Impact of energy storage to future society

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Self introduction

Sony Research Center (1990-2002)

University of Texas (1996-1997)

Prof. John. B. Goodenough

Novel Prize, 2019

Tokyo Tech (2002-2009)

University of Bordeaux I (2005)

University of Tokyo (2009-present)

Storage !

Food

Information

Wealth

Energy

Category of Batteries

Close system

Primary Battery

Irreversible chemical reaction

Secondary Battery

Reversible chemical reaction, Rechargeable

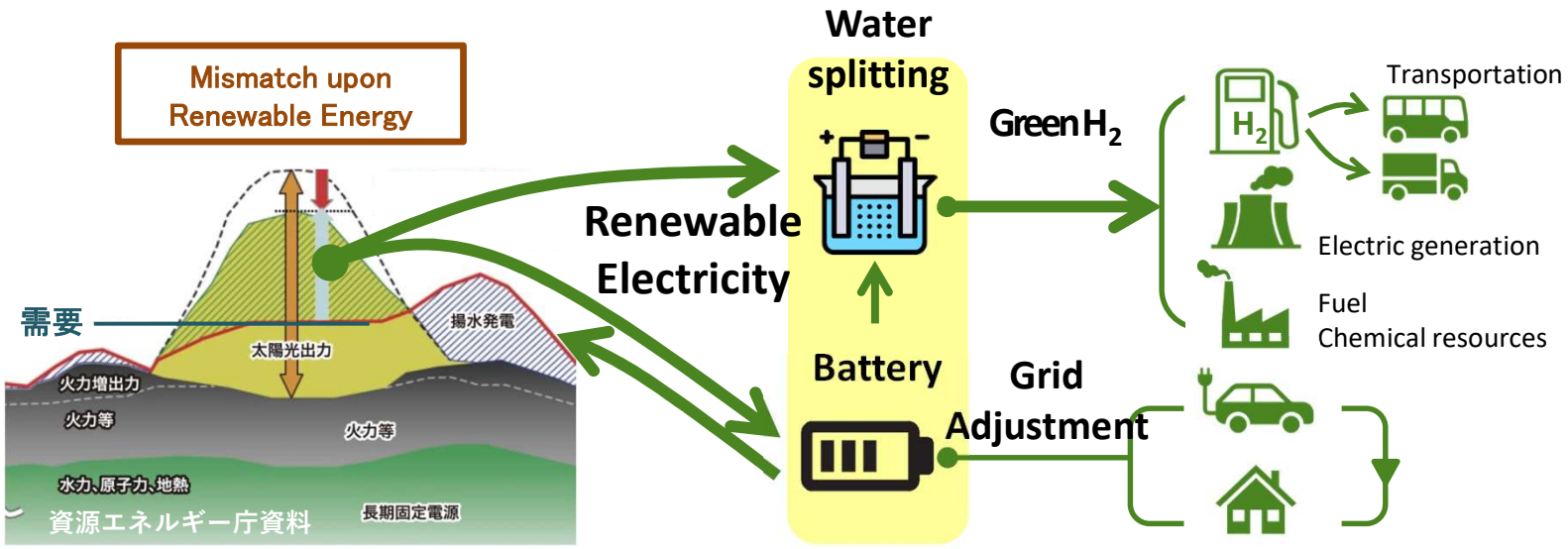
Open system

Fuel Cell

Electric generator by fuel supply and gas exhaust

Importance of electricity storage

Towards carbon neutral until 2050



Smart House

※ 家庭用燃料電池「エネファーム」の発電量とV2Hシステムの充放電量のHEMSでの計測については、一部対応していない場合があります。

Recent world situation on EV

Norway: 100% EV by 2025

England, France: 0% combustion vehicle by 2027

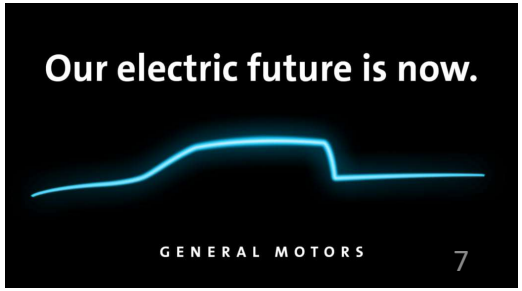
India: 100% EV by 2030

Japan: 70% PHEV or EV by 2030

China: 10% EV last year

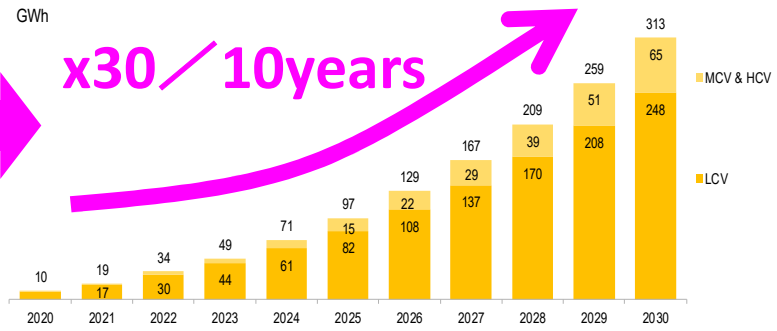
Daimler stopped developing combustion engine
(2019. 9. 19, focusing on EV powertrain)

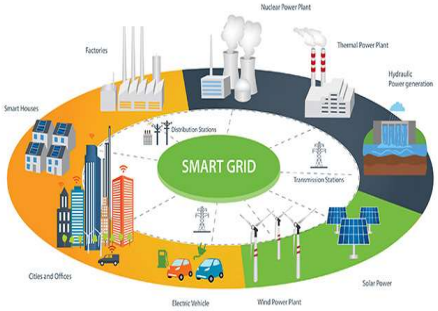
General Motors(**GM)** 100% changed their factory at Detroit to EV production.
(2020. 1. 27, investing $3,000,000,000)



EV Battery : 30 times for coming 10 years !

