

Advanced Materials for Energy Storage

Meeting co-organised by STOA & EuCheMS

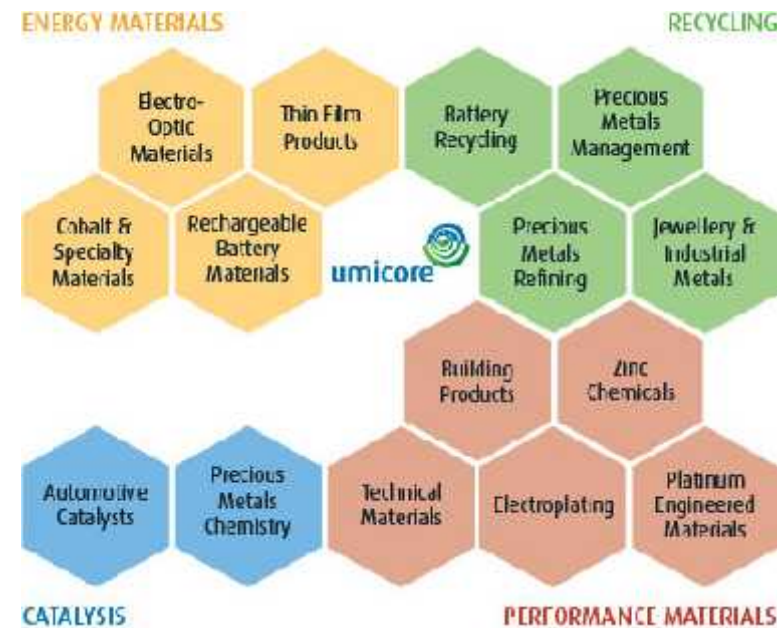
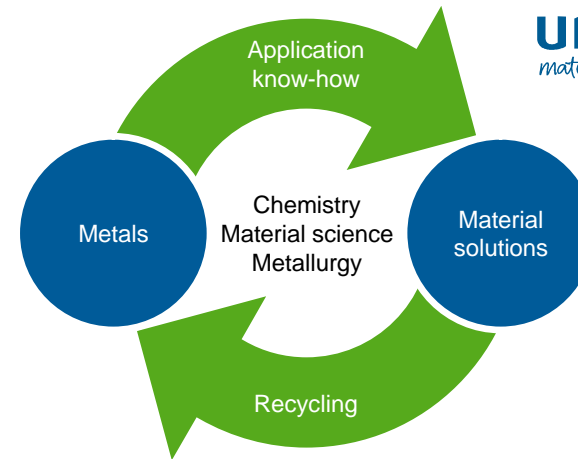
THE ENERGY STORAGE CHALLENGE

February 11th 2014 – European Parliament - Brussels

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Energy Materials Industrial Research Initiative

Umicore in a nutshell

- We are a **global materials technology company** (14.600 people, 79 sites, > 50% sales in Europe, Turnover 2012 @ 12.5 B€ or 2.4 B€ excl. metal value)
- Our mission is to make **“materials for a better life”** (from metals to high-tech applications)
- The majority of our **growth comes from clean technologies**
- We use application know-how to create **tailor-made solutions** in close collaboration with our customers
- We **close the loop and secure supply** by recycling production scrap and end-of-life materials

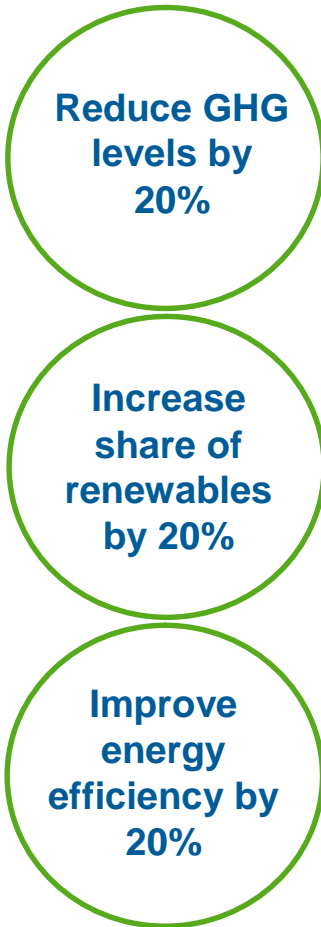


No. 1 ranking in global index companies (Jan. 2013)

EU faces strong energy challenges and has set ambitious goals and priorities

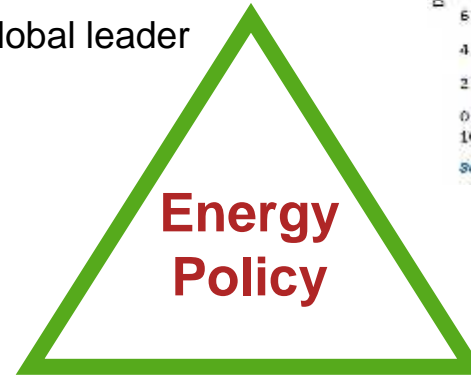


EU “20-20-20” Targets by 2020:



Competitiveness

- Cut Europe’s energy bill
- Create growth & jobs
- Boost R&D where EU can become a global leader



Security of Supply

- Decrease EU’s energy dependence
- Help balance trade: single European energy market

Sustainability

- Fight climate change
- Limit environmental degradation

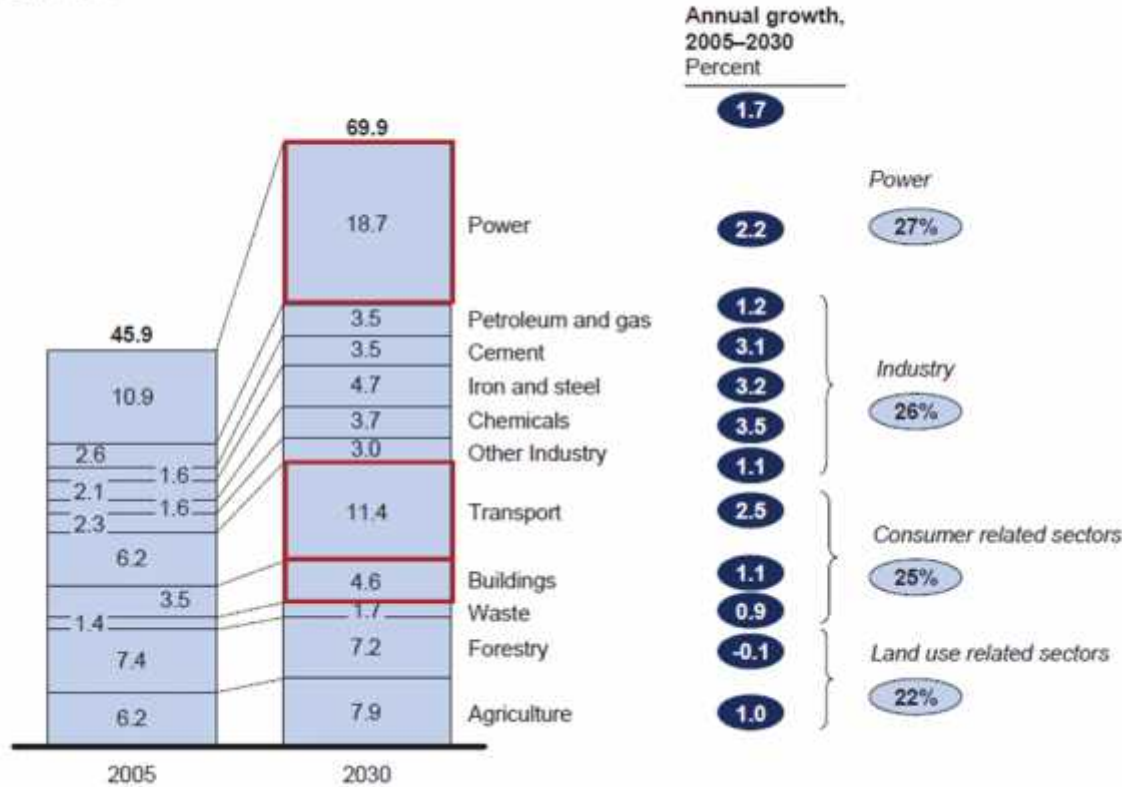


By 2050: Reduce GHG levels by 80-95% below 1990 levels

In a BAU scenario, the power sector would be accountable for ~ 30% of GHG emissions



