

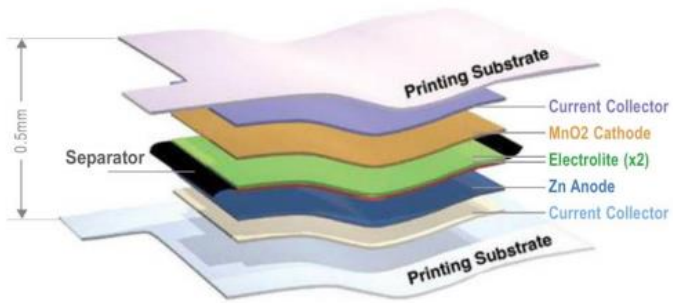
FIEECE

National Centre for Flexible Electronics

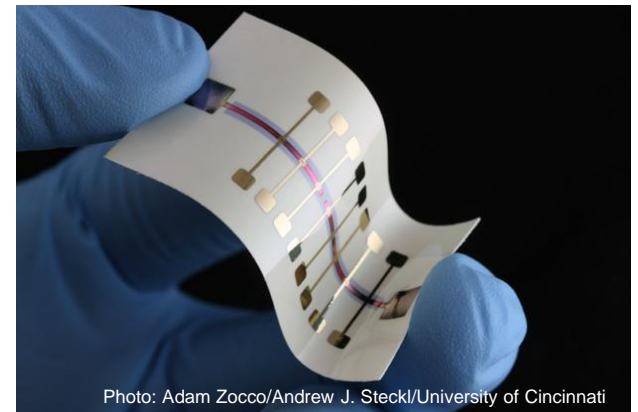


Call for
Expression of Interest
Printed Flexible Batteries

27th August 2015

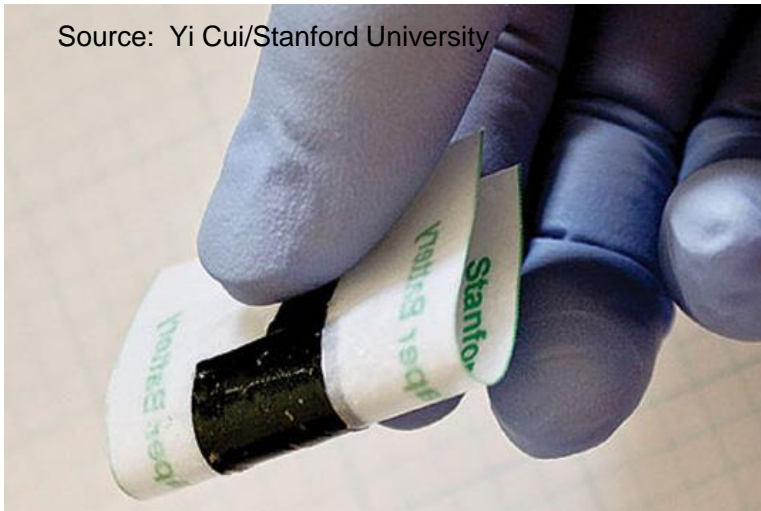


Source: Power Paper



Printed Flexible Batteries

Source: Yi Cui/Stanford University



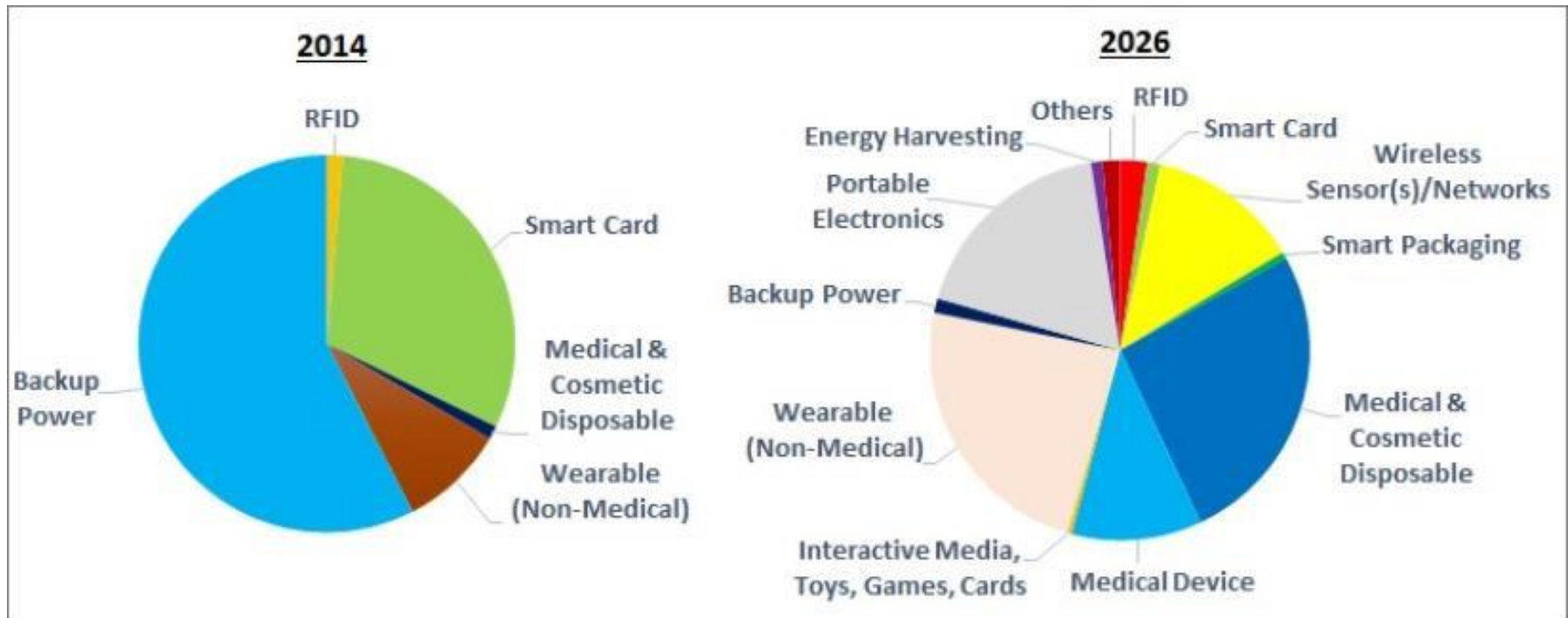
Background

- Energy storage devices, especially batteries, are intensely seeking for **novel form factors** to cater to the new market categories such as **wearable electronic** devices and **Internet of Things**
- **Healthcare sector**, specifically disposable medical diagnostic devices and medical sensors requiring **micro-power** batteries requires **thinness** and **flexibility**
- Memory backups, RFID cards, smart cards are also attractive sectors.

Printed batteries as solution:

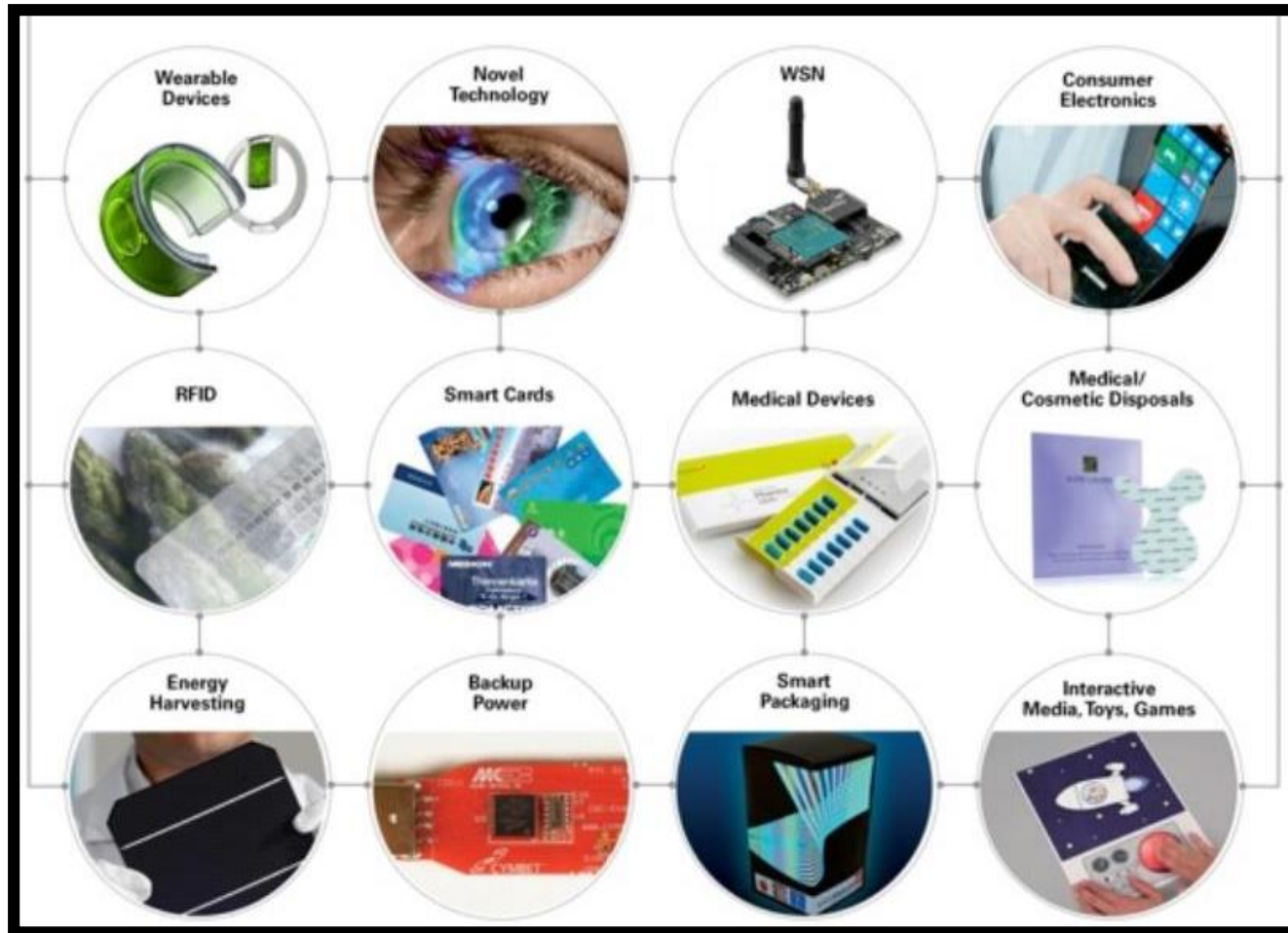
- Can be disposable and environmentally friendly
- Save to use
- No toxic chemicals
- Lightweight
- Flexible
- Adjustable shape
- Easy to integrate in electronic products
- Can be extremely cheap

Need for thin film batteries



Source: IDTechEx

Applications for printed batteries



Source: IDTechEx

Market Size and Potential

- Global market for all batteries used in portable devices in billion \$

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Single use	16.8	17.0	18.8	19.9	21.0	22.3	24.3	26.6	29.6	33.7	38.7
Rechargeable	19.4	20.2	23.2	25.3	27.7	30.3	33.1	36.3	40.3	48.1	54.9
Total market value \$billion	36.2	37.2	42.0	45.2	48.7	52.6	57.6	62.9	69.9	81.8	93.6
Market drivers	Laptops, mobile phones, e-books, talking gift cards, calculators, watches, active RFID, toys, torches, car keys etc with a rapid increase in the variety of products using them					Add e-labels, e-packaging, e-posters, medical disposables such as diagnostics and drug delivery etc and use of rechargeable batteries in energy harvesting devices					