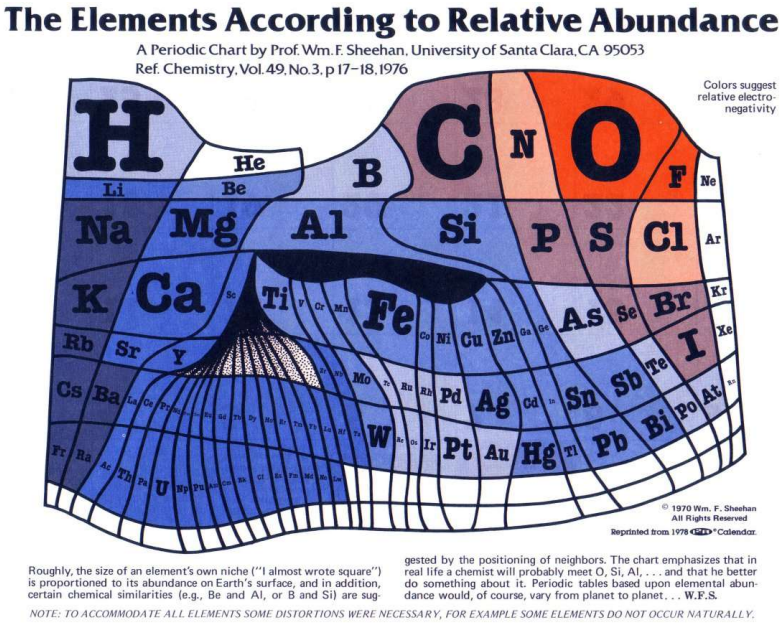
Electric Vehicles





Infrastructure

Toward Sustainability → Element Strategy

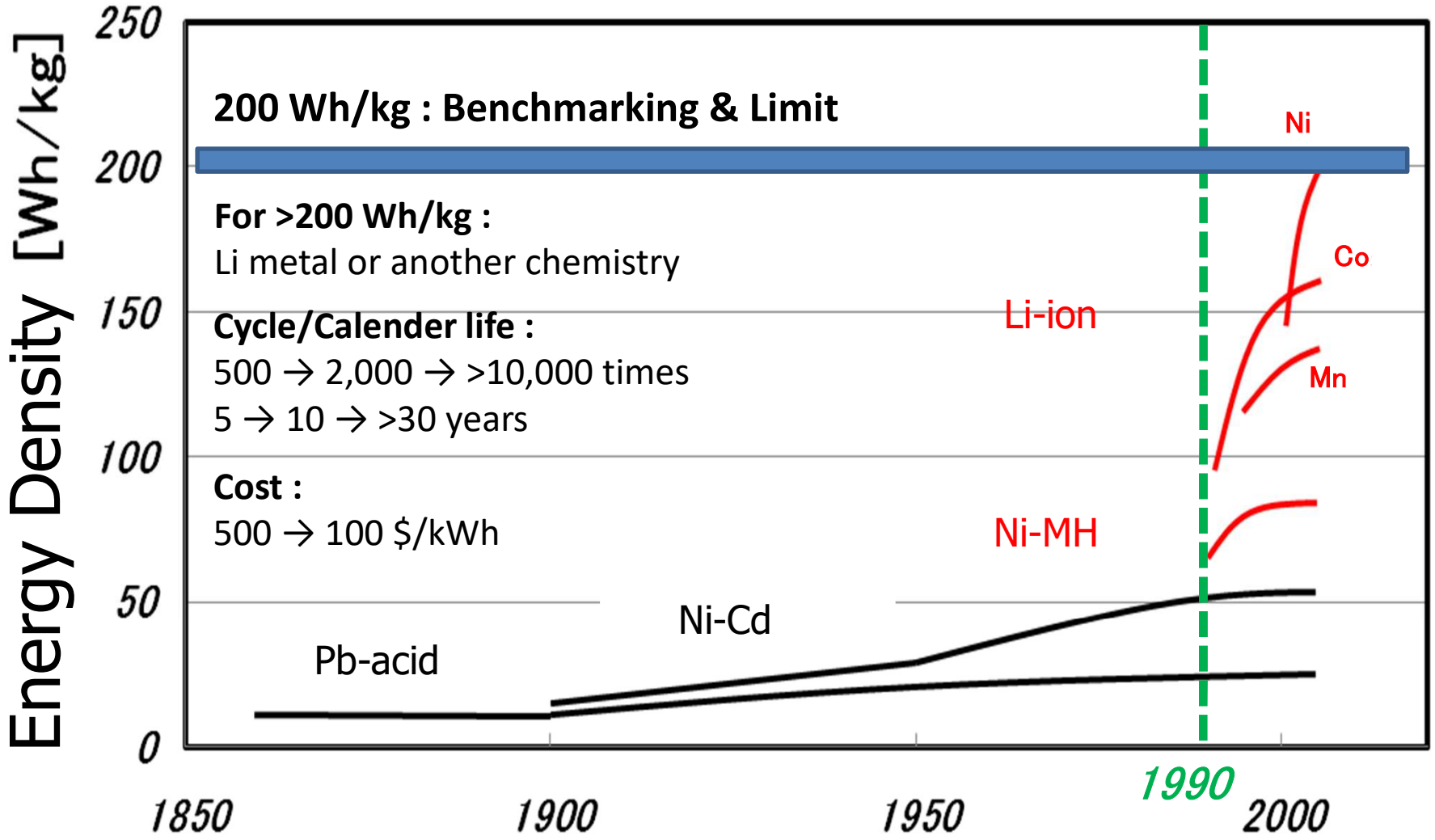


