

Applications of Energy Harvesting within apparel

Toju Raine

Special Project Lead

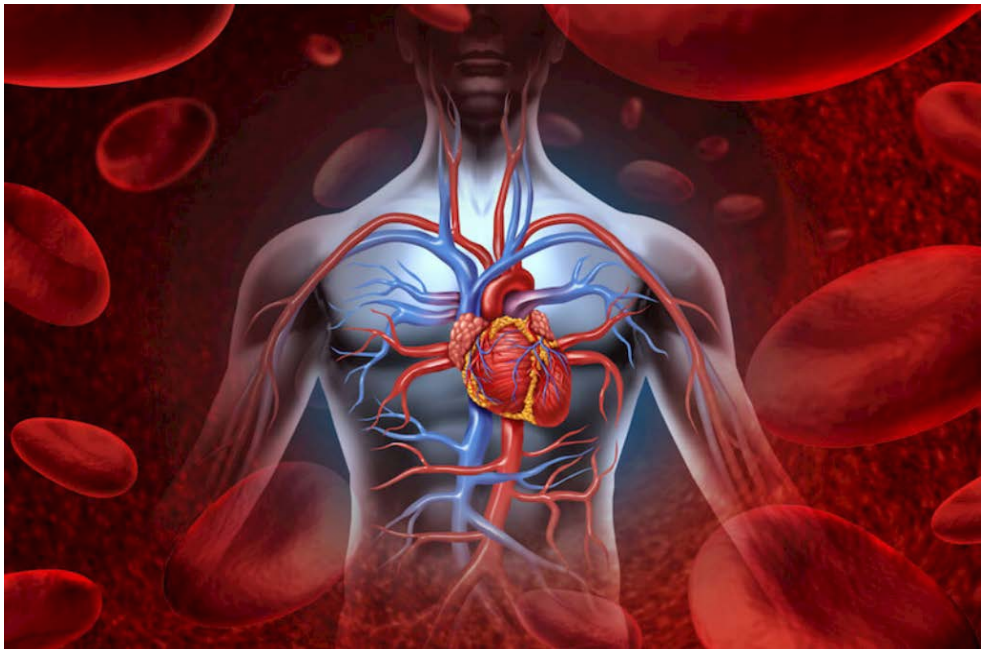
KYMIRA



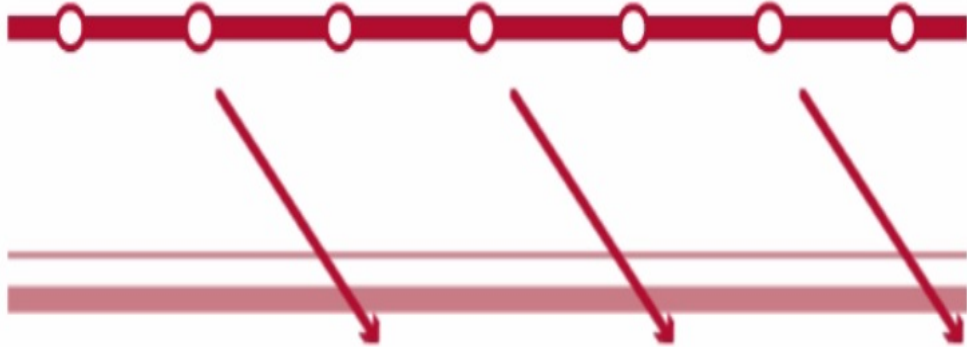
Brief Background

- UK based SME operating in fitness and healthcare
- Infrared (IR) Sportswear sold globally
- R&D into energy harvesting wearables and e - textiles





