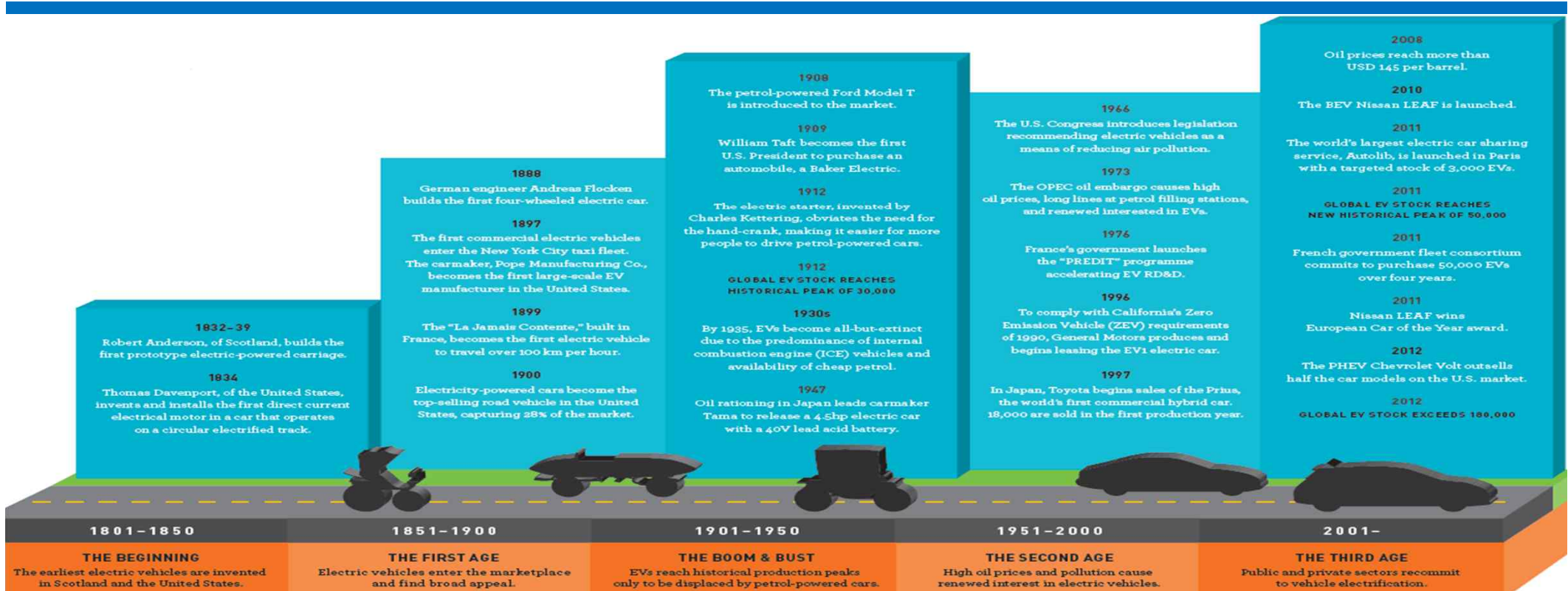


The activities of LiB standardization for xEV in Korea



2014. 11. 18
Yu Tack, Kim

Content

I . Battery Industry in Korea

II . Battery development Trend

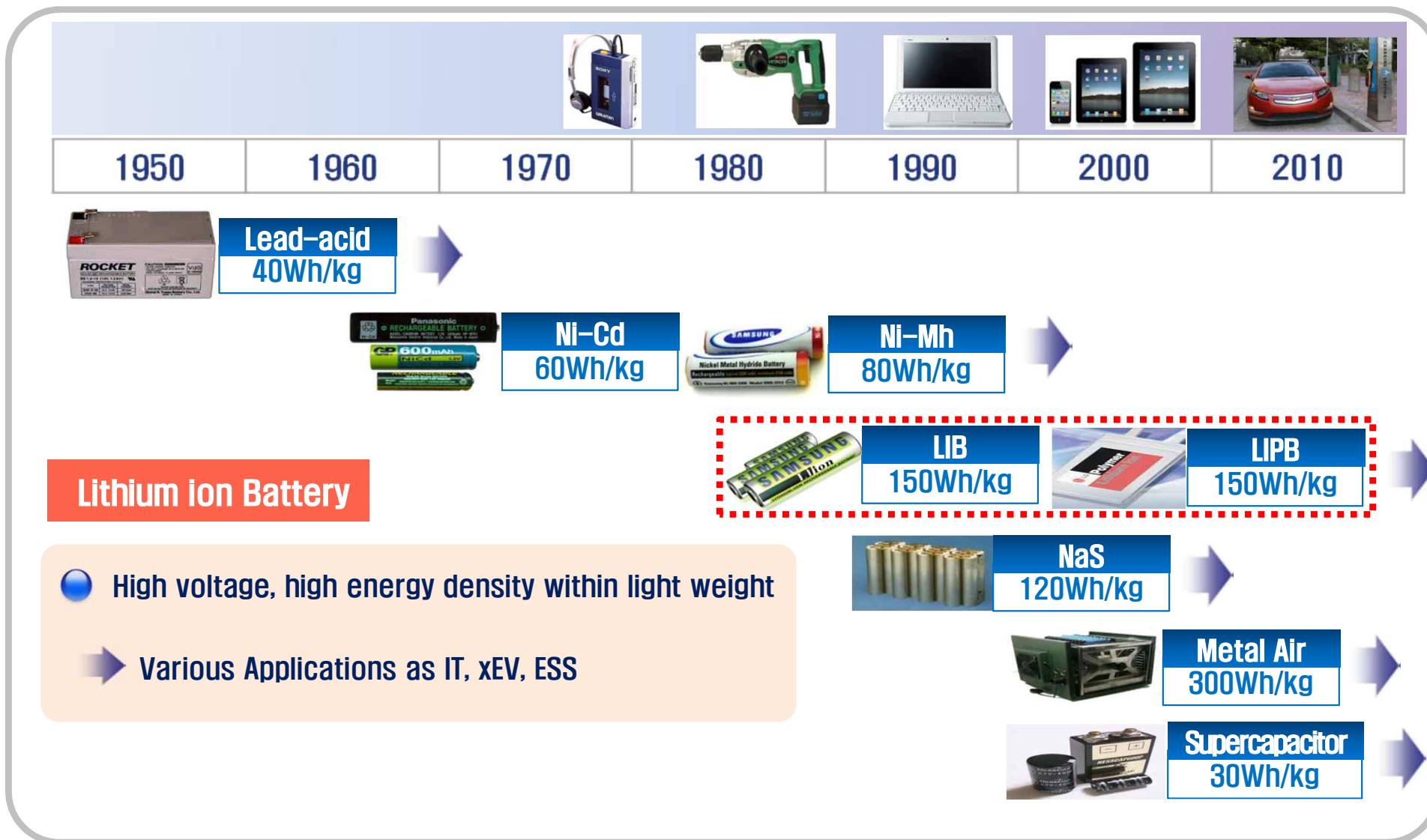
III . Battery Standardization for xEV

IV . Summary

I . Battery Industry in Korea

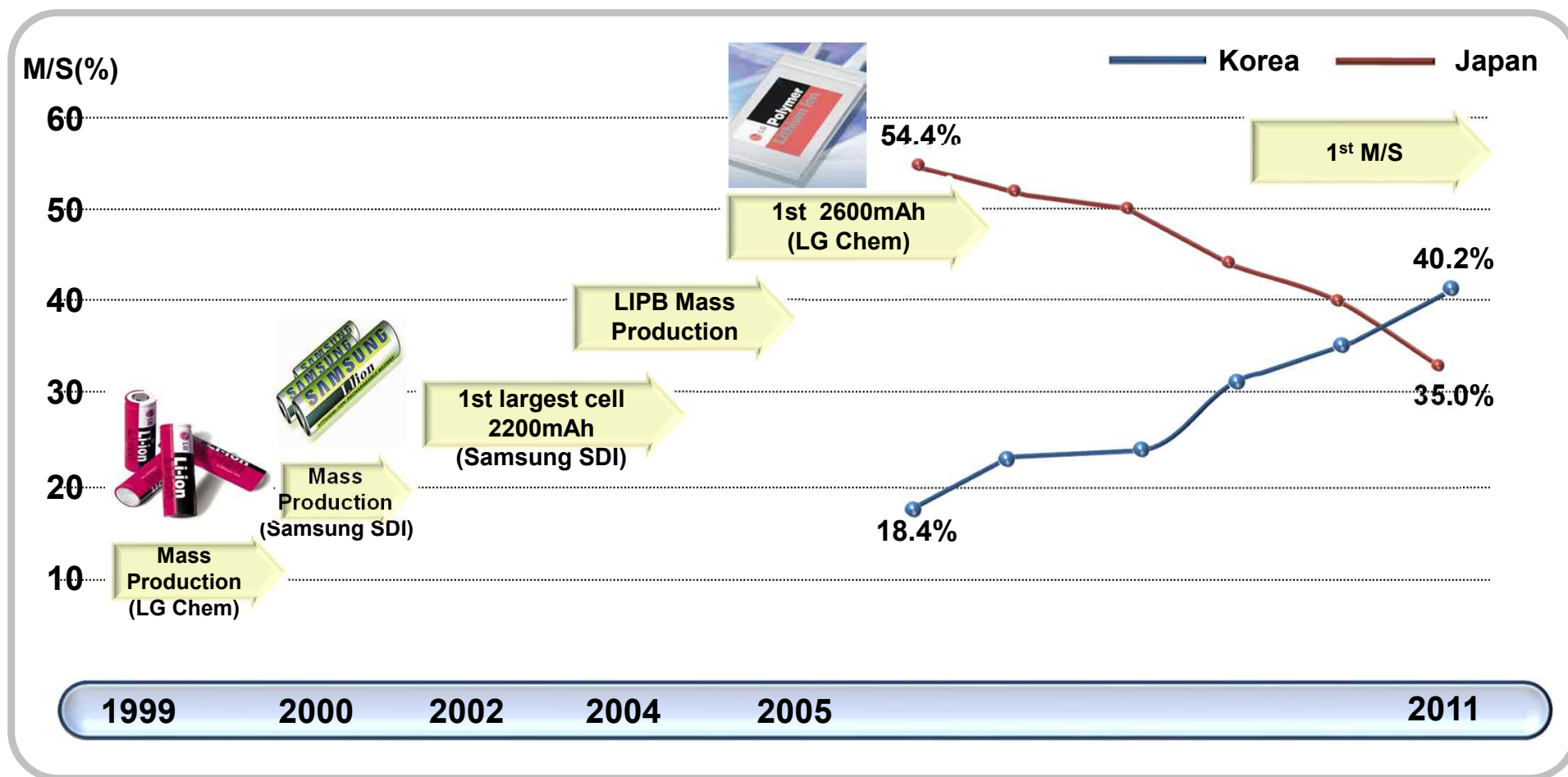
1. Battery Technology

Rechargeable Battery Industry development