Business-as-usual emissions split by sector in 2005 and 2030
GtCO₂e per year



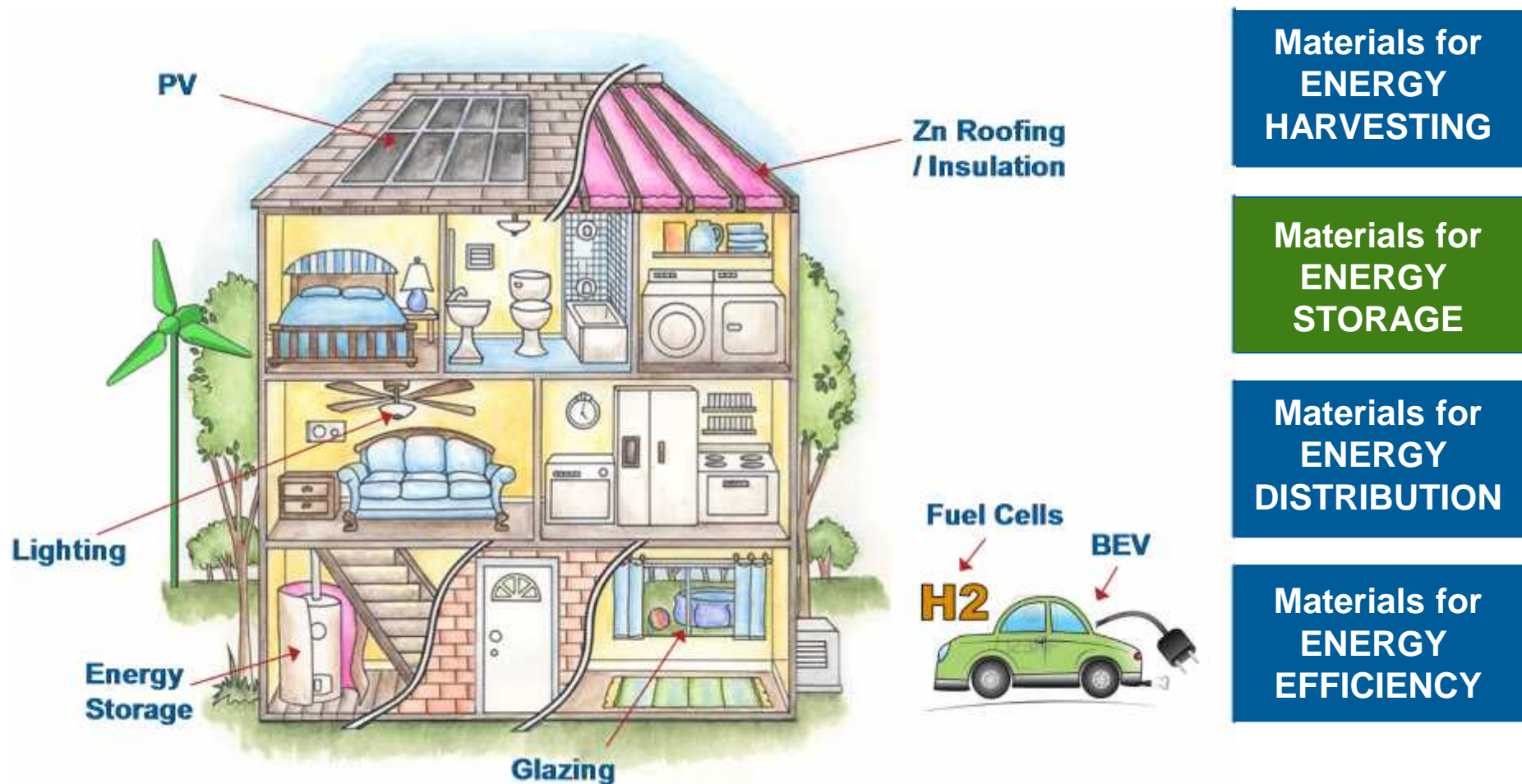
Source: Houghton; IEA; IPCC; UNFCCC; US EPA; Global GHG Abatement Cost Curve v2.0

CO₂ = P ↑
 X
 S ↑
 X
 E ↓
 X
 C ↓

Reducing CO₂ emissions relies upon innovations in energy efficiency, sustainable energy harvesting & storage

Advanced Materials facilitate deployment of sustainable energy technologies

Umicore helps with its innovations



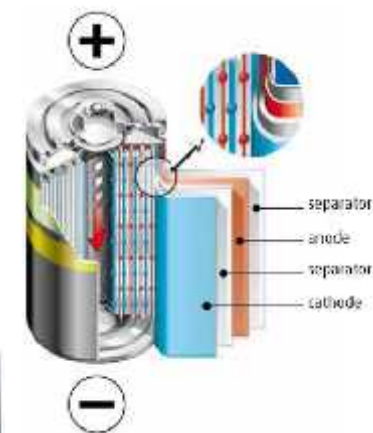
Energy Storage using Li-ion batteries could enable a EU value chain while solving sustainability challenges

- Large storage potential forecasted (BCG 2013) with EU stronger than Japan, China and ROW
- Batteries 2 times more than Hydrogen & together >80% of the market (2020+)