Source IDTechEx



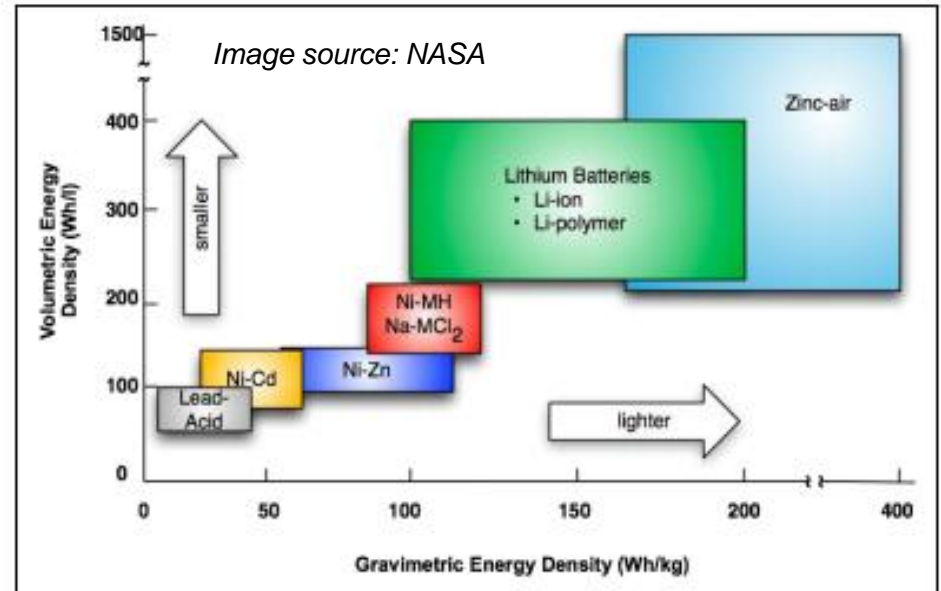
Key Drivers

Current Technology Options

- Multitude of designs:

- Ordinary coin cells, cylinders and block cells
- Thick film Batteries
- Thin film Batteries
- Thin Flexible Supercapacitors
- Rigid, flexible or stretchable
- Large area or mm^2 to μm^2

- Multitude of materials:

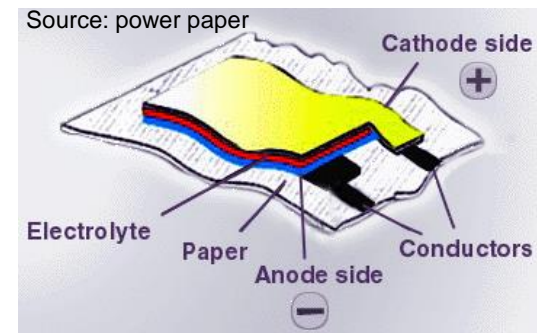
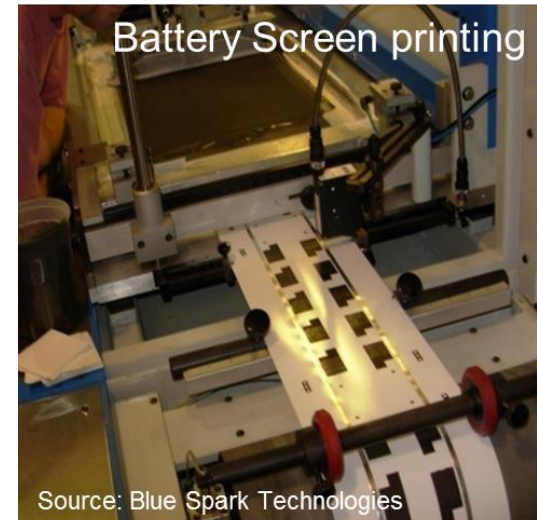


- However:

- New advanced flexible batteries only on lab scale or small production scale
- Not customised for applications

Proposed Solution

- [FlexE Centre](#) is developing flexible batteries with **tailored properties** to suit the requirements of different applications by using different battery materials and designs
- Our technology will be **compatible** with low-cost **paper and plastic substrates** and hence has the potential to be much **cheaper** conventional batteries
- The developed process will be **compatible** with **cost efficient**, high through put **mass production** utilizing coating and printing techniques
- Flexible batteries **would enable** applications where light weight, flexibility and low price are important, such as **disposable medical sensors, smart packaging, smart labels, smart cards, ...**



