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Mobile Thermal Energy Recovery and Storage

Multiple Energy-Powered Electrical Vehicles and Future Refueling Infrastructure

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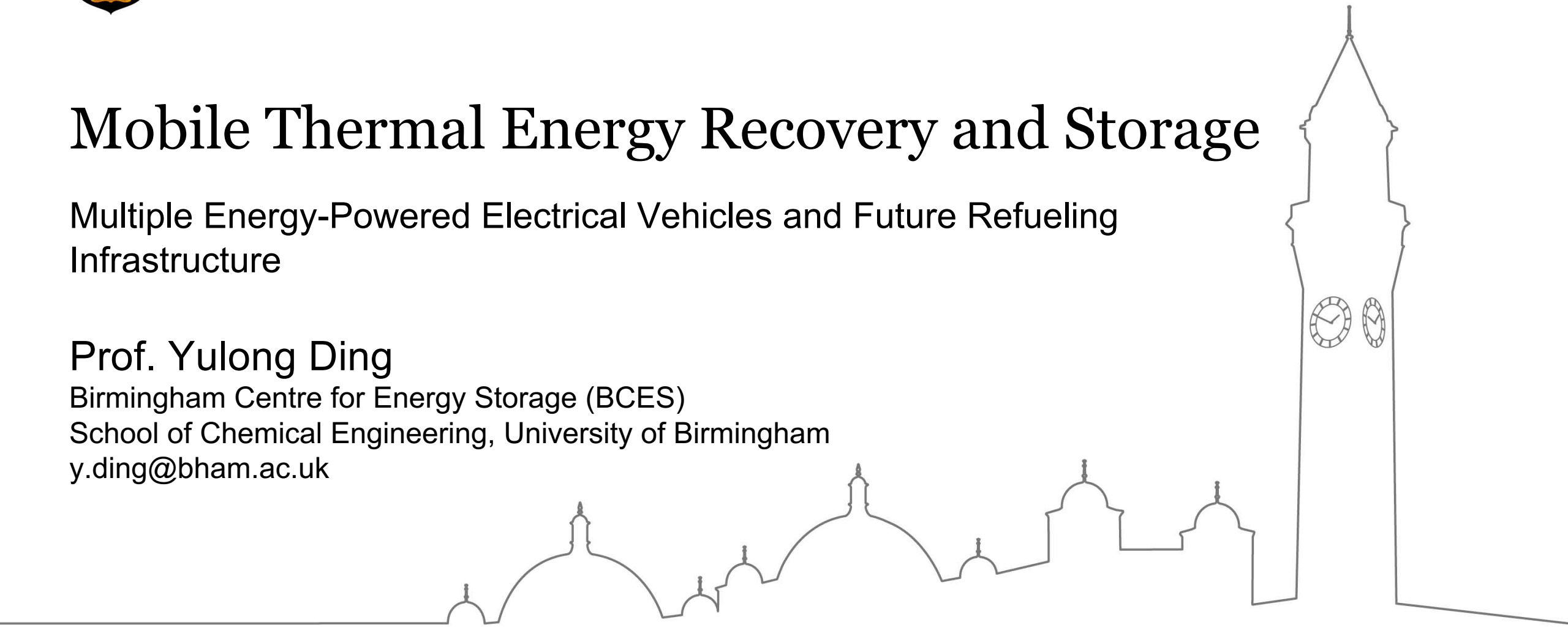
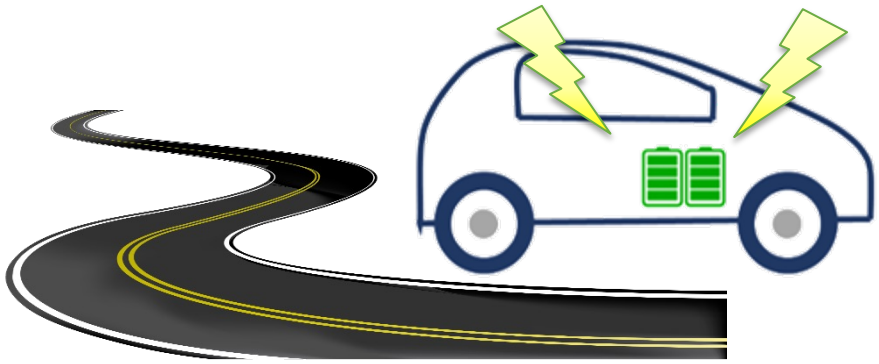
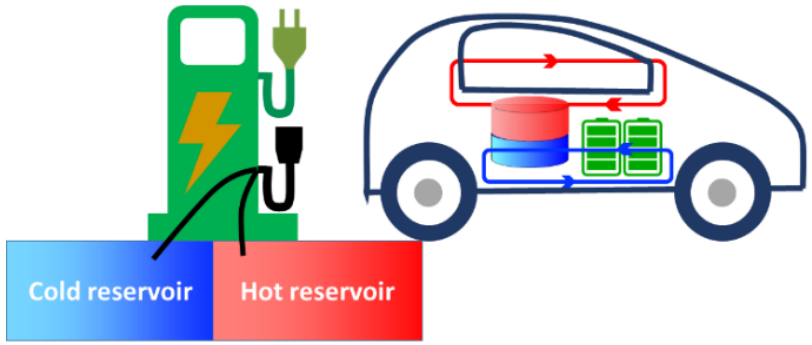