KYMIRA[®] ← absorbs Heat

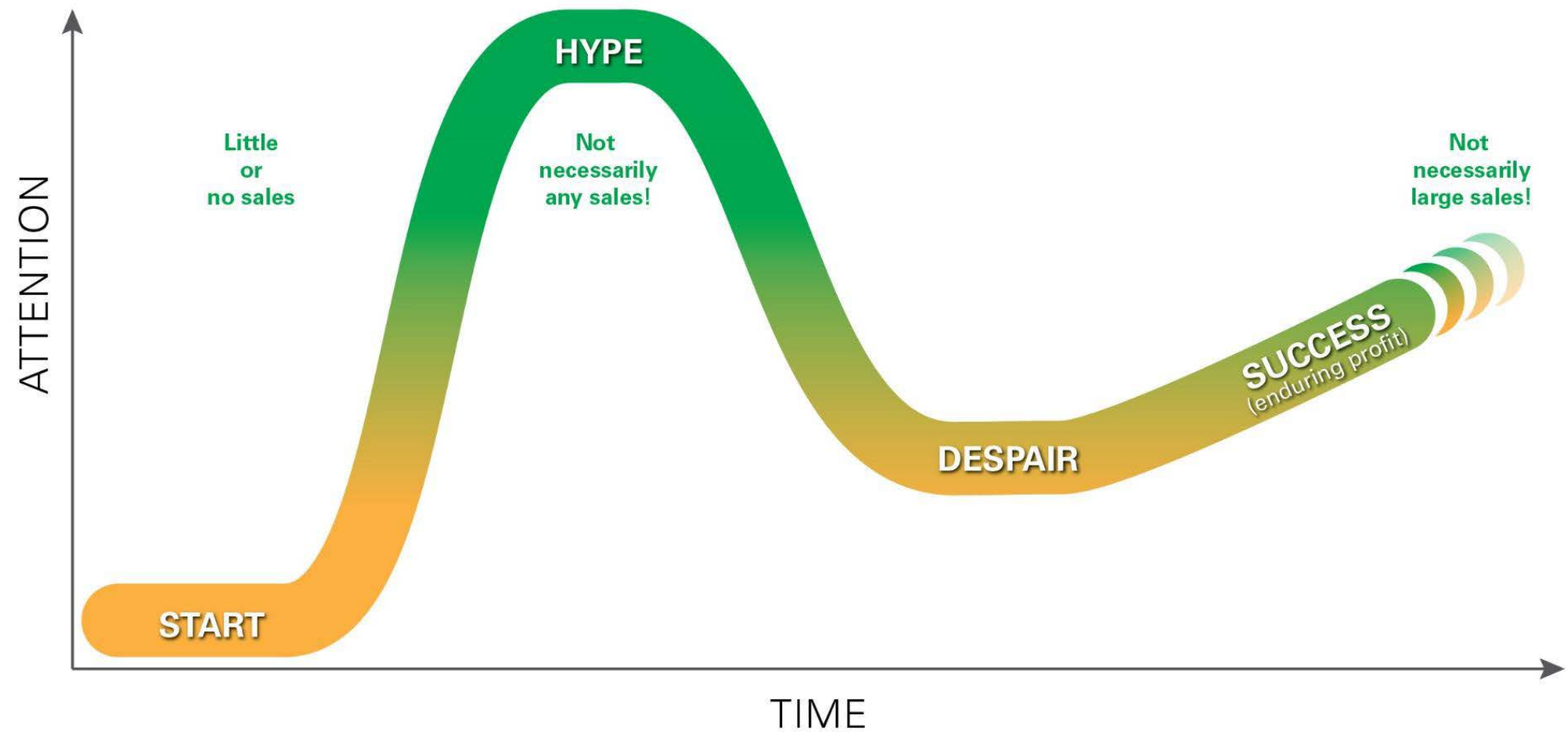


Infrared → redirects towards the Skin



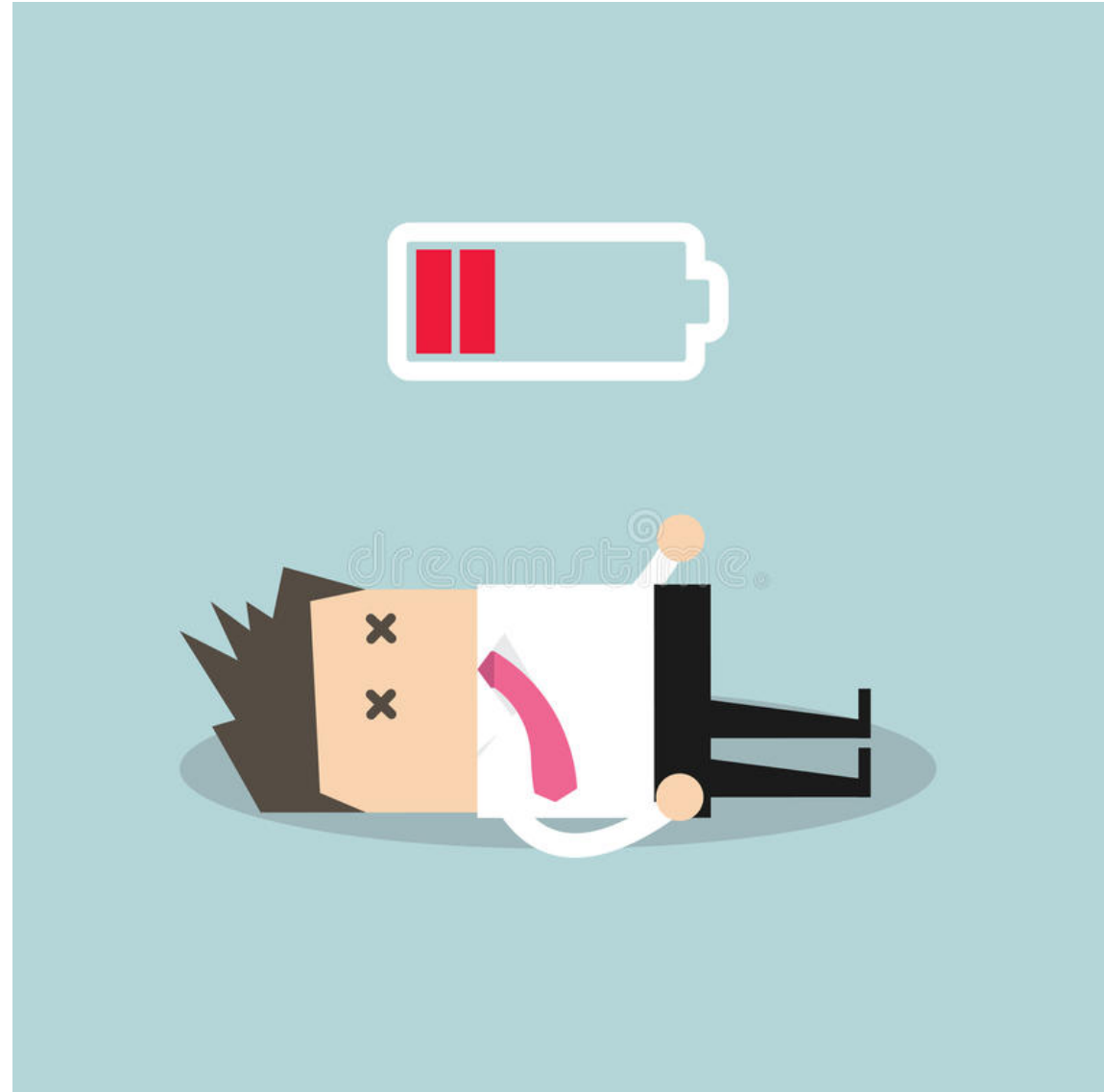
Smart Clothing today

Ref: IDTechEx



Obstacles to wearable technologies

- **Cumbersome batteries**
- **Constant recharging**
- For extended lifetime –
 - increase storage capacity (battery size usually)
 - reduce power consumption