Li → Na

Co, Ni → Fe, Mn, Ti

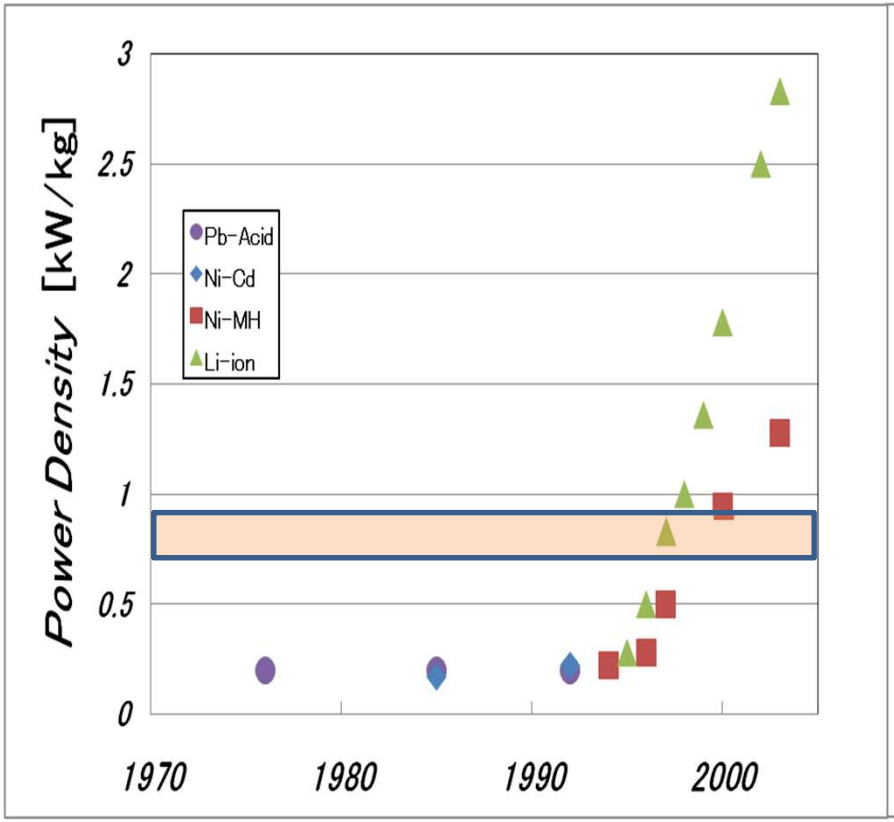
Flammable organics → H_2O

History of Secondary Batteries (Energy Density)