Source: IDTechEx



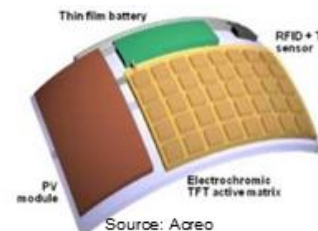
Source: ThinFilm



Source: IDTechEx



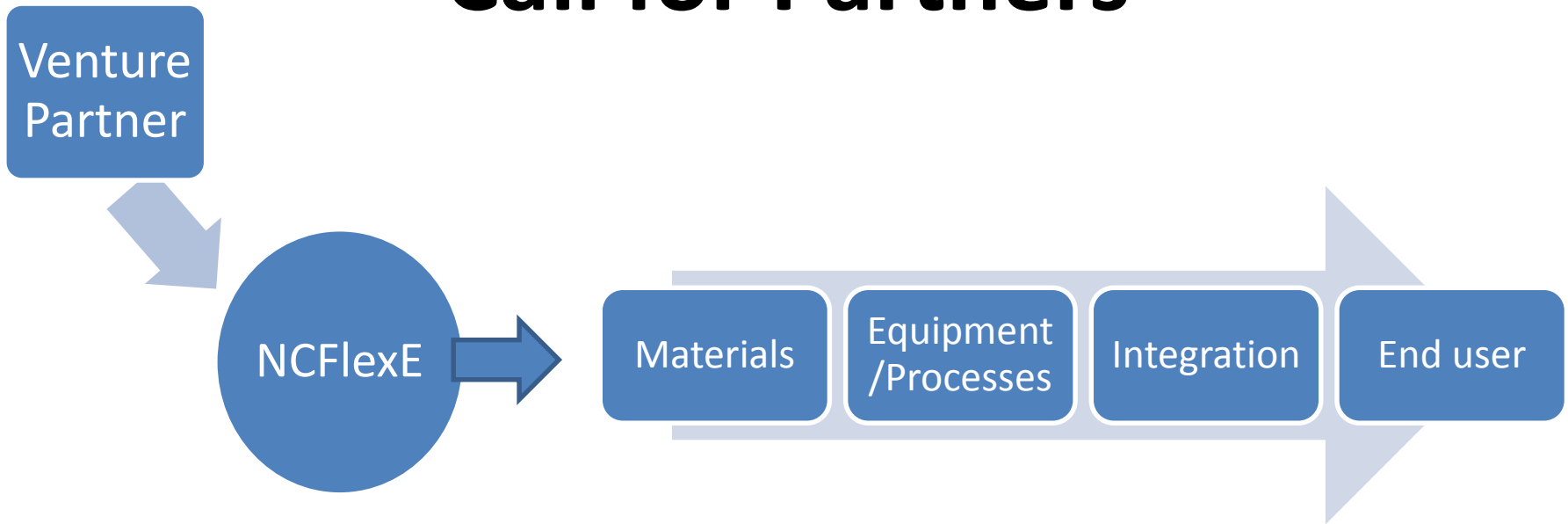
Thin film battery



Advantages of Proposed Solution

- Printed batteries can be
 - Tailored for different applications
 - Long lasting
 - Non toxic as they do not involve harmful chemical reactions.
 - Flexible or stretchable and can be folded or cut without any effect on their efficiencies.
 - Disposable and bio degradable
 - Used in harsh climate conditions like heat and cold.
 - Beneficial for applications where portability and small size is the main requirement
 - produced at very cost efficient

Call for Partners



- ✓ We are seeking partners across the value chain shown above
- ✓ We are looking for partners to enable the scaling and manufacturability of the developed processes
- ✓ Preferential terms for early partners

Contact Information

Dr. Sudhindra Tatti
Chief Operating Officer,
National Centre for Flexible Electronics,
Indian Institute of Technology Kanpur.
statti@iitk.ac.in

Prof. Monica Katiyar
Co-ordinator,
National Centre for Flexible Electronics,
Indian Institute of Technology Kanpur.
mk@iitk.ac.in

Also visit our webpage for more details on partnership models and other technology domains: www.ncflexe.in