2. Battery Industry in Korea

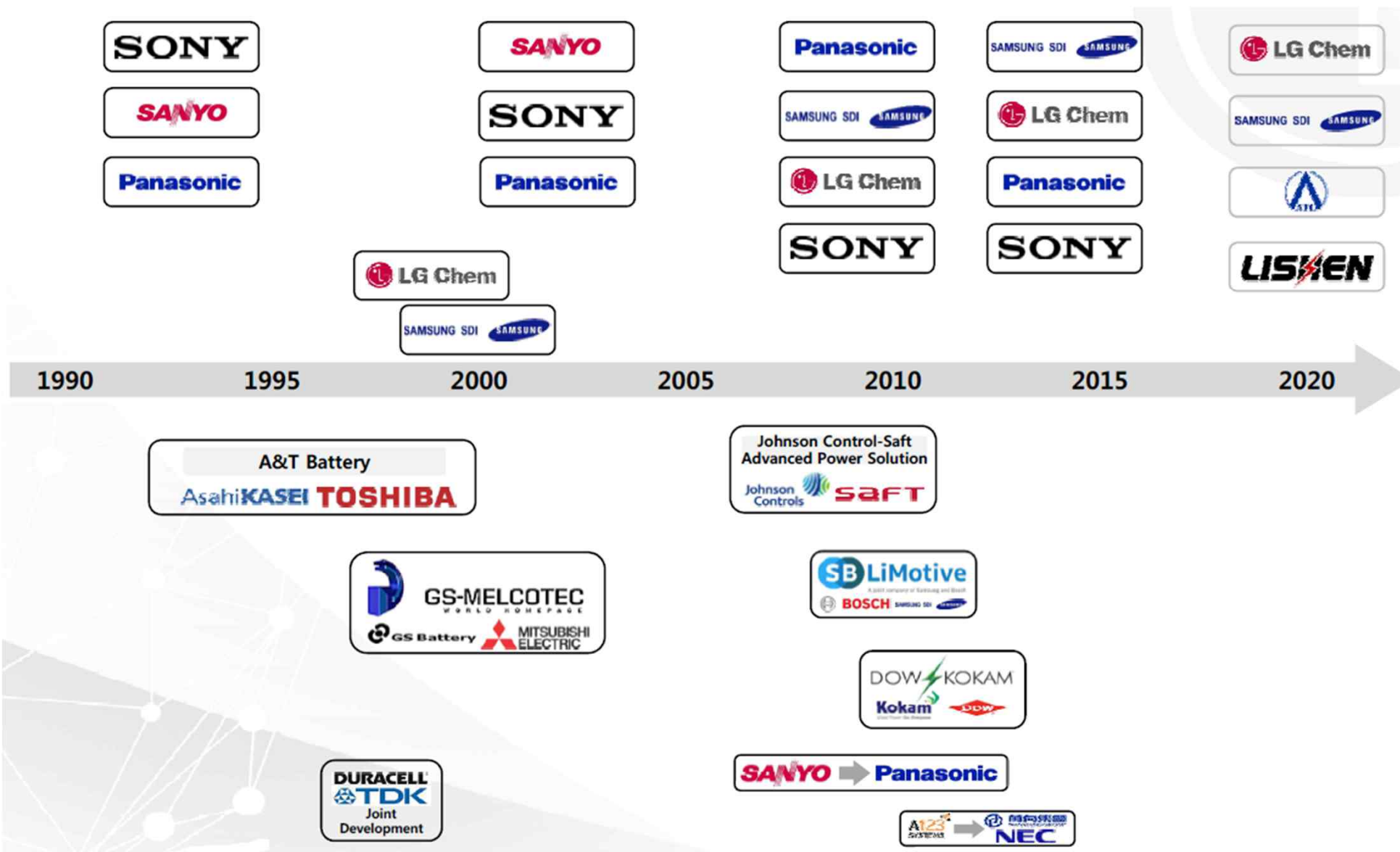
- Korea Lithium ion battery Industry
- Start from 1999, 1st Market Share from 2011



2. Global LIB Company

(From. SNE Energy)

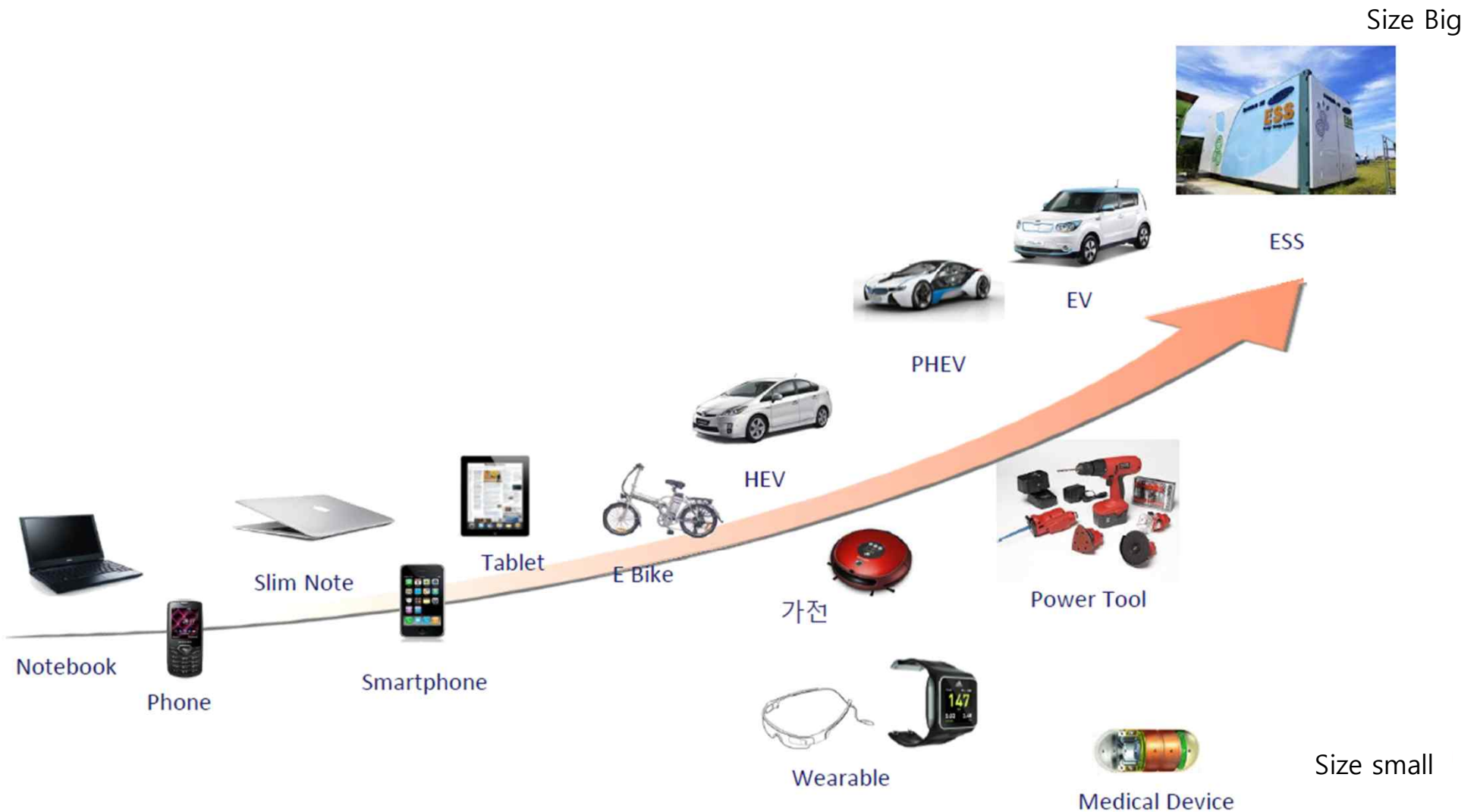
Global Lithium Ion Battery company



2. Battery Industry in Korea

(From. SNE Energy)

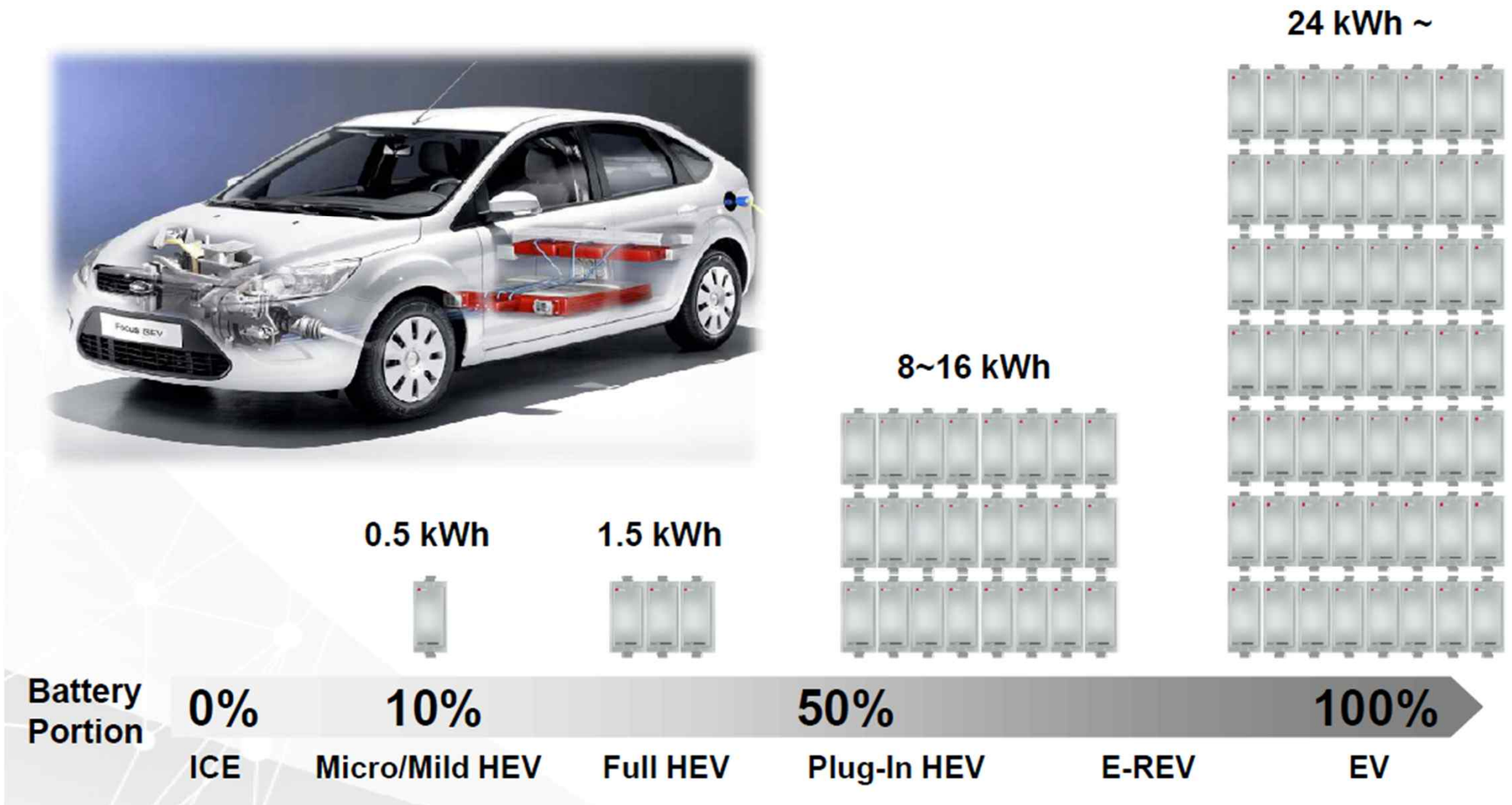
○ Lithium ion battery applications development