Two pathways of extending the travelling range of EVs:



Mobile energy recovery and storage:

1. Mechanical energy recovery while driving:
   - Harvest wasted mechanical/thermal energy
   - Deposit in battery/thermal reservoir



2. Multi-vector energy charge while parking:
   - Electricity charging in battery
   - Thermal energy refueling in on-board thermal reservoir

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State-of-the-art

Two pathways of **extending the travelling range** of EVs:

1. En-route recovery (while driving)
2. Direct refueling storage (while parking)

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Energy Recovery (Turn waste to wealth)

Vibrational work

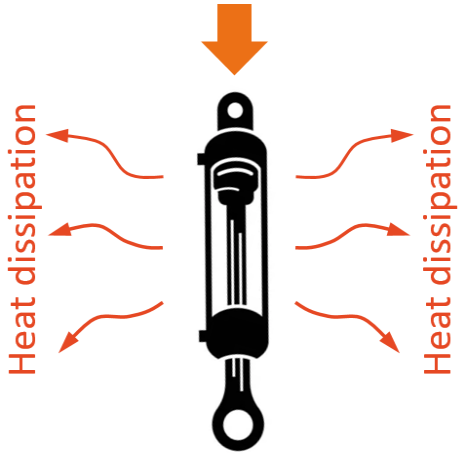
Damping friction

Heat dissipation

Wasted
about 10% of total
energy

(a) Oil shock absorber

Input:
Mechanical work

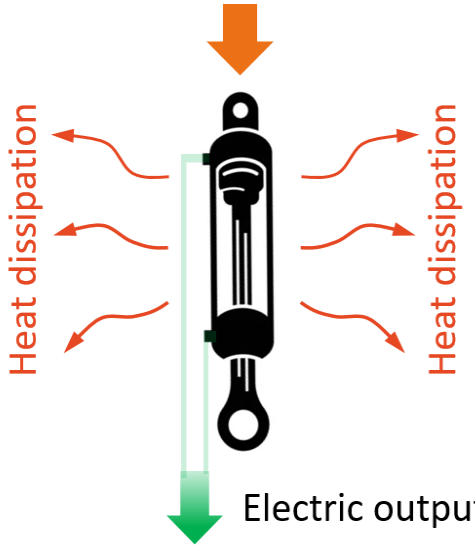


No electric output:

$$Electricity = 0$$

(b) Electromagnetic shock absorber

Input:
Mechanical work

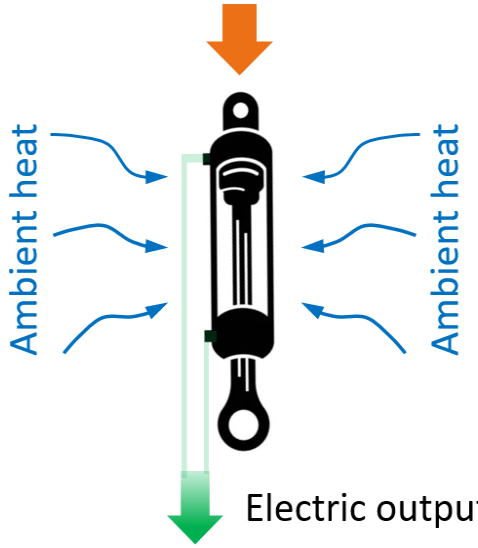


Electric output:

$$Electricity = \eta_{mech} \cdot Work$$

(c) Nanotriboelectrification shock absorber

Input:
Mechanical work



Electric output:

$$Electricity = \eta_{mech} \cdot Work + \eta_{therm} \cdot Heat$$

Ref. IEEE Transactions on Vehicular Technology, 2013, 62(3), 1065-1074. DOI: 10.1109/TVT.2012.2229308.

Ref. Electro-Intrusion Project | H2020 | European Commission n.d. https://cordis.europa.eu/project/id/101017858

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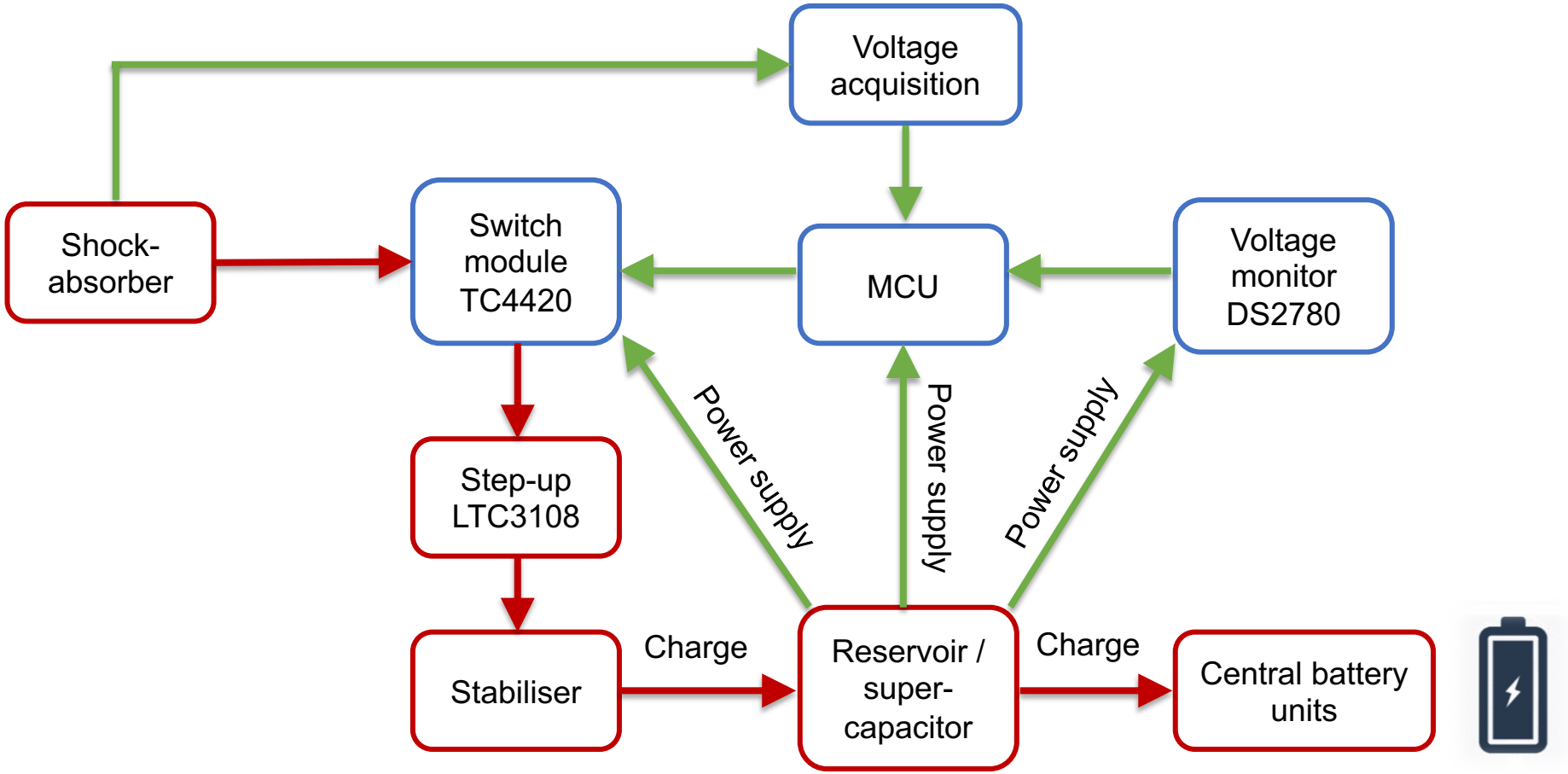
From Device to Vehicle