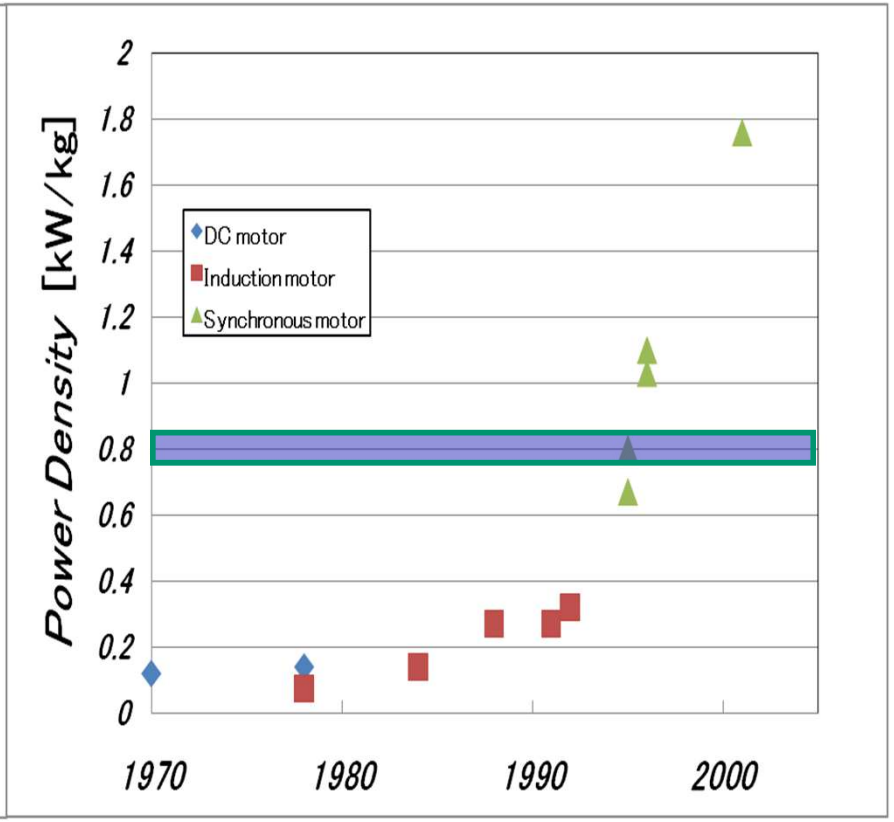


Power density exceeding combustion engine

Batteries

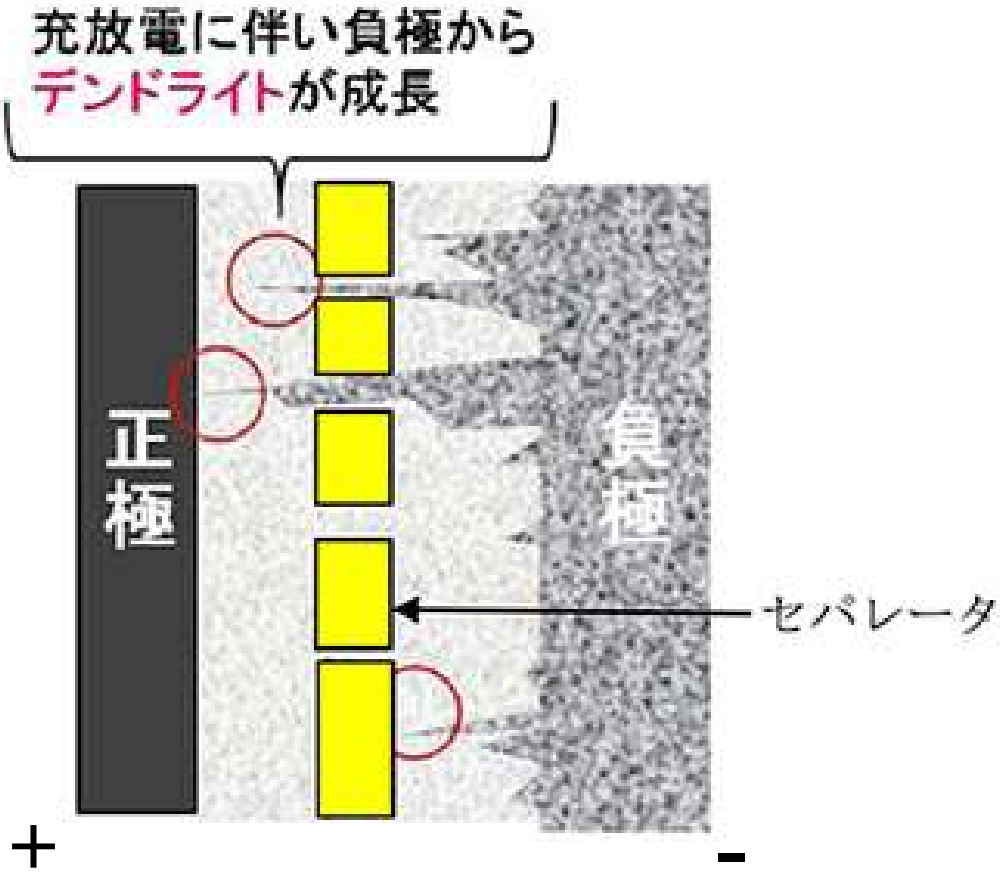


Motor



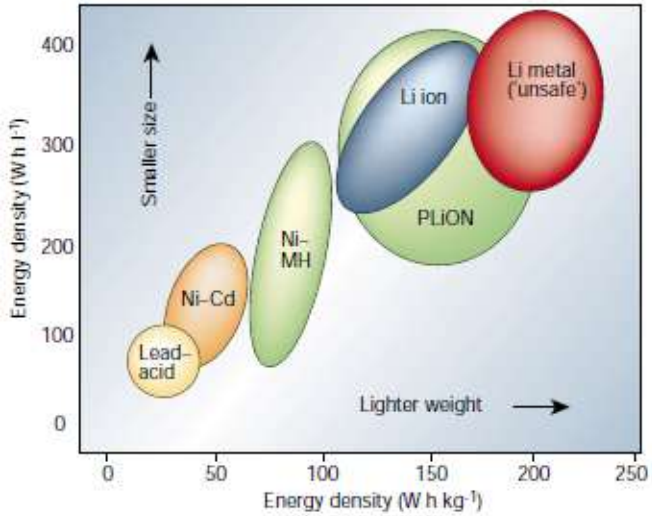
Why called lithium “ion” battery ?

Dendrite growth