II . Battery Development Trend

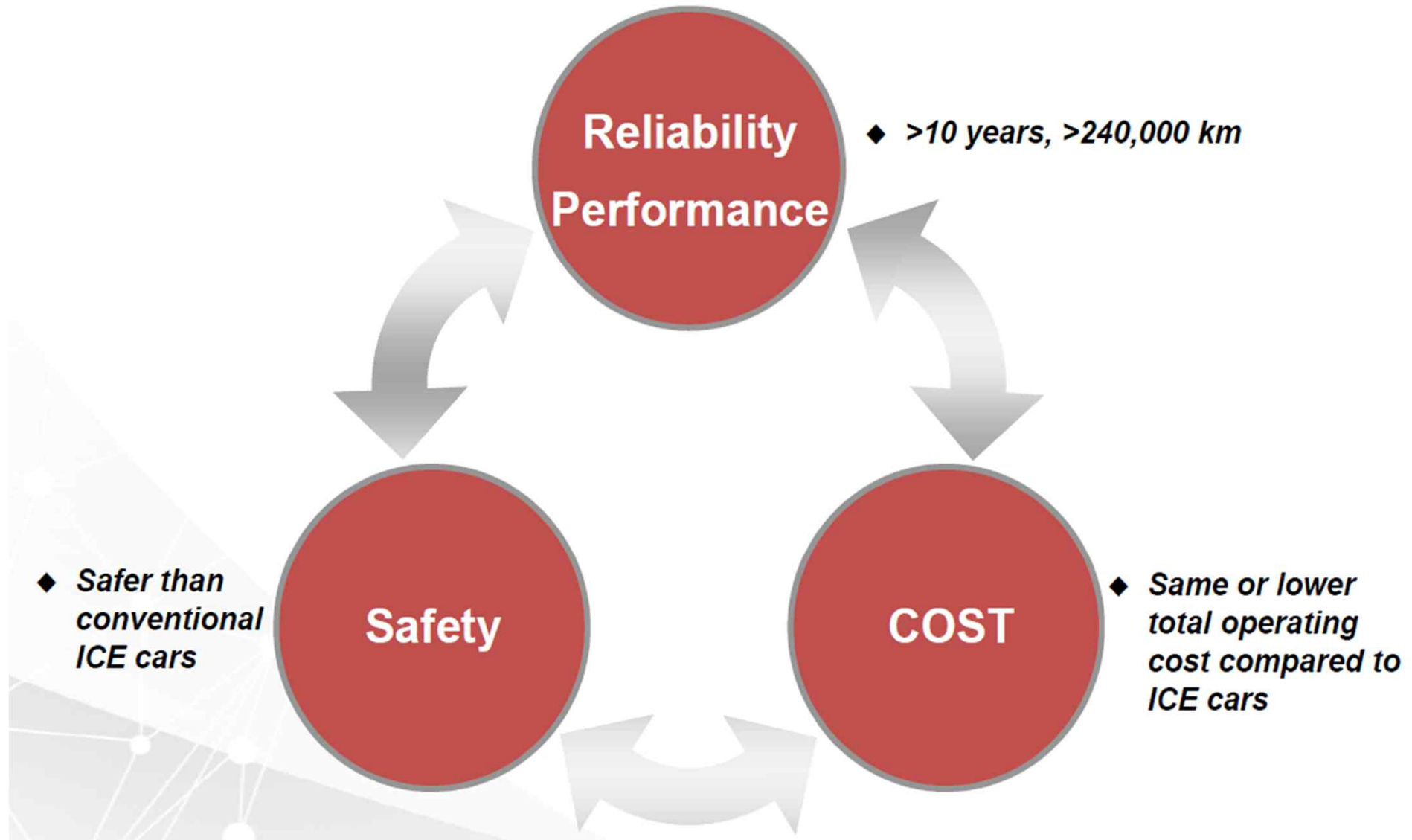
1. Battery for EV

LIB capacity for xEV



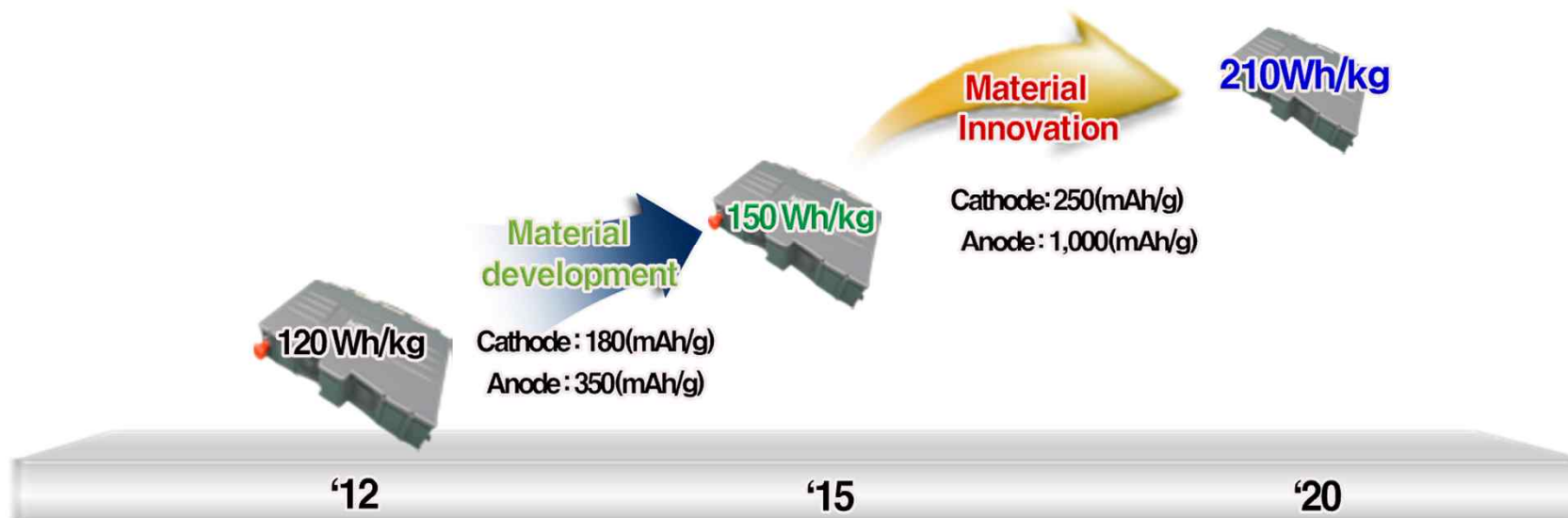
2. Key issue for EV

3 Key issues of LIB

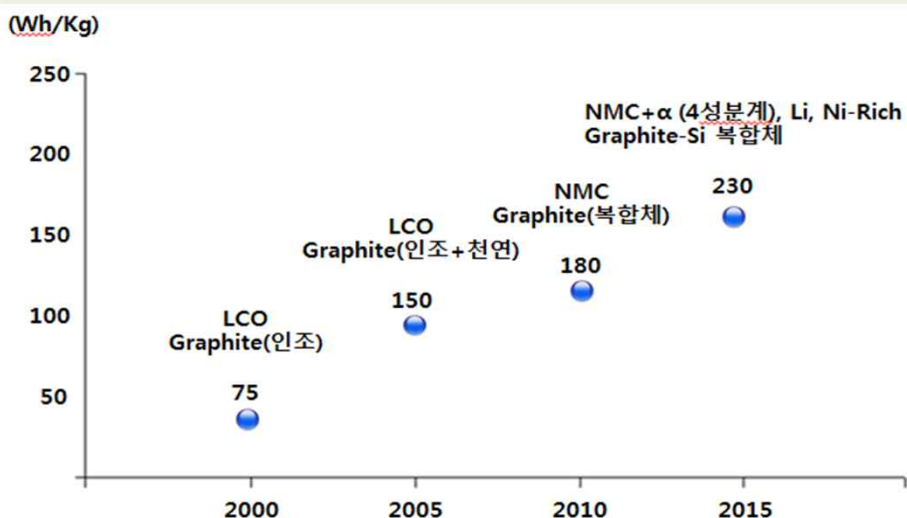


3. Forecast LIB Technology

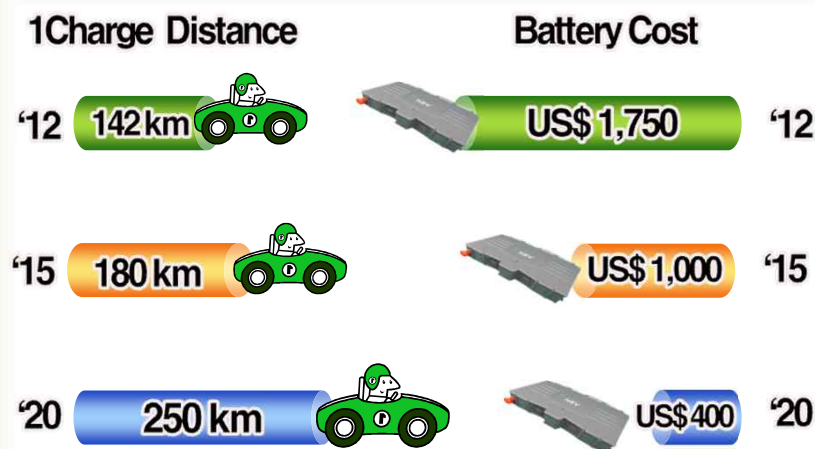
LIB Battery Energy density development for xEV



