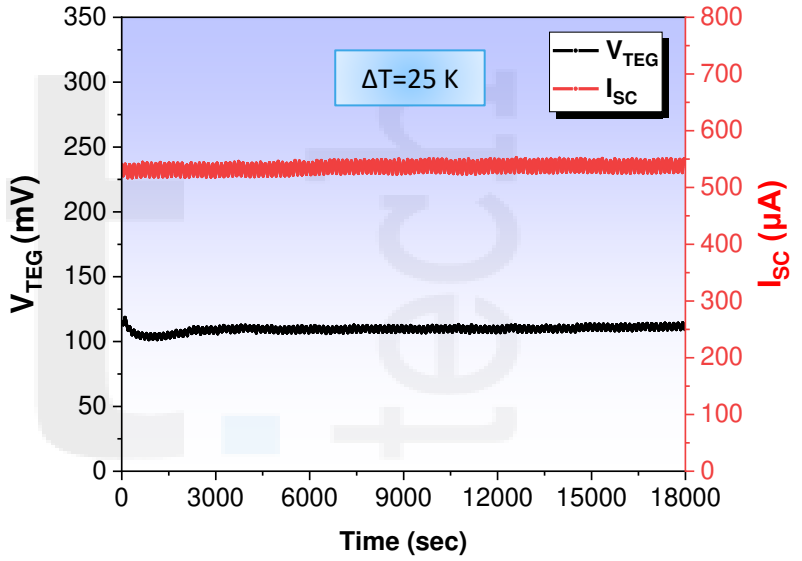
WE GIVE YOU…

PDOTEG
PRINTED THERMOELECTRIC GENERATOR

☑ **Solution: 3D printed Thermoelectric generators (TEGs) for battery-free IIoT sensors**







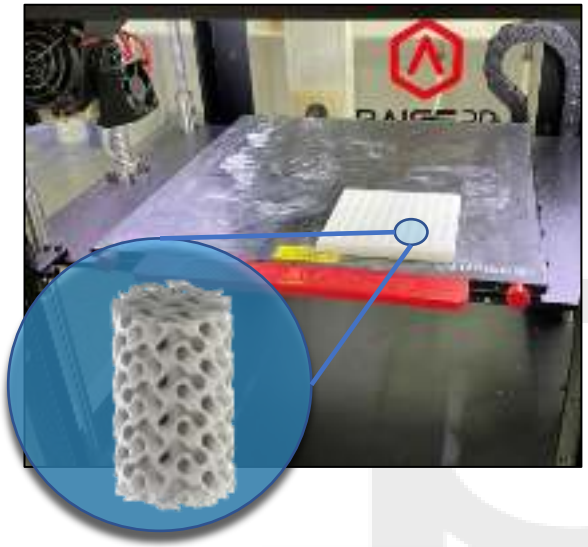
PDOTEG UNIQUE FEATURES

Benefits of printed TE films technology:

- ✓ low-cost
- ✓ flexible
- ✓ lightweight
- ✓ highly conductive (10^5 S/m)
- ✓ p- & n-type CNT-based aqueous inks
- ✓ highly stable electronic properties
- ✓ superior TE efficiency

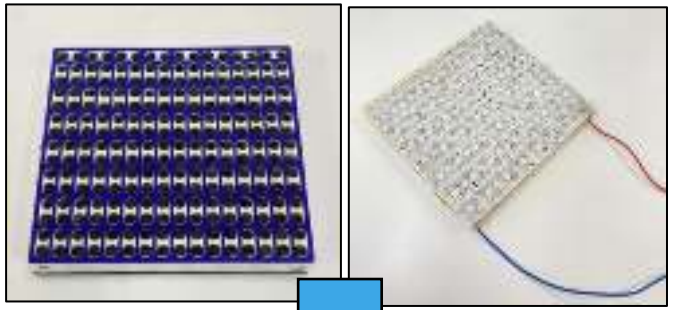
Aqueous Carbon Nanoinks with tailorable electronic properties