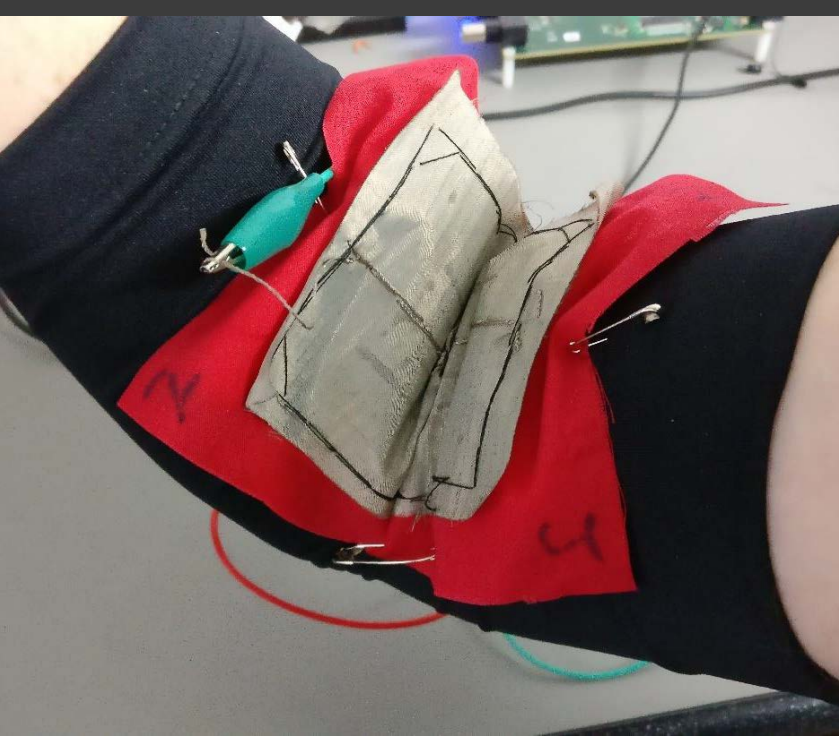
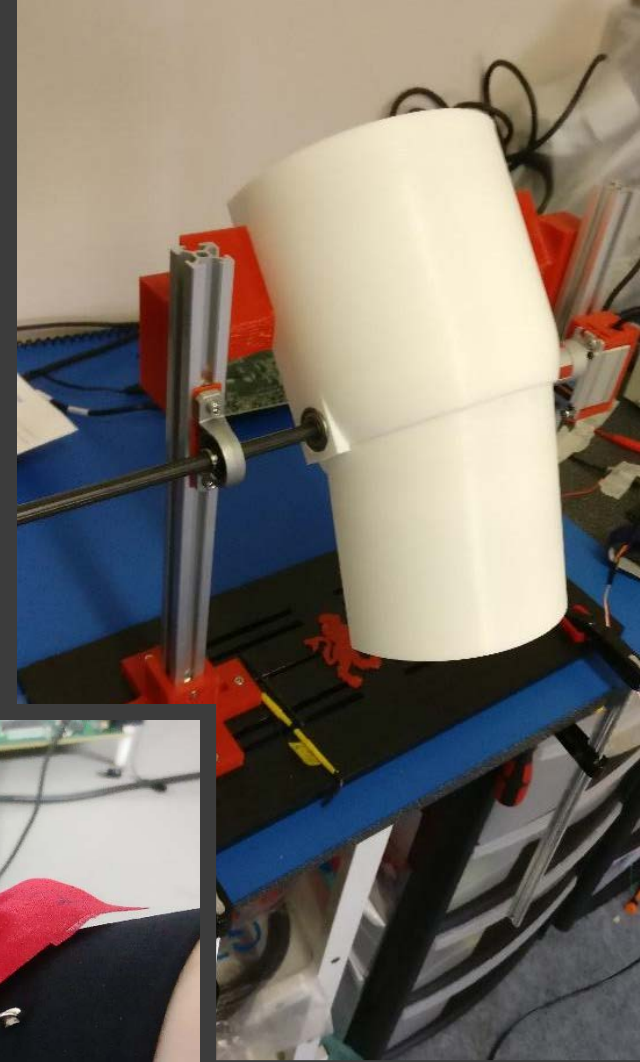
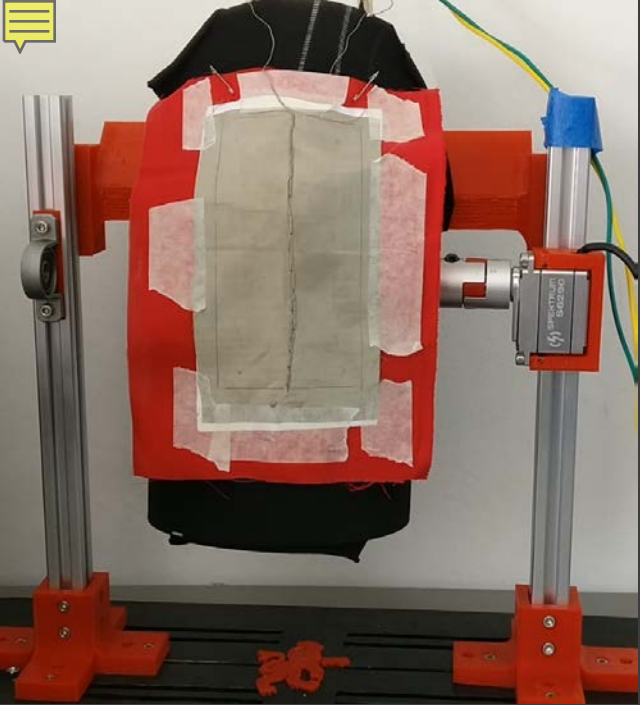
KYMIRA's R&D