Material Technology

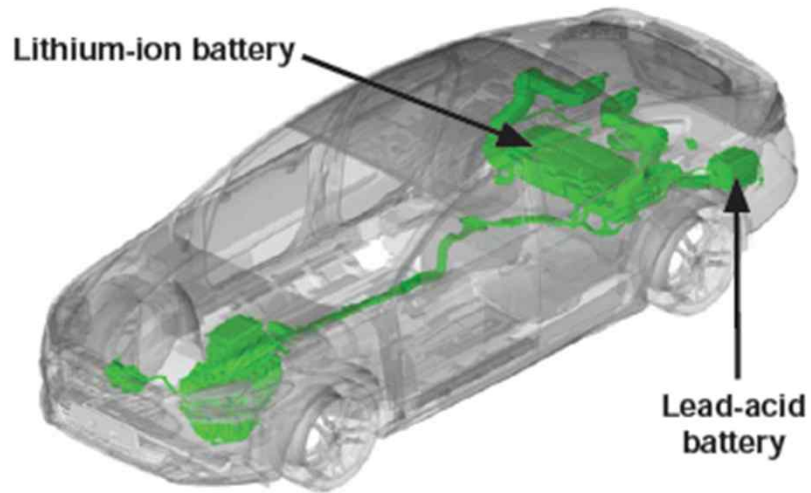


xEV



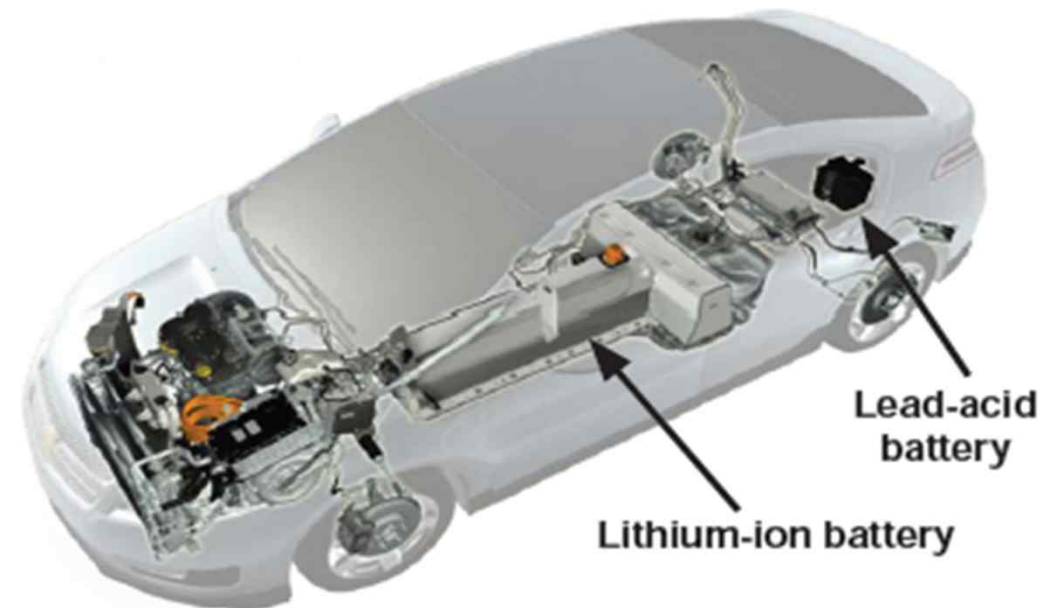
4. Another approach

● Dual Battery System



<Ford Fusion Hybrid Battery System>

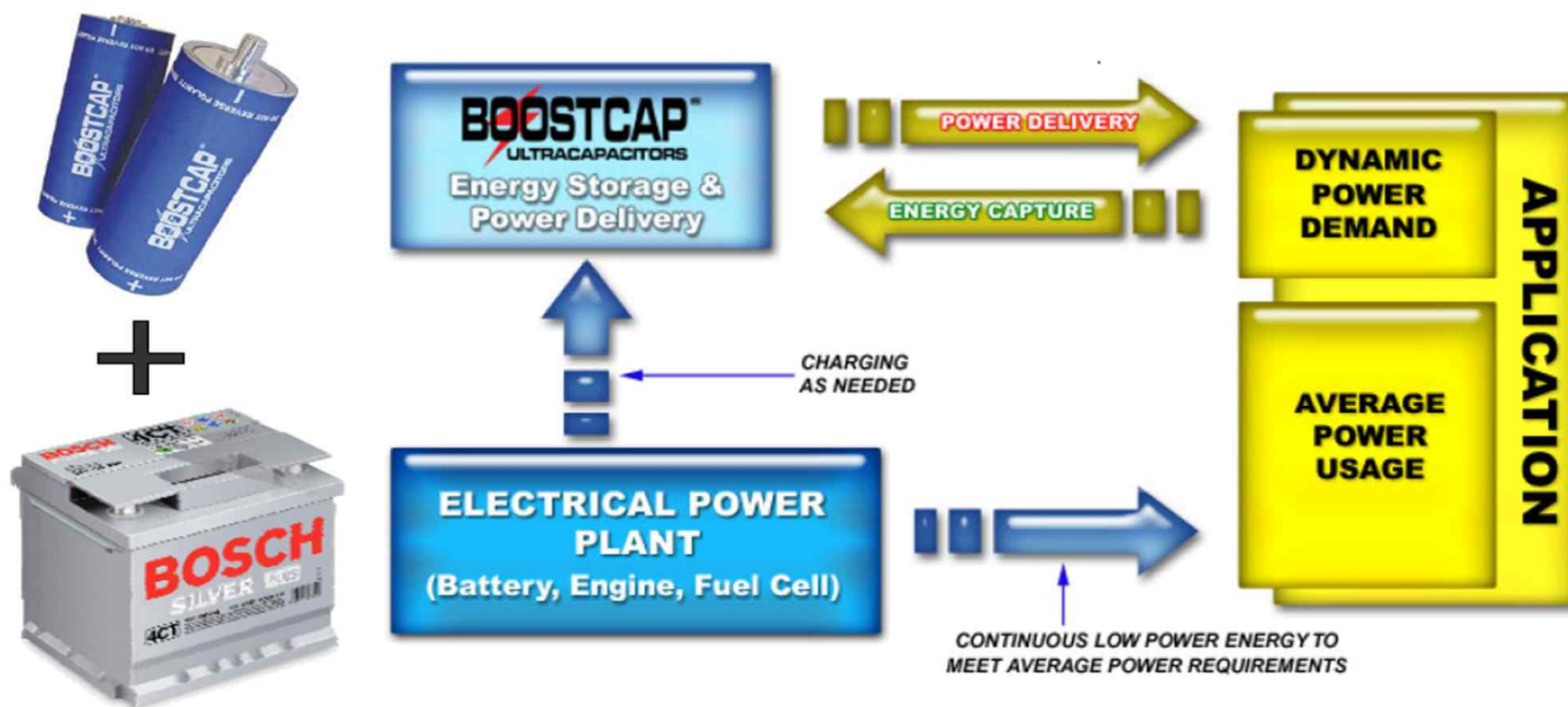
<Chevrolet Volt Battery system>



4. Another approach

• Dual Battery System

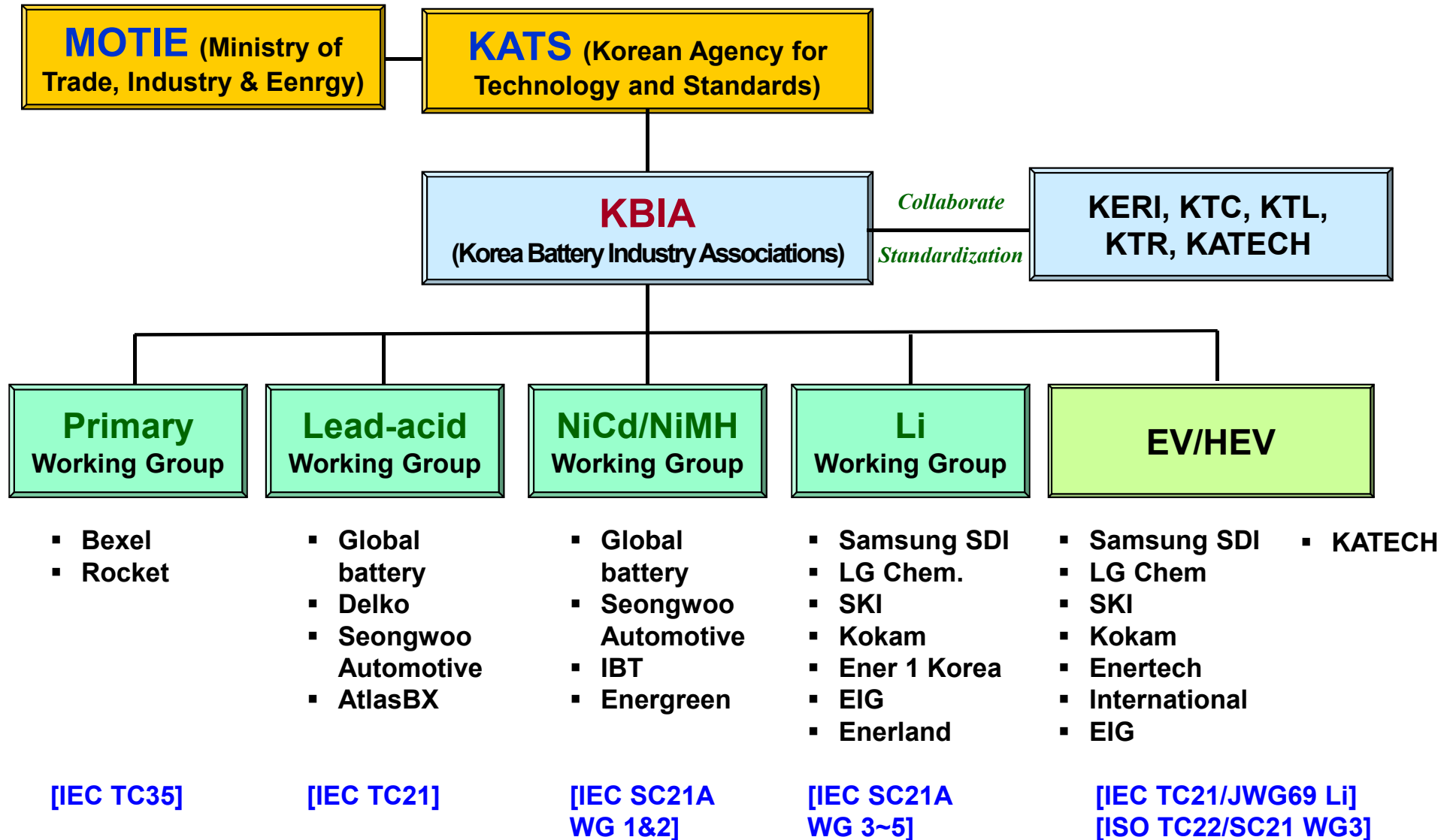
- The new combination!
 - The strengths of both.
 - High power density component plus
 - High energy density component