Lithium-ion battery: A Novel prize winner

What's inside and technical issues?



Safety ? ?
Cost ? ?
Reliability ? ?

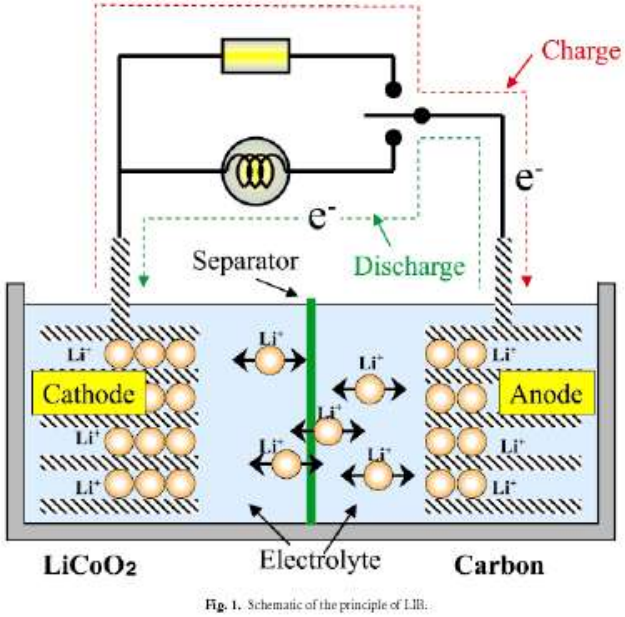
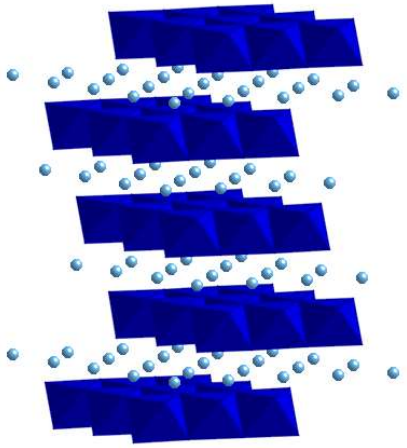
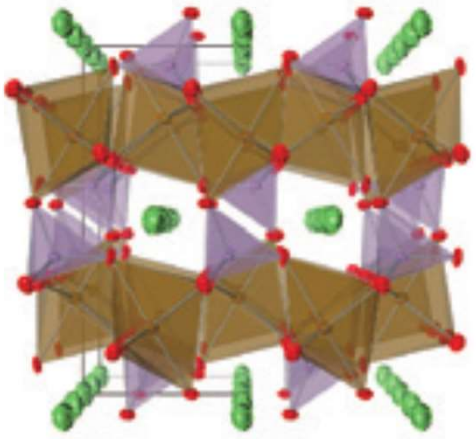