PDOTEG PHYLOSOPHY



as 3DP

3DP with CNT

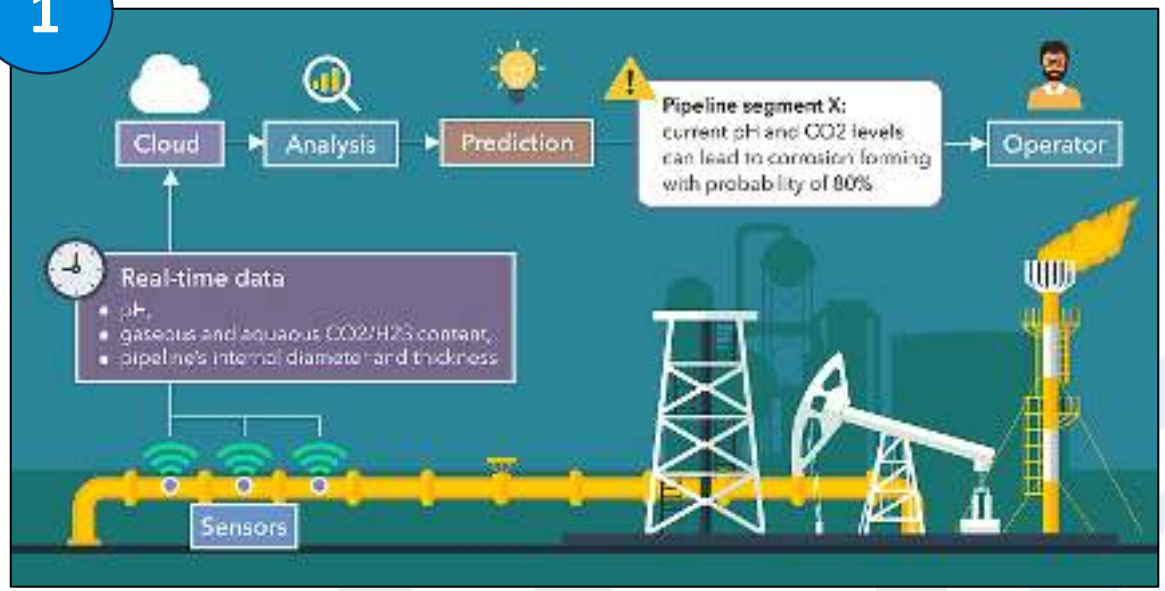


3D printed TEGs for battery-free IIoT sensors:

- ✓ low-cost, sustainable & lightweight (ca. 175 g)
- ✓ flexible & durable
- ✓ “install & forget”
- ✓ converting directly temperature differences into power
- ✓ P_{max} = 200 µW with 861.82 mW/g @ ΔT=80K

CASE STUDIES

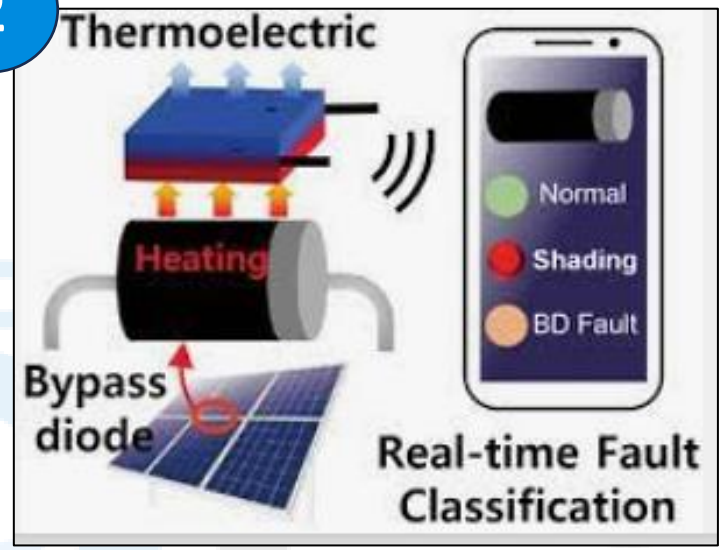
1



Powering Real-Time condition monitoring of structural components in industrial environment via Thermoelectric Devices

e.g. typical low-sense rate accelerometers need a power-input of **20 µW**

2



Real-Time **deviation patterns Detection** & Classification of Bypass Diode-Related Faults in Photovoltaic Modules via Thermoelectric Devices

MARKET ANALYSIS (1/2)

IIoT-driven Predictive Maintenance isn't the future — it's the new standard

⚙ Why Predictive Maintenance?