III. Battery Standardization for xEV

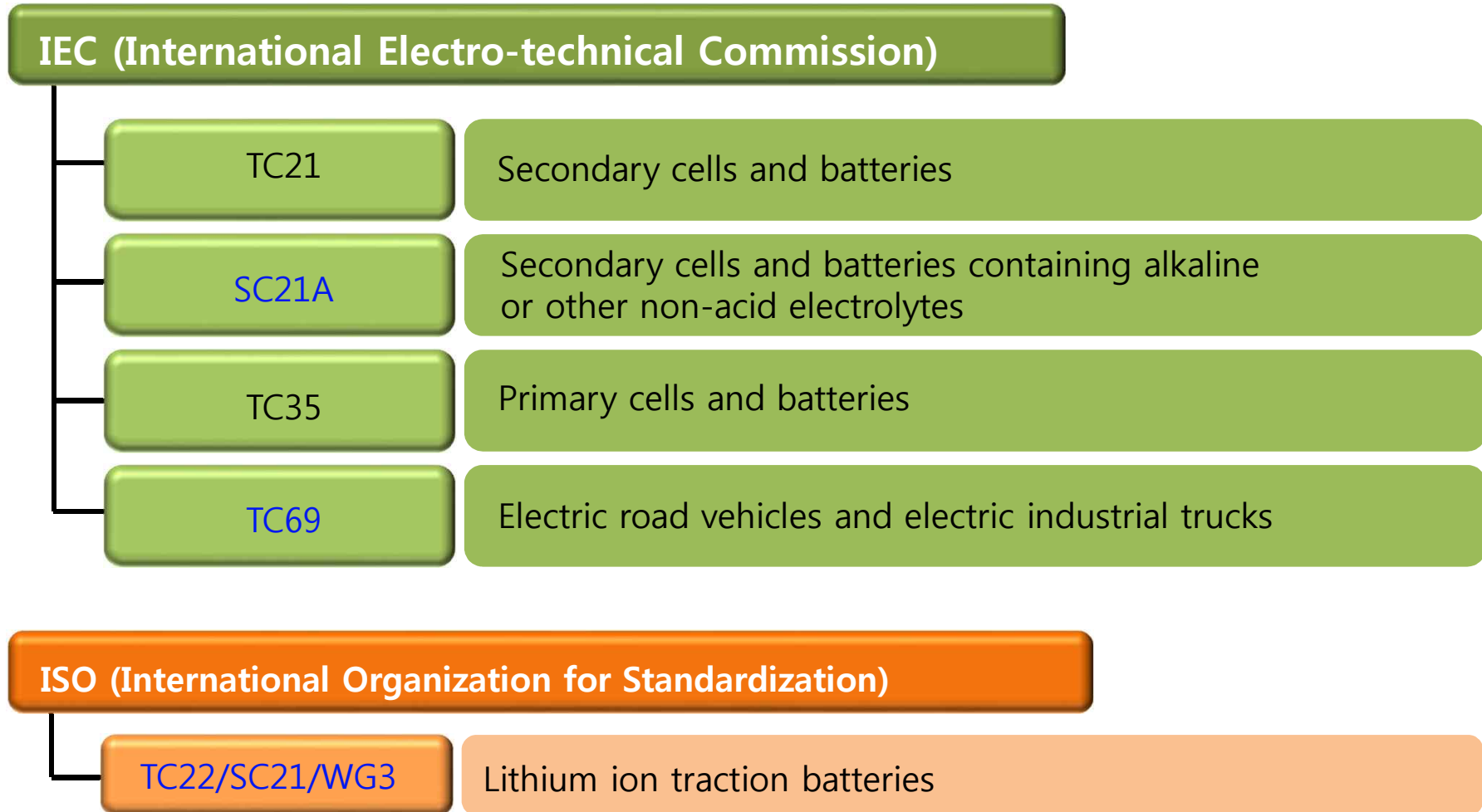
1. Standard activities

○ Korea Battery Standardization Structure



2. Organization

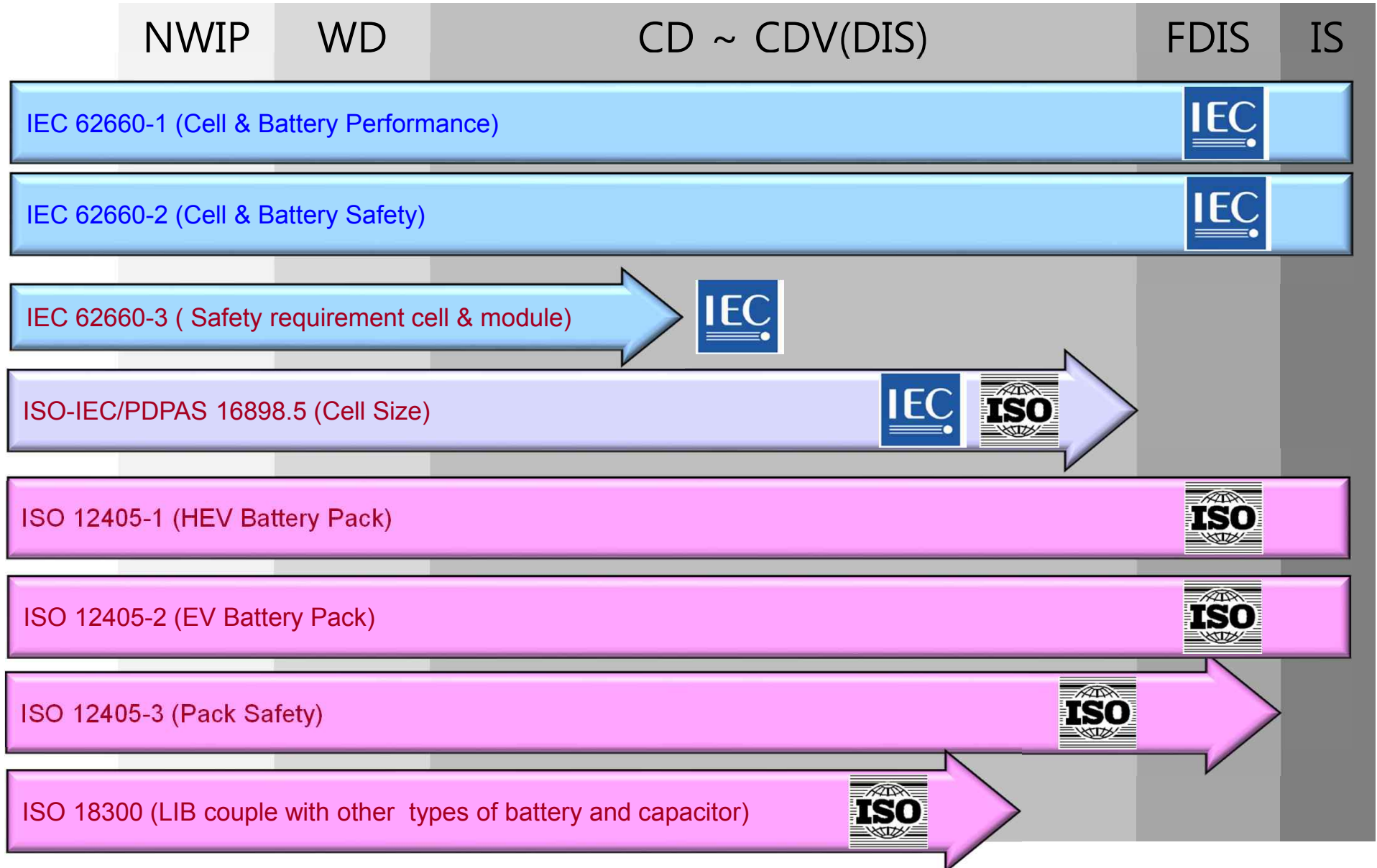
- TC(Technical Committee) & SC(Sub-Committee)



※ TC : Technical Committee, SC : Sub-Committee

3. International Standard

Working Documents



4. Cost reduction

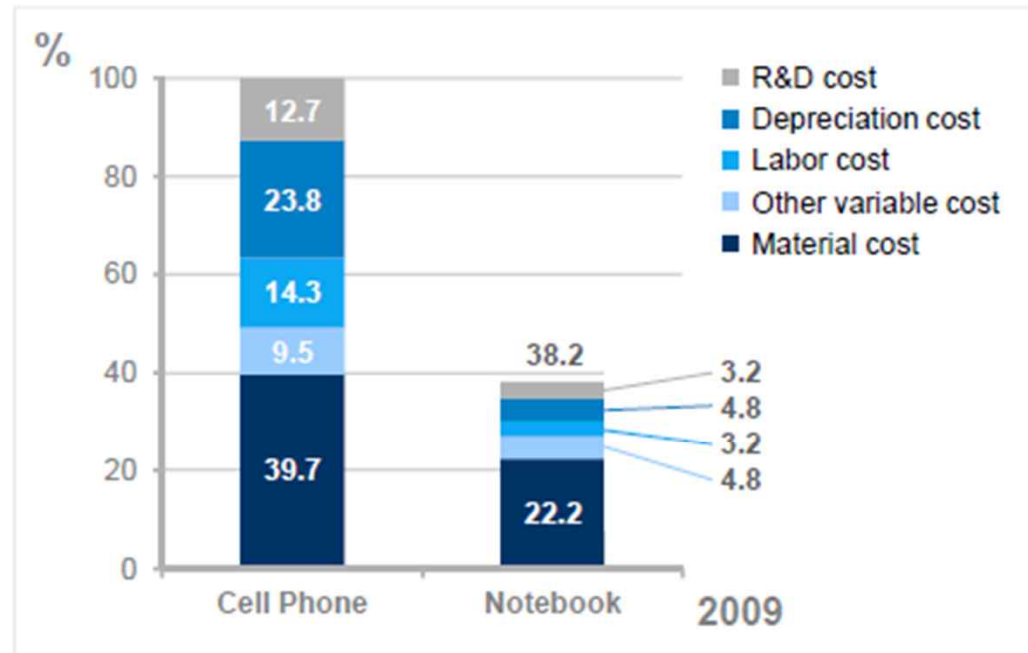
Standardization of Li-Ion Cell Dimensions

Cost of Battery Cells

Standardization is Key Requirement for Cost Reduction



→ Relative Cost of Li-Ion Cells per Wh

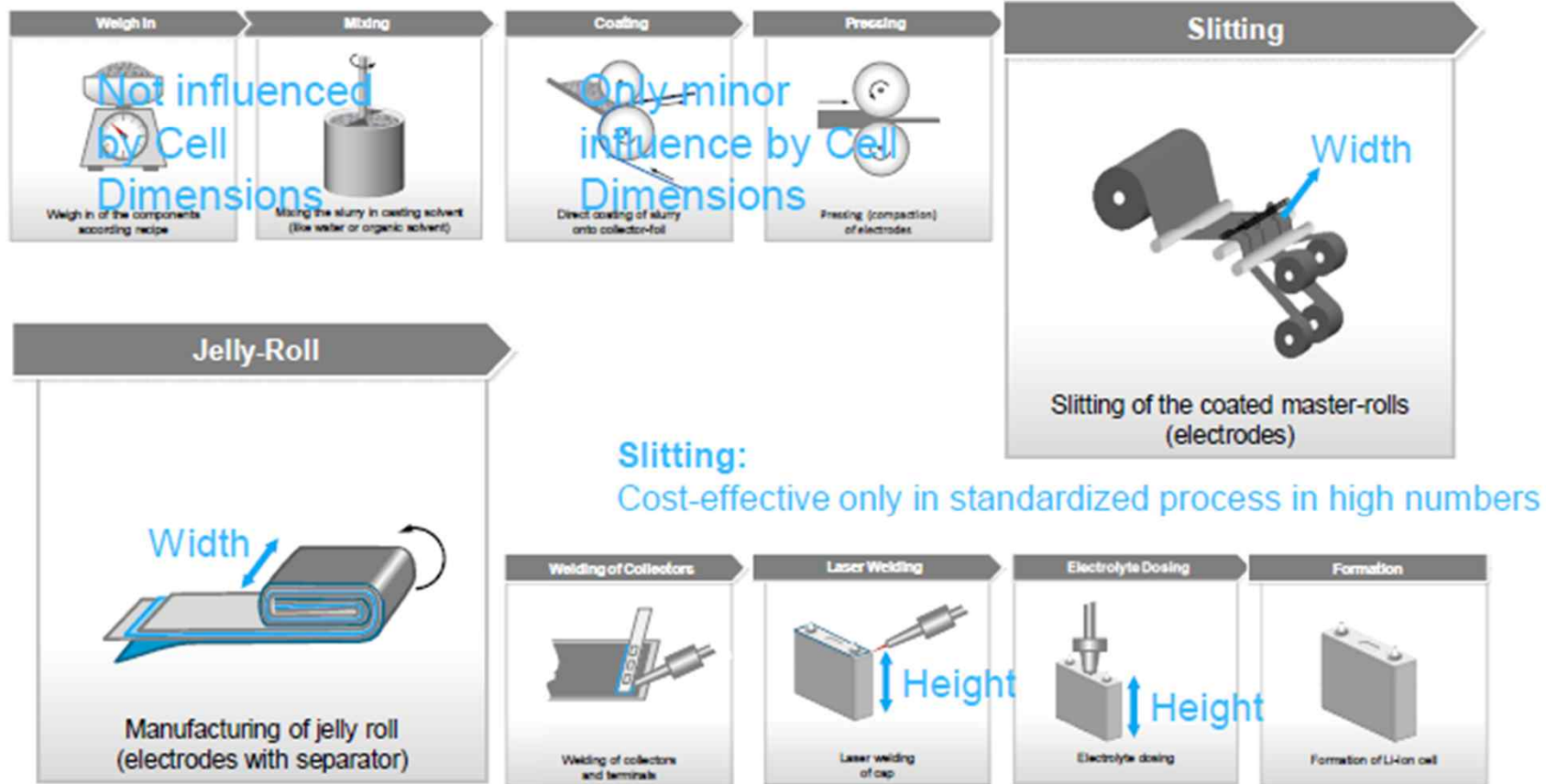


* Source: Li-ion Battery Market & Industry Trend - Goldman Sachs Japan Analyst Report - September 2009