Fig. 1. Schematic of the principle of LIB.



$LiCoO_2$, $LiNiO_2$
Layered rocksalt



$LiFePO_4$
Olivine

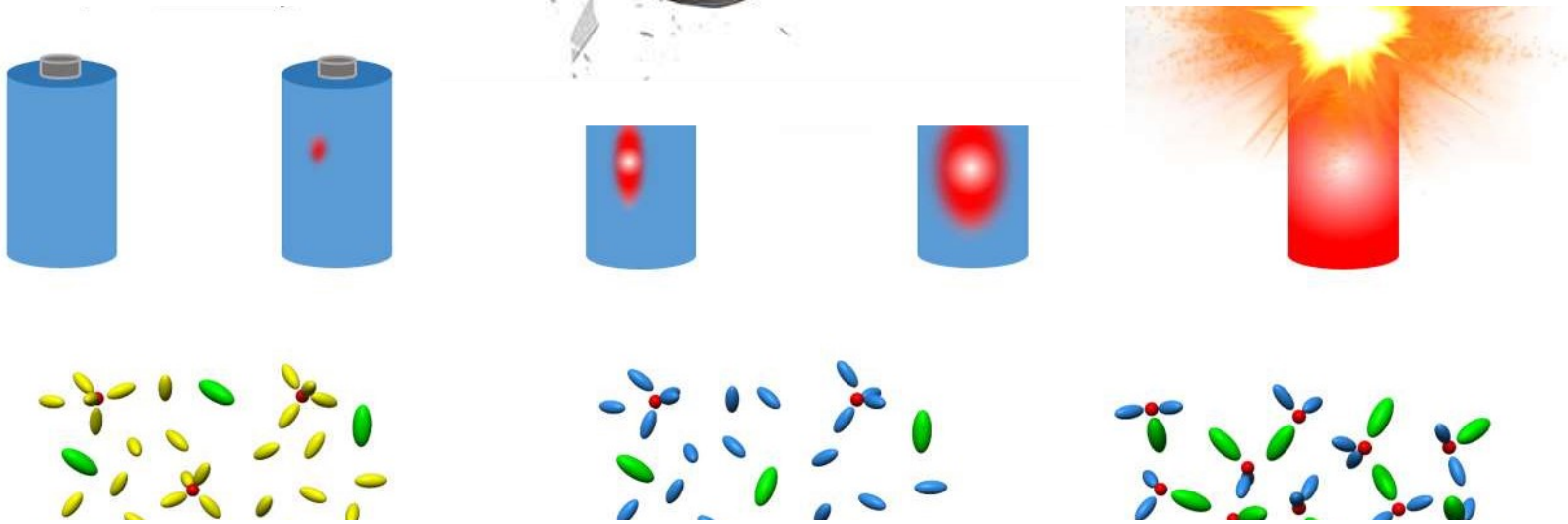
2019 Novel Prize in Chemistry

Nobel Prize in Chemistry

For Lithium-ion Batteries

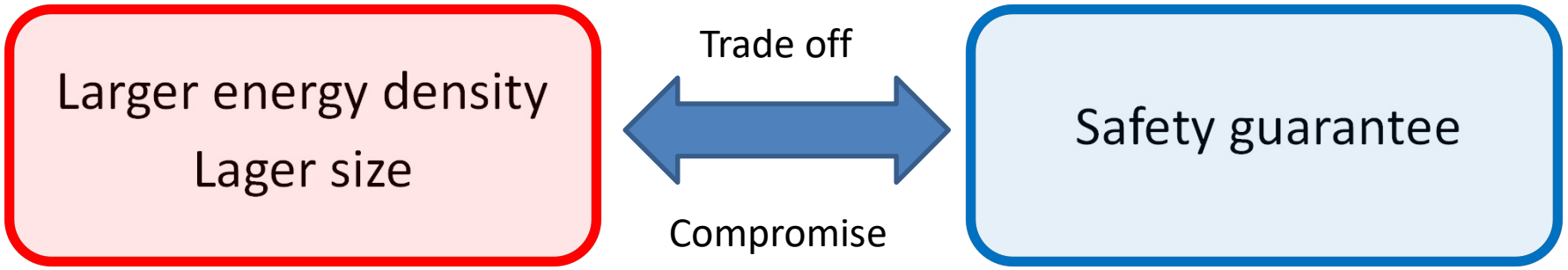