- Thermoelectric
- Mechanical
- Electromagnetic
- Can all be integrated with wearable textiles

Innovate UK



KYMIRA



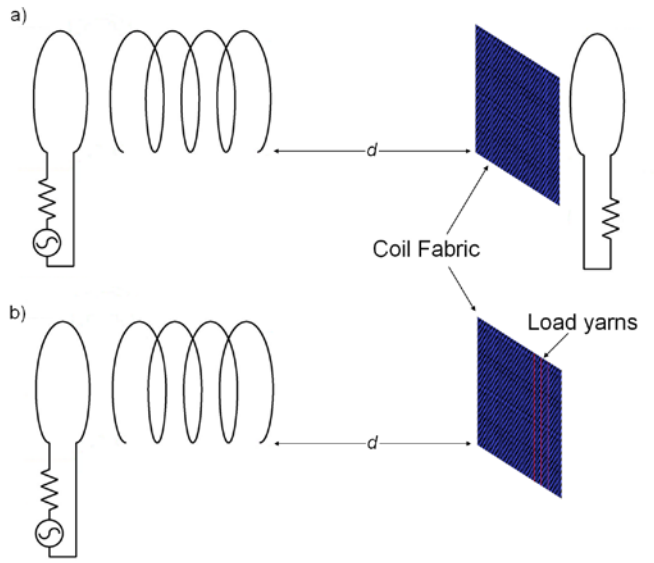
Mechanical - PVDF

- Piezoelectric polymer (PVDF) fibre sheets
- 5 x 10cm in size, scalability very feasible
- Best knee rig prototype produced 18.5 nW
- Impact testing power output of 493 microwatts (0.493mW)

Thermoelectric – Wearable TEG

- Device used Bi₂Te₃ as the TEG material
- Dimensions: 35mm x 45mm
- Output:
 - 10-12 mV ($\sim 4\mu\text{W}$) open circuit worn by a person at rest
 - 20 mV ($\sim 14\mu\text{W}$) with moderate airflow