4. Cost reduction

Standardization of Li-Ion Cell Dimensions

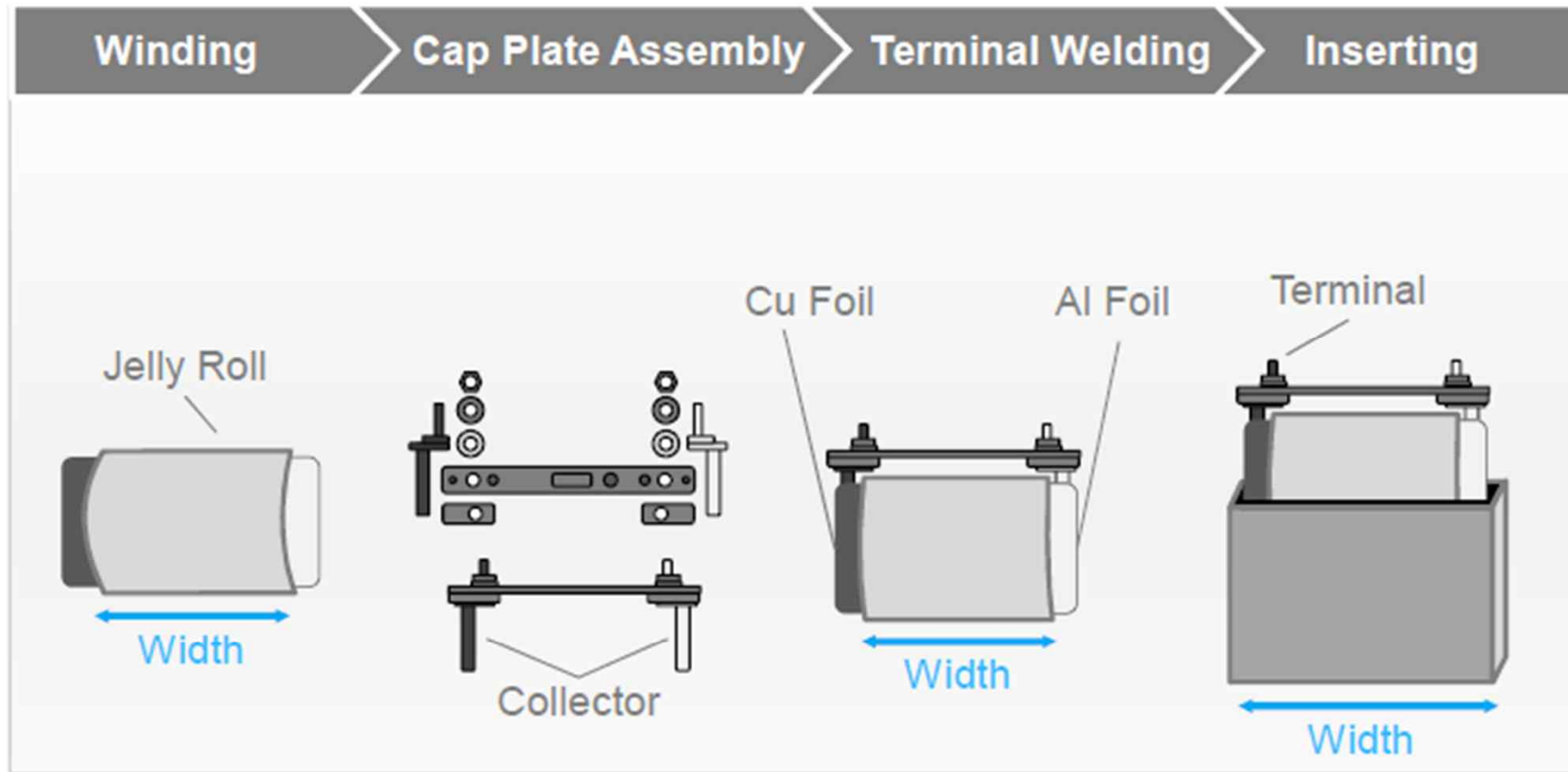
Manufacturing Process of Prismatic Li-Ion Cell Main Manufacturing Steps



4. Cost reduction

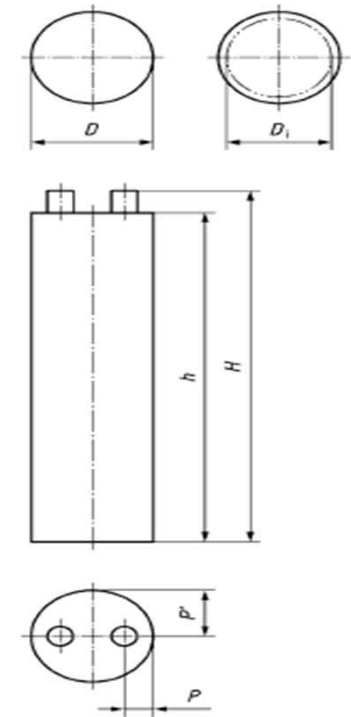
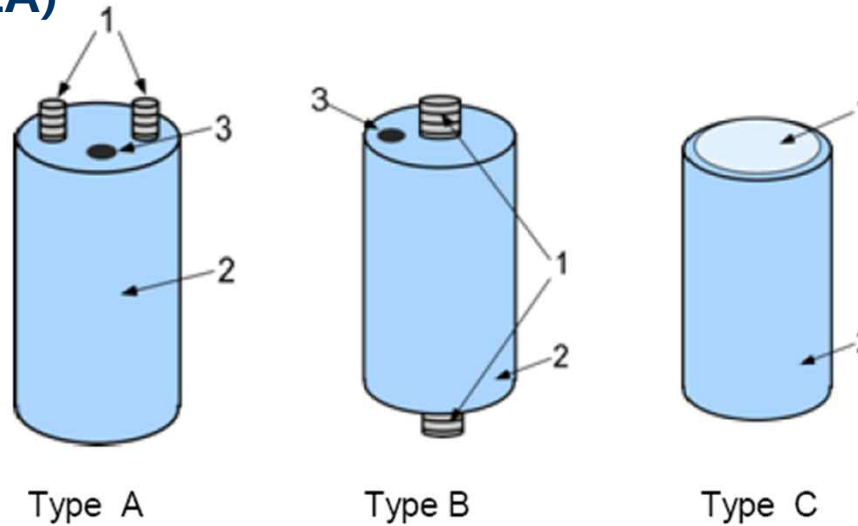
Standardization of Li-Ion Cell Dimensions

Li-Ion Cells Main Parts



5. Cell Size

● Cylindrical Type (8EA)



NOTE For type C the cell housing may be used as connection terminal.

Key:

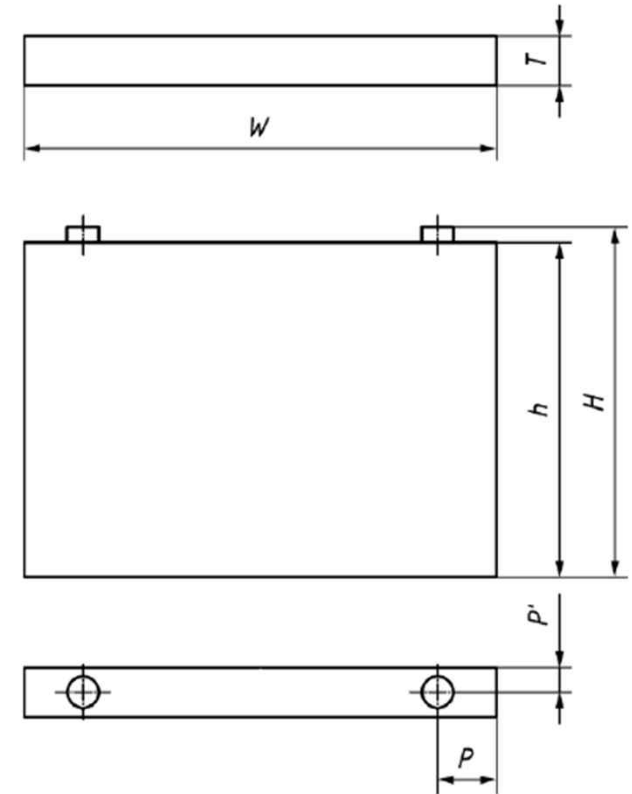
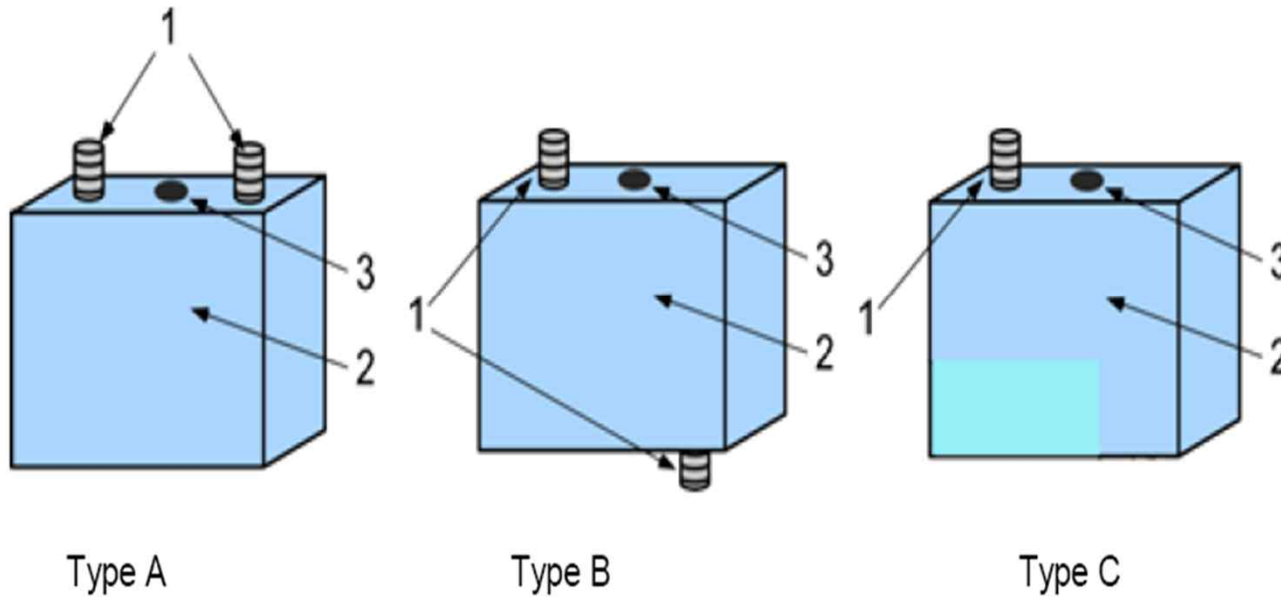
- 1 terminal
- 2 cell housing
- 3 over pressure safety device

Designation ^a (A ₁ A ₂ A ₃ A ₄ N ₁ /N ₂ /N ₃)	Design dimensions						OPSD
	D	h	H	Di	p	p'	
VIRA38/-/136	37,7	136	<145	32,5	-	D/2	RO
VIRA38/-/138	38	138	143	29	8	19	RO
VIRA54/-/137	54	137	145	35	13	27	RO
VIRA54/-/215	54	215	223	35	13	27	RO
VIRB27/-/-	27	-	66	-	-	-	RM
VIRC19/-/66	19	-	66	-	-	-	RM
VIRC40/-/92	40	-	92	-	-	-	RM
VIRC40/-/108	40	-	108	-	-	-	RM

^a Details for designation see clause 5.