With Prof. John. B. Goodenough, 1997

Battery explosion



Explosion of note PC and EV

Dilemma in battery development



Frontier Researches vs. Terminate Researches

Discussion Point

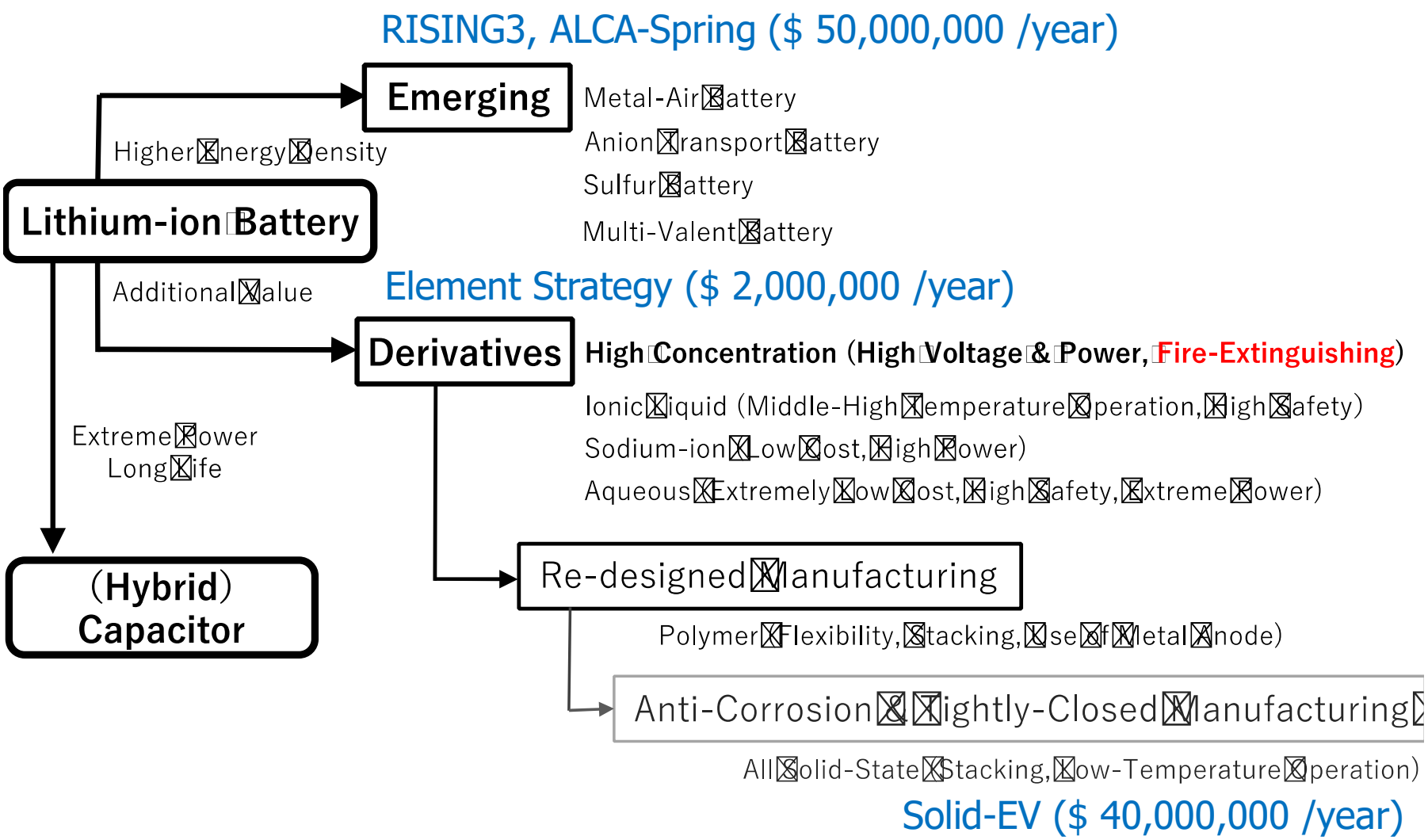
Next generation battery？