Initial design of the whole circuit



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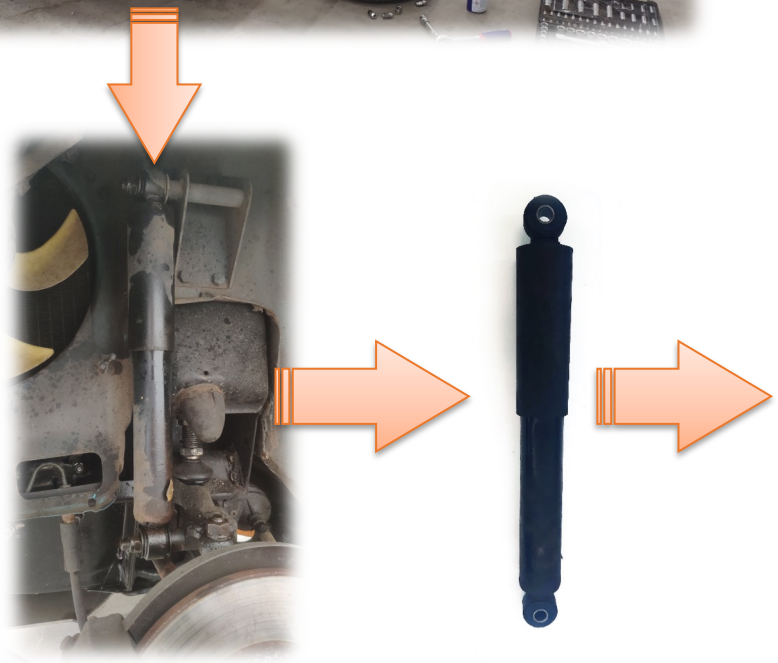
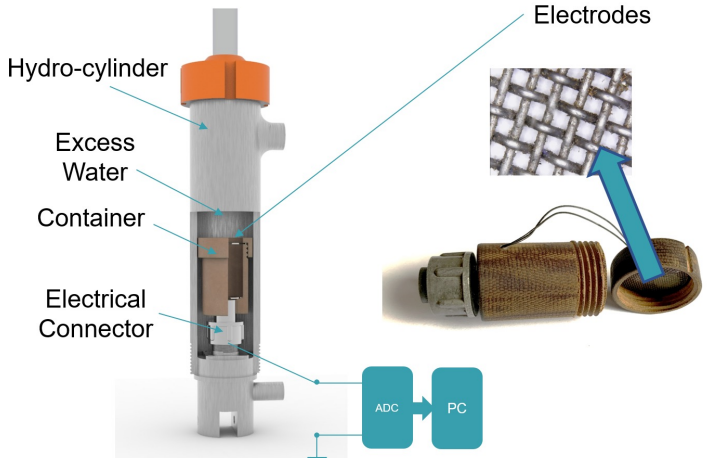
From Device to Vehicle

- Plug-in EV Rover Mini from 1995
- Integrate the Shock-absorber in
- Harvest Vibrational Energy for Charging
- Stretch its Travelling Range in Field Tests





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