5. Cell Size

Prismatic Type



NOTE For type C the cell housing may be used as connection terminal.

- Key:**
- 1 terminal
 - 2 cell housing
 - 3 over pressure safety device

5. Cell Size

● Prismatic Type

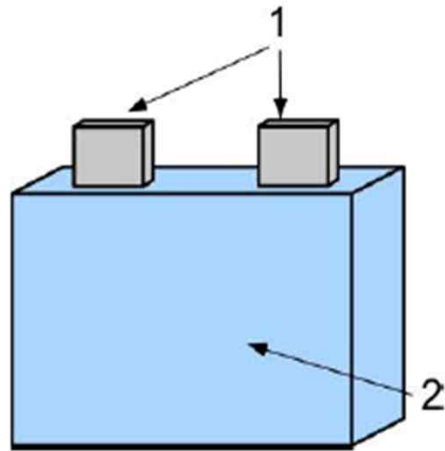
26EA

Designation ^a (A ₁ A ₂ A ₃ A ₄ N ₁ /N ₂ /N ₃)	Design dimensions						OPSD
	T	W	h	H	p	p'	
VIPA12/120/81	12	120	80,5	<105	6-28	6	PA
VIPA12/160/228	12	160	228	275	32	T/2	PA
VIPA13/120/85	12,5	120	85	<92	12-18	T/2	PA
VIPA13/62/94	13	61,8	93,7	96	9-11	T/2	PA
VIPA14/111/92	13,8	111	91,8	<115	10-30	T/2	PA
VIPA14/137/64	13,3	137	63,2	<80	10-30	T/2	PA
VIPA16/112/79	15,7	112	78,5	<95,5	13	T/2	PA
VIPA20/66/127	20	66	127	138	14.5	10	PA
VIPA21/173/85	21	173	85	<103	12-22	T/2	PA
VIPA22/115/103	21,5	115	103	105	16,5-18,5	T/2	PA
VIPA23/167/129	22,5	167	129	144	-	T/2	PA
VIPA24/180/169	23,6	179,5	168,5	181,5	45,75	11,8	PA
VIPA25/135/105	25	135	104,1	107	32,5-35	12,5	PA
VIPA27/148/91	26,5	148	91	<110	10-39	T/2	PA
VIPA28/100/358	27,5	99,5	357,8	374,8	W/2	10-15	PA
VIPA29/72/117	29	72	117	120	15	14,5	PA
VIPA30/173/115	29,5	173	115	120	29-31	T/2	PA
VIPA32/173/115	32	173	115	<133	12-22	T/2	PA
VIPA34/92/134	34	92	133,3	146	20	16	PA
VIPA35/171/108	34,5	171	108	<123	21	T/2	PA
VIPA44/171/98	44	171	98	<114	21	T/2	PA
VIPA45/147/260	45	147	260	275	28	24	PA
VIPA45/173/115	45	173	115	<133	12-22	T/2	PA
VIPA55/171/115	55	171	115	<129	21	T/2	PA
VIPB8/118/342	118	8	342	390	59	4	PA
VIPB11/80/130	11	80	130	140	W/2	T/2	PA

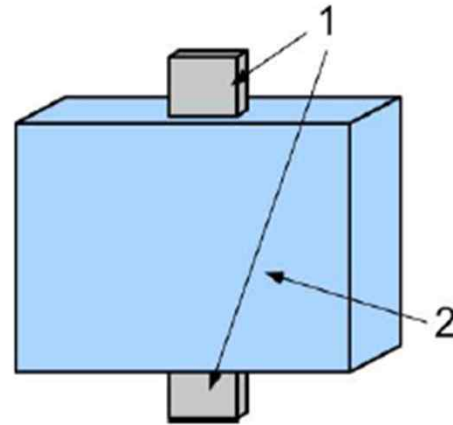
^a Details for designation see clause 5.

5. Cell Size

● Pouch Type



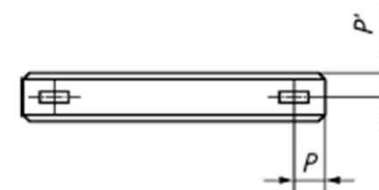
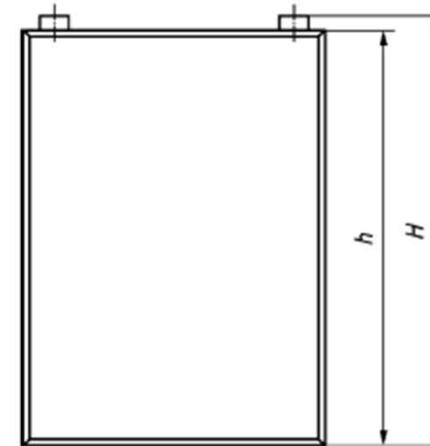
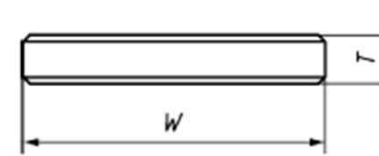
Type A



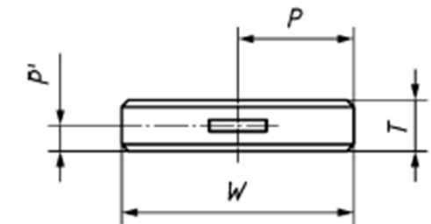
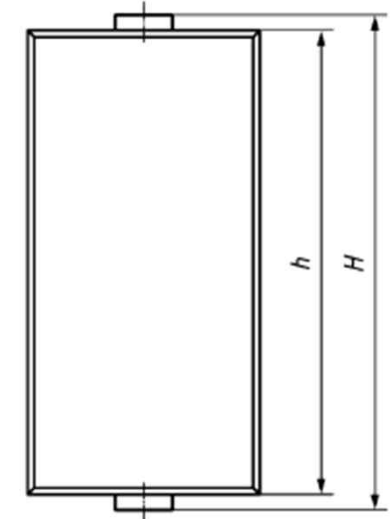
Type B

Key

- 1 terminal
- 2 cell housing



c) pouch cells Type A



d) pouch cells Type B

NOTE Sealing area is included in dimensions W and h.

5. Cell Size

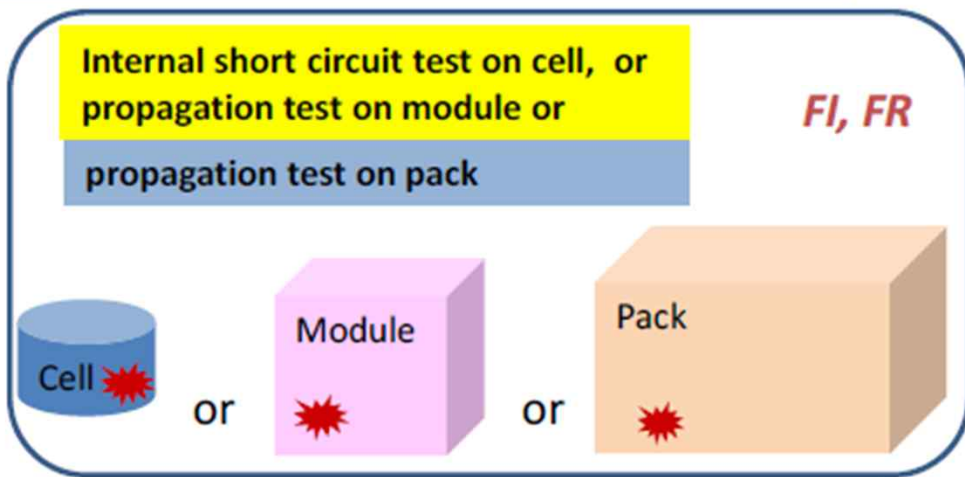
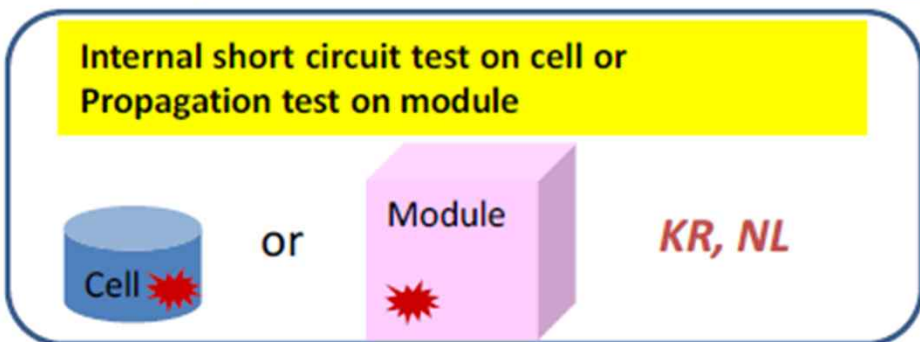
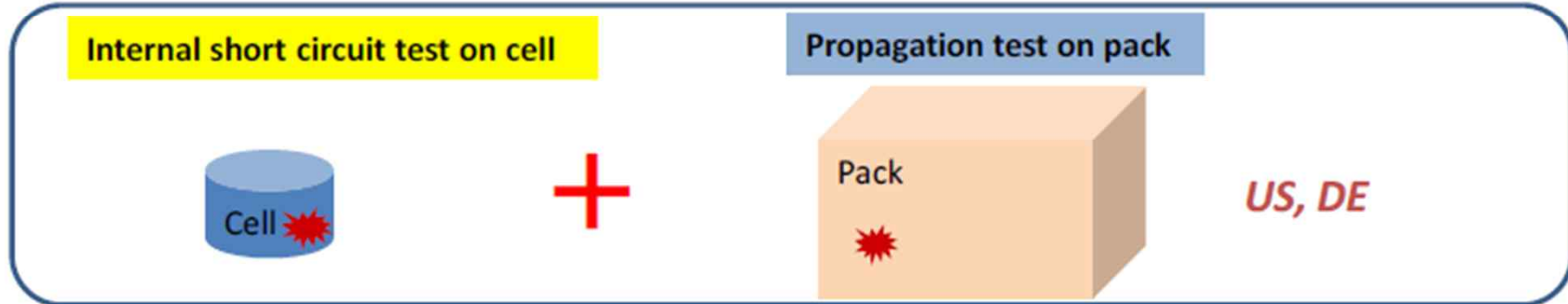
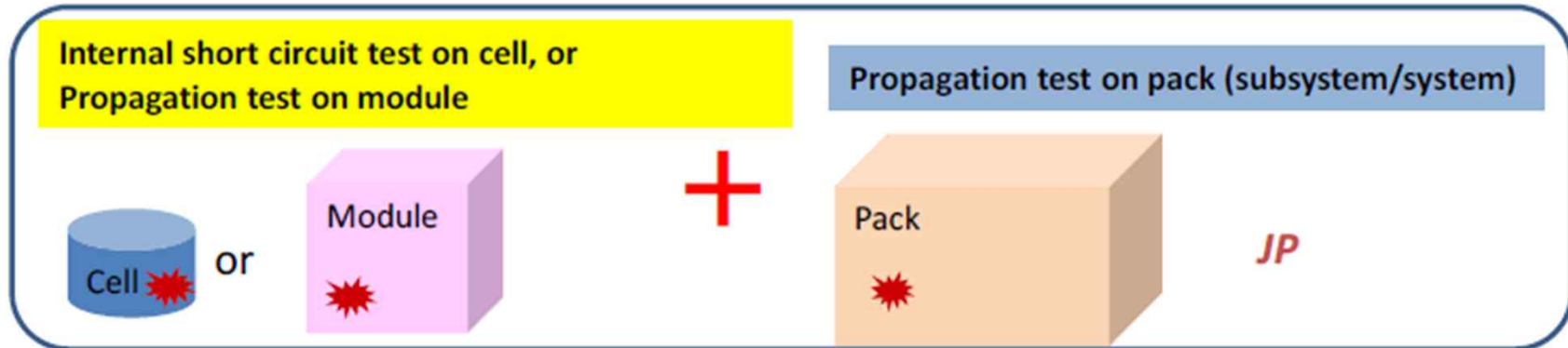
● Pouch Type (28EA)