- Reduces **unplanned downtimes by up to 50%**
- Extends asset life by **20–40%**
- Cuts maintenance costs by **10–25%**

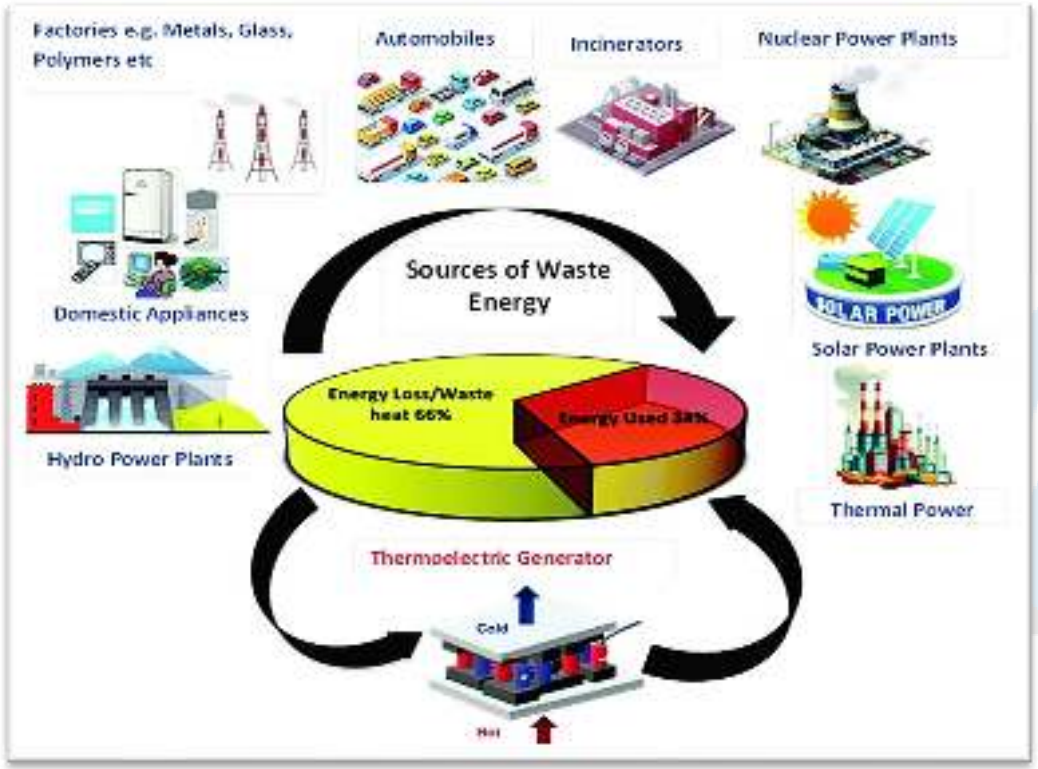
☑ Market Opportunity

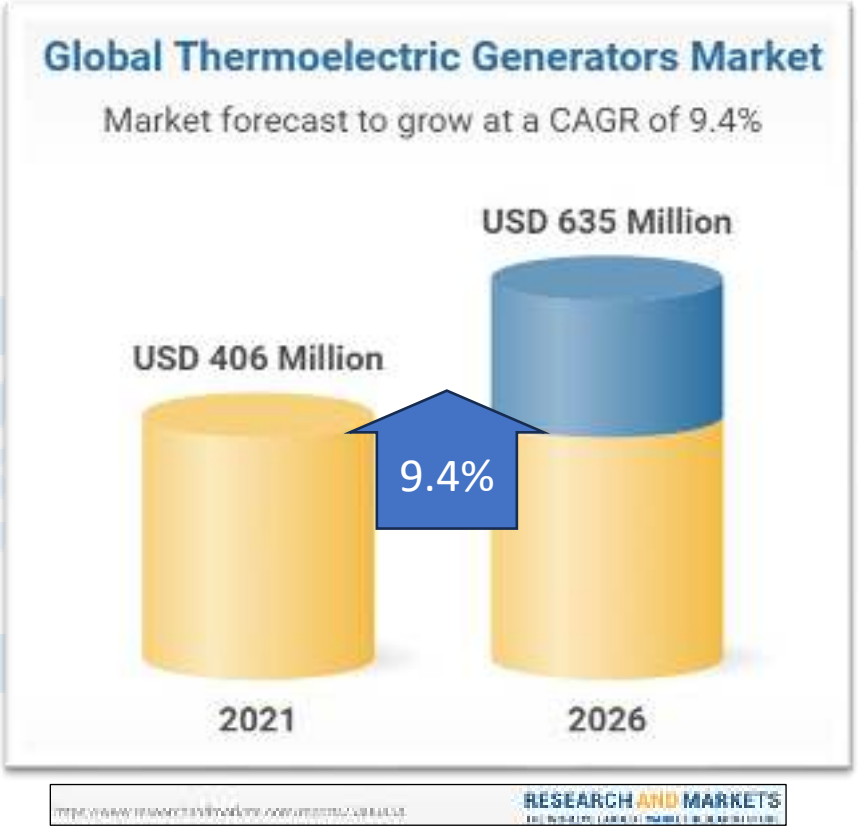
- **Driven by Industry 4.0 "Smart Factories"**
- **IIoT in Predictive Maintenance Market** expected to reach **€15B+ by 2026**

MARKET ANALYSIS (2/2)