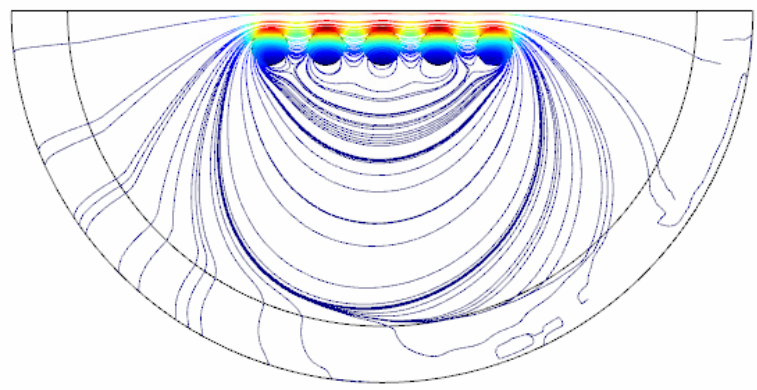




Electromagnetic – Wireless power transfer

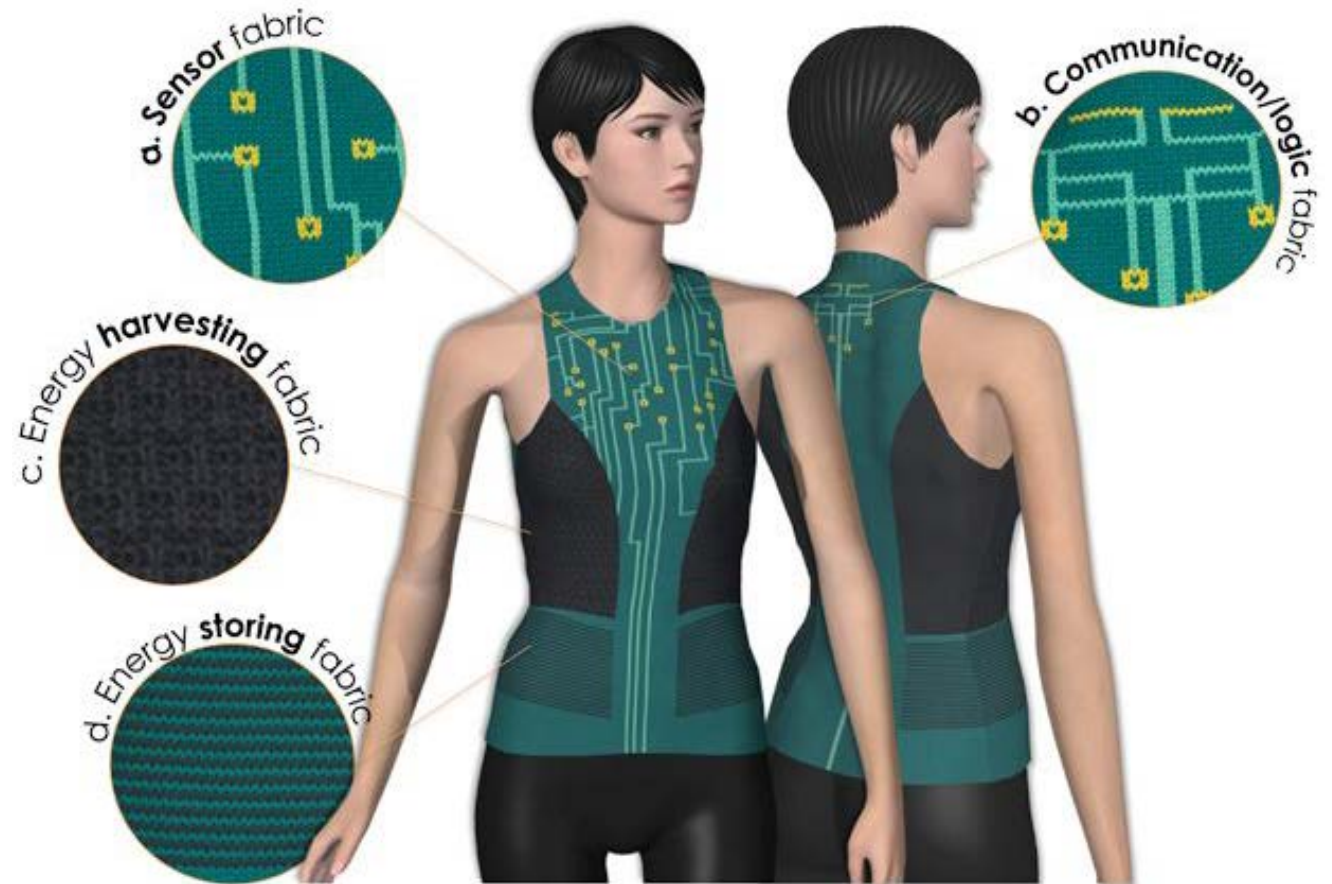
Magnetic induction for mid-range WPT

- Maximize this power transfer
- Construct structure to embed into fabrics
- Harvest ambient RF waves
- Power and data transfer



Potential for EH in apparel

- Vast amounts of energy to be harvested
- Current TEG prototype body cover = 0.014W in wind flow!