Innovative battery？

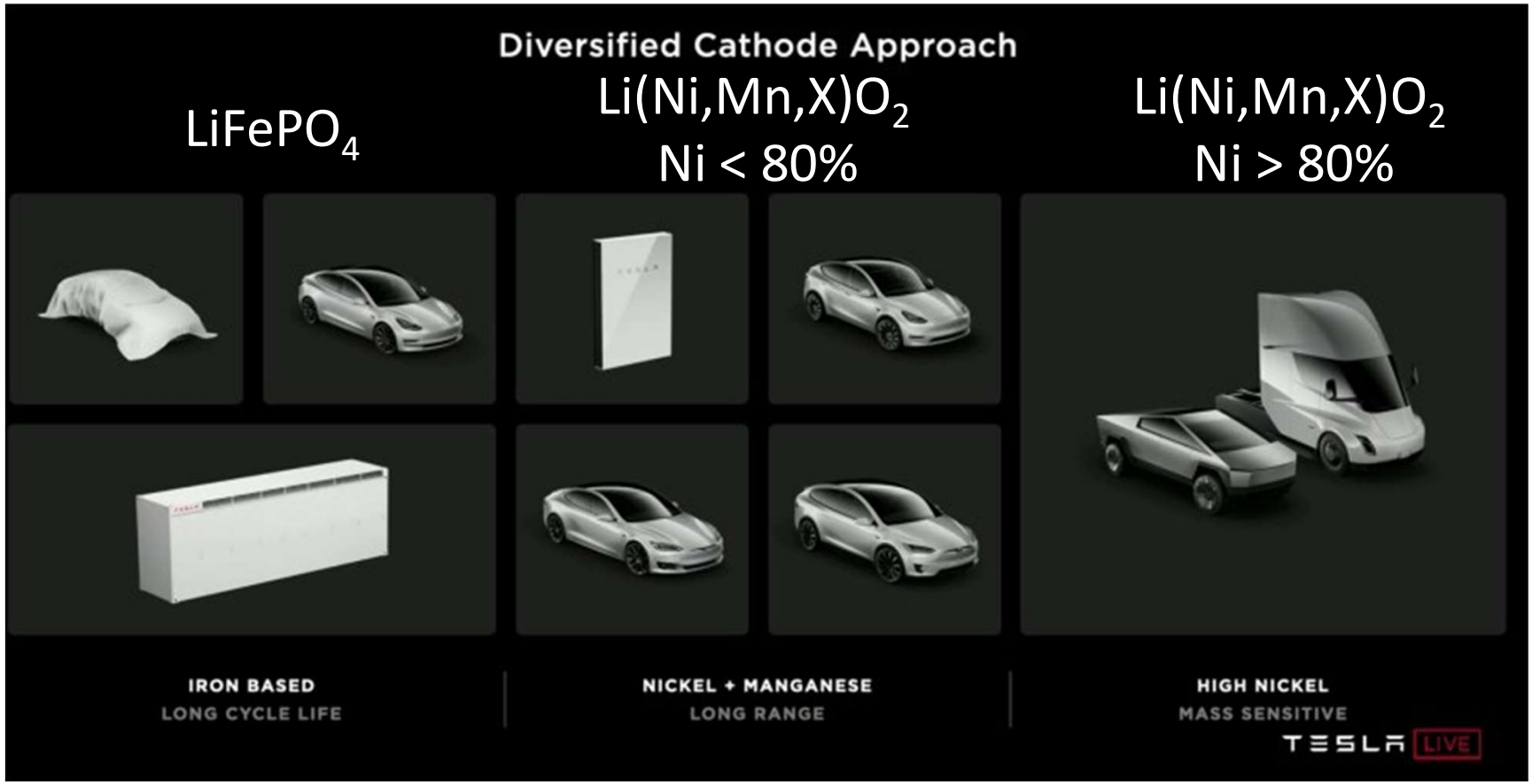
What is really necessary？

Overviewing battery technologies

What's going on Japanese national project



Tesla's realistic strategy



Cell size : 18650 → 2170 → 4680

Mounting : Cell ~~⇒ Module ⇒ Pack ⇒~~ Chassis