Example



umicore
materials for a better life



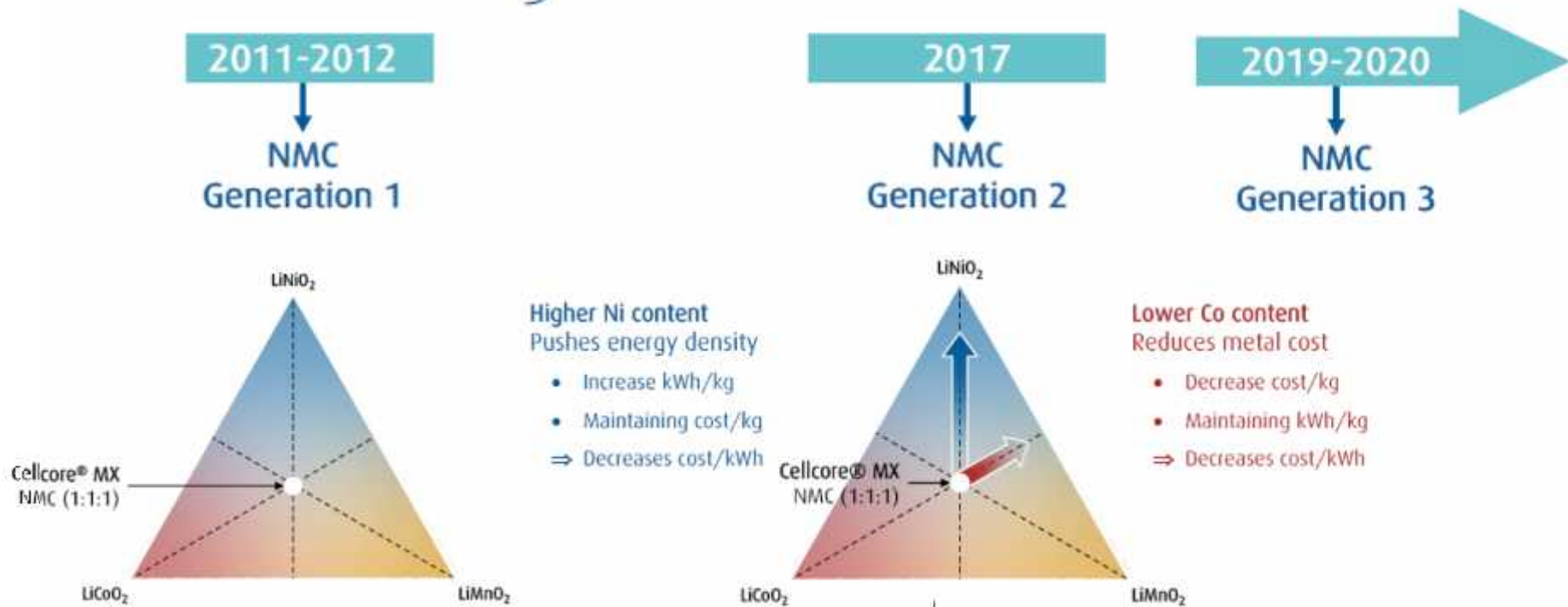
	Energy	Power	Safety*	Life	Cost
LCO lithium cobaltite LiCoO_2	+++	+++	-	++	+
LMO lithium manganese oxide LiMnO_2	-	+++	++	-	++
NMC nickel manganese cobalt $\text{Li}(\text{Ni}_x\text{Mn}_y\text{Co}_{1-x-y})\text{O}_2$	++	++	++	+++	+++
LFP lithium iron phosphate LiFePO_4	+	+++	+++	++	++

Developing products with suitable cost & performance requires strong materials R&D



Different NMC material generations are being developed

- Reducing cost/kg
 - Increasing kWh/kg
- } ⇒ Reducing cost/kWh



Key actors in advanced materials team up within EMIRI Energy Materials Industrial Research Initiative



- 50+ organizations active in research & innovation in advanced materials
- Collaborating to achieve commercially successful development in EU
- Of advanced materials for low carbon energy & energy efficiency



SET Plan

- Energy storage
- Wind & marine
- PV & CSP
- FC/H₂
- CCS
- Grids
- Energy efficiency
- Others

Activities of EMIRI span essential parts of the innovation value chain



Vision

To ensure the long term **industrial leadership** of the European “advanced materials for low carbon energy & energy efficiency” sector

Mission Statement

To be a key player at EU level in defining & implementing **a policy framework** for advanced materials for low carbon energy & energy efficiency



EMIRI defining topics of focus for research & innovation on various SET plan technologies including Energy Storage



Topics of focus (ToF)			Functional particles / filaments	Materials for functional layers / coatings	Composite materials	High performance materials for challenging conditions	Novel chemistry / metallurgy for new materials / systems
#1	Li ion batteries	Competitive low cost high capacity cathode materials for Li ion batteries (highest priority within ToF #1) and other battery materials to enable these (electrolytes, binders, separators, ...)					
		Novel, high energy density anode materials with long life time for Li ion batteries					
		Development of solid state Li ion batteries (lowest priority within ToF #1)					
#2	Redox flow batteries						
#3	Metal air batteries (focus on Li & considering others)						
#4	Power oriented materials for electrochemical capacitors - Development of pseudo-capacitors (redox-based)						