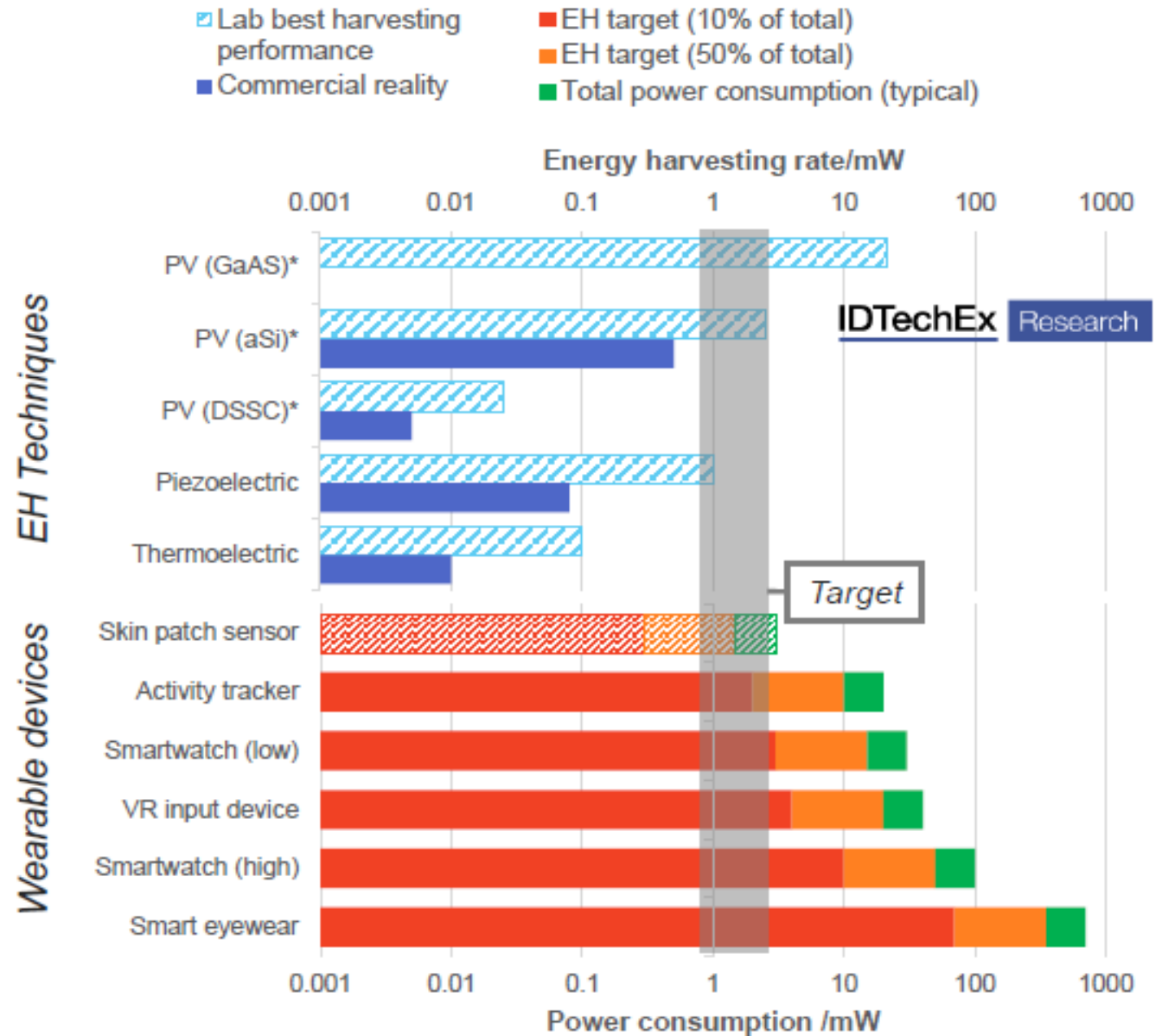




Today's Energy Harvesting Smart Clothing

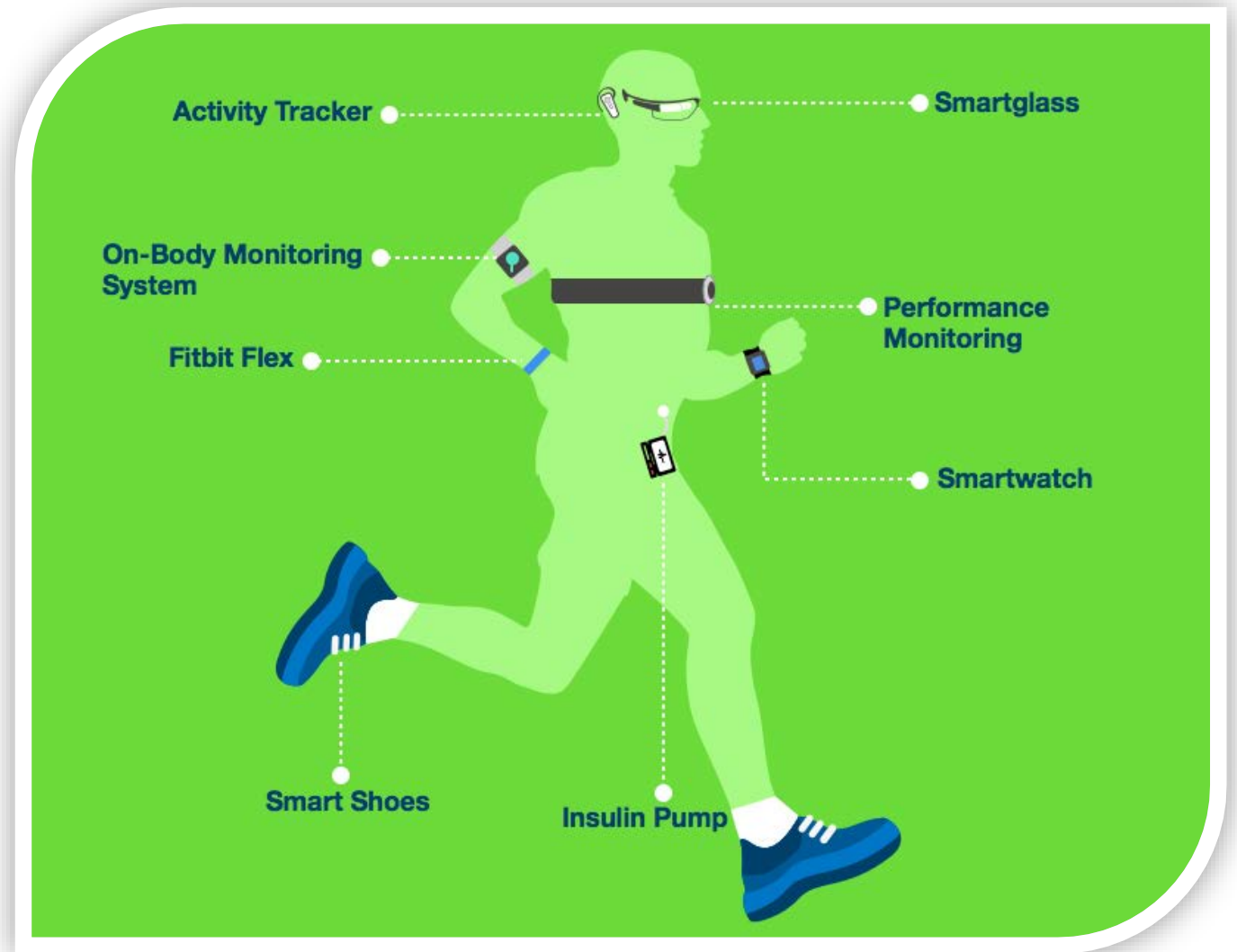
EH can be the solution wearables need

- Power consumption reducing faster than EH techniques improving
- EH Advancements key to widespread wearable tech



What EH can do for wearables

- Energy harvesting - IoT, AR/VR, transport
- Healthcare – real-time monitoring devices
- Widespread implementation of “everyday wearables”



Future plans for innovation

- The body is a constant energy source.
Collective EH methods = big supply of energy
- 2 follow on projects ongoing, more planned
- Open to further collaboration in the future





ULTIMATE GOAL:

A wearer powered smart garment that can detect the precursors to a heart attack, diagnose and action an emergency

Thank You – Q & A

Toju Raine – Special Projects Lead

toju@kymira.co.uk

www.kymira.co.uk

www.kymirasport.com



KYMIRA