THERMAL ENERGY HARVESTING MARKET POTENTIAL

🚀 **1 Trillion** battery-free sensors in IIoT



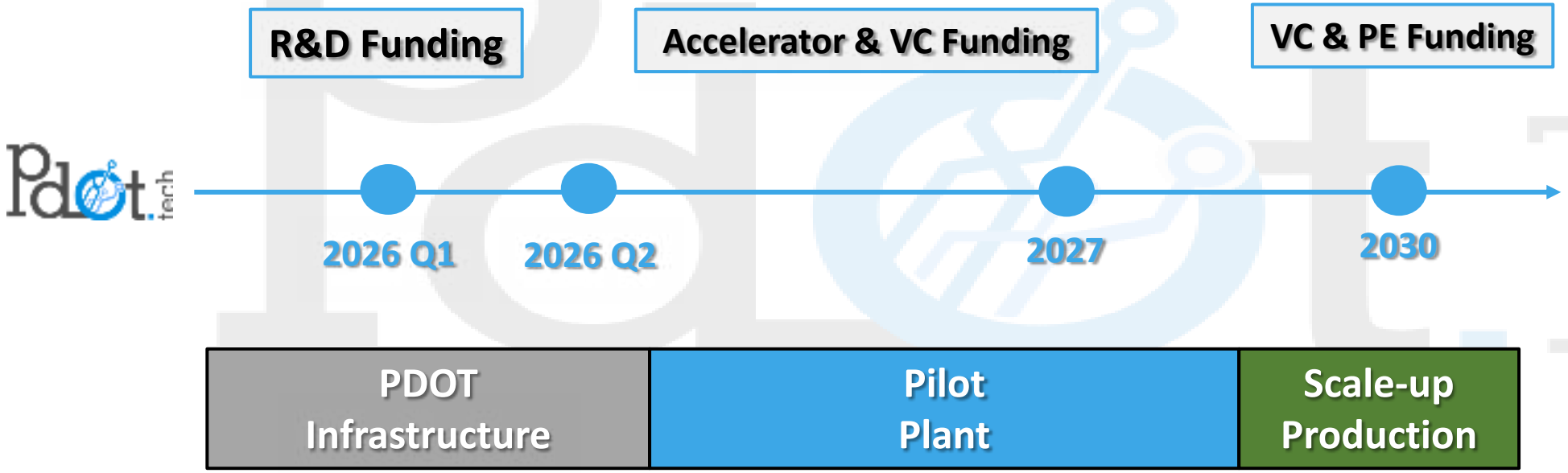


Call to Action

- ✓ Continue R&D activities
- ✓ Raise capital

- ✓ Pilot production establishment

- ✓ Commercial activities



Thank you for your attention!

Any questions ?

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