Designation ^a (A ₁ A ₂ A ₃ A ₄ N ₁ /N ₂ /N ₃)	Design dimensions				
	T	W	h	p	p'
VIFA—/130/221	-	130	221	-	-
VIFA—/161/227	-	161	227	-	-
VIFA—/162/142	-	162	142	-	T/2
VIFA—/164/226	-	164	226	-	-
VIFA—/164/232	-	164	232	-	-
VIFA—/210/121	-	210	121	-	-
VIFA—/244/190	-	244	190	-	-
VIFA—/253/172	-	253	172	-	-
VIFA—/270/135	-	270	135	-	-
VIFA—/280/180	-	280	180	-	-
VIFA6/249/192	5,9	249	192	124	2,95
VIFA9/136/230	9	136	230	30	4,5
VIFA9/216/262	6,00-9,00	216	262	-	-
VIFA11/223/224	<11	223	224	-	-
VIFA13/330/162	13	330	162	-	t/2
VIFA19/343/245	18,5	343	245	80	9
VIFB—/99/300	0	99	300	0	0
VIFB—/121/243	-	121	243	-	T/2
VIFB—/126/325	-	126	325	-	-
VIFB—/128/310	-	128	310	-	-
VIFB—/128/325	-	128	325	-	-
VIFB—/134/290	-	134	290	-	-
VIFB—/144/251	-	144	251	-	-
VIFB—/159/291	-	159	291	-	-
VIFB—/172/254	-	172	254	-	-
VIFB—/173/235	-	173	235	-	-
VIFB—/210/260	-	210	260	-	-
VIFB5/136/251	3,00-5,00	136	251	-	-

^a Details for designation see clause 5.

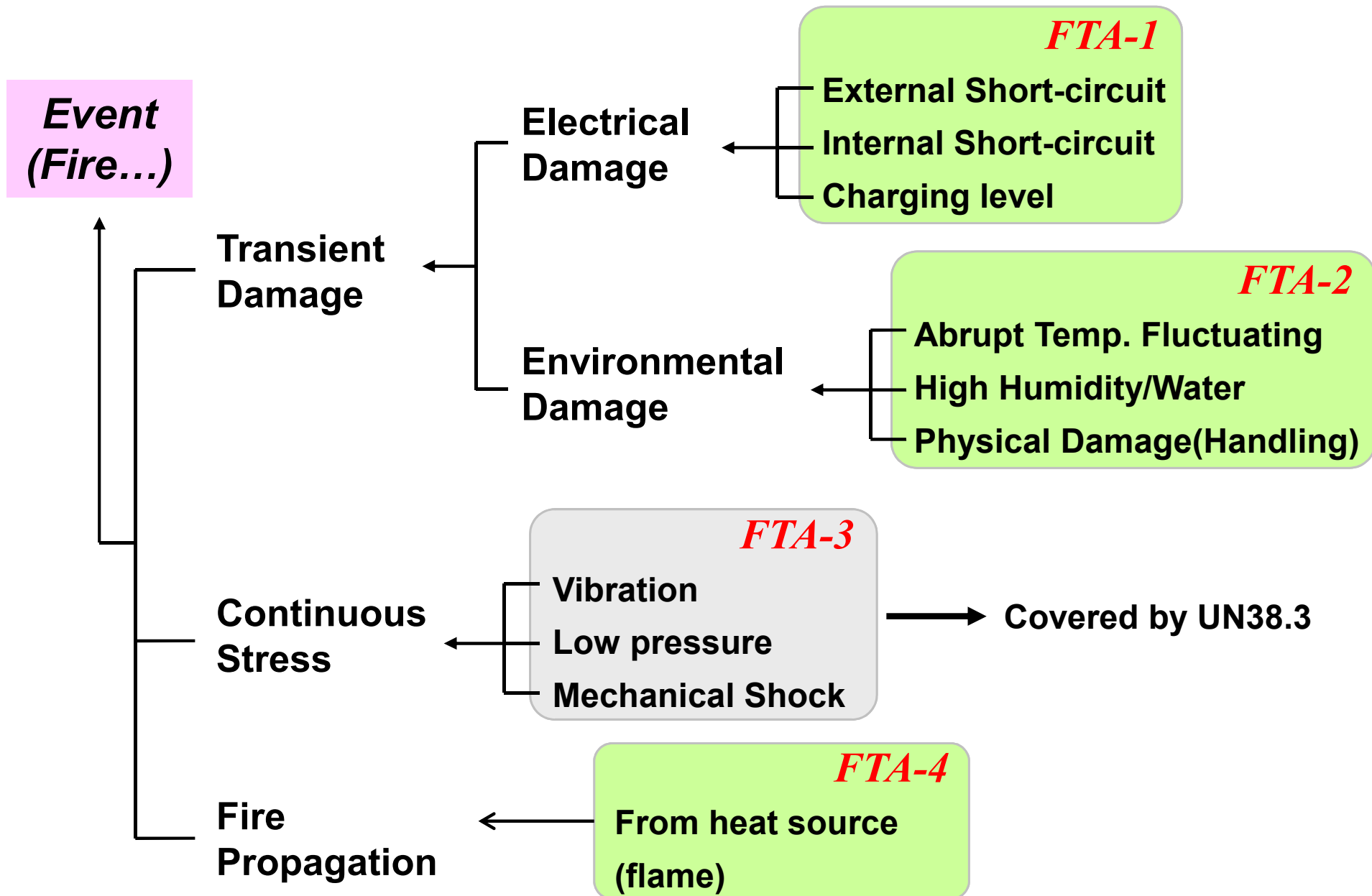
6. Internal Short circuit & Propagation

Test scope and national suggestions



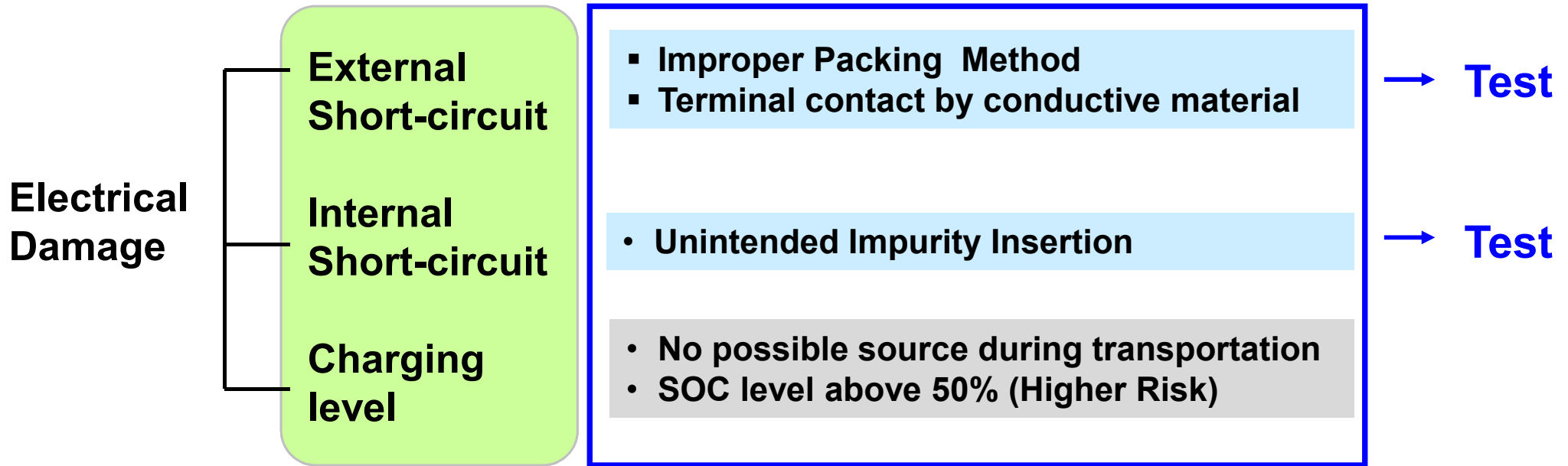
7. Safety Test Report in ICAO



FTA(Fault Tree Analysis) for LIB



7. Safety Test Report in ICAO

FTA(Fault Tree Analysis) for LIB



FTA-1 Test	Condition	Result	
External Short Circuit	Direct terminal short-circuit using Wire and Bolt	No Fire	
Internal Short Circuit	Nail penetration	No Fire	

7. Safety Test Report in ICAO


FTA(Fault Tree Analysis) for LIB

Fire
Propagation



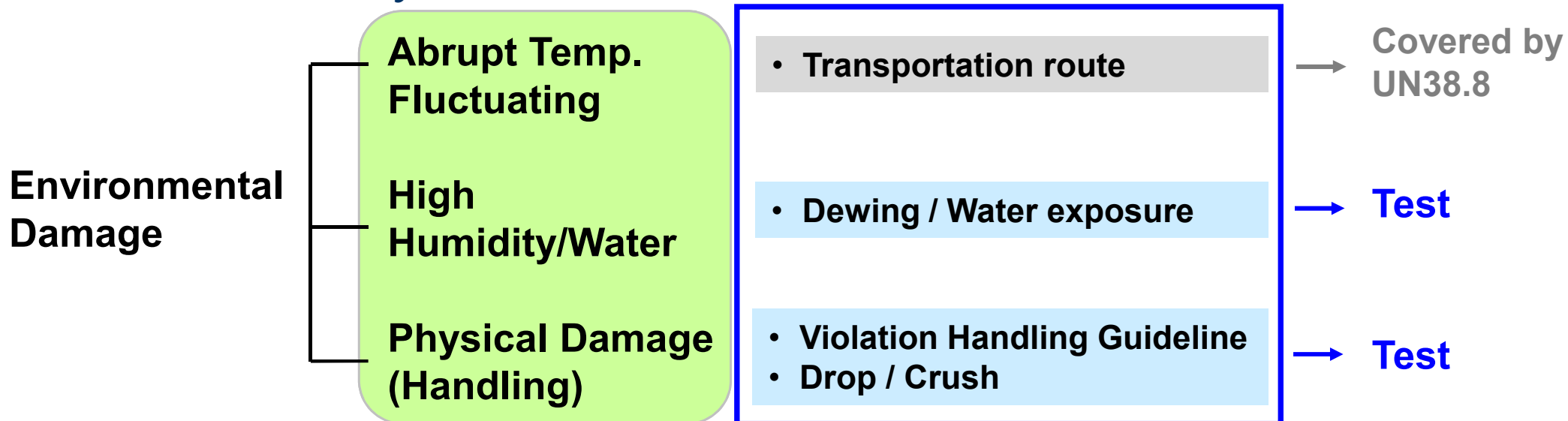
- Aircraft fire (initiated from surrounded material)





→ Test

FTA-4 Test	Condition	Result	
Fire Propagation Test	From fire source(Charcoal) Temperature of heat source: 800~900 °C	No issue	

7. Safety Test Report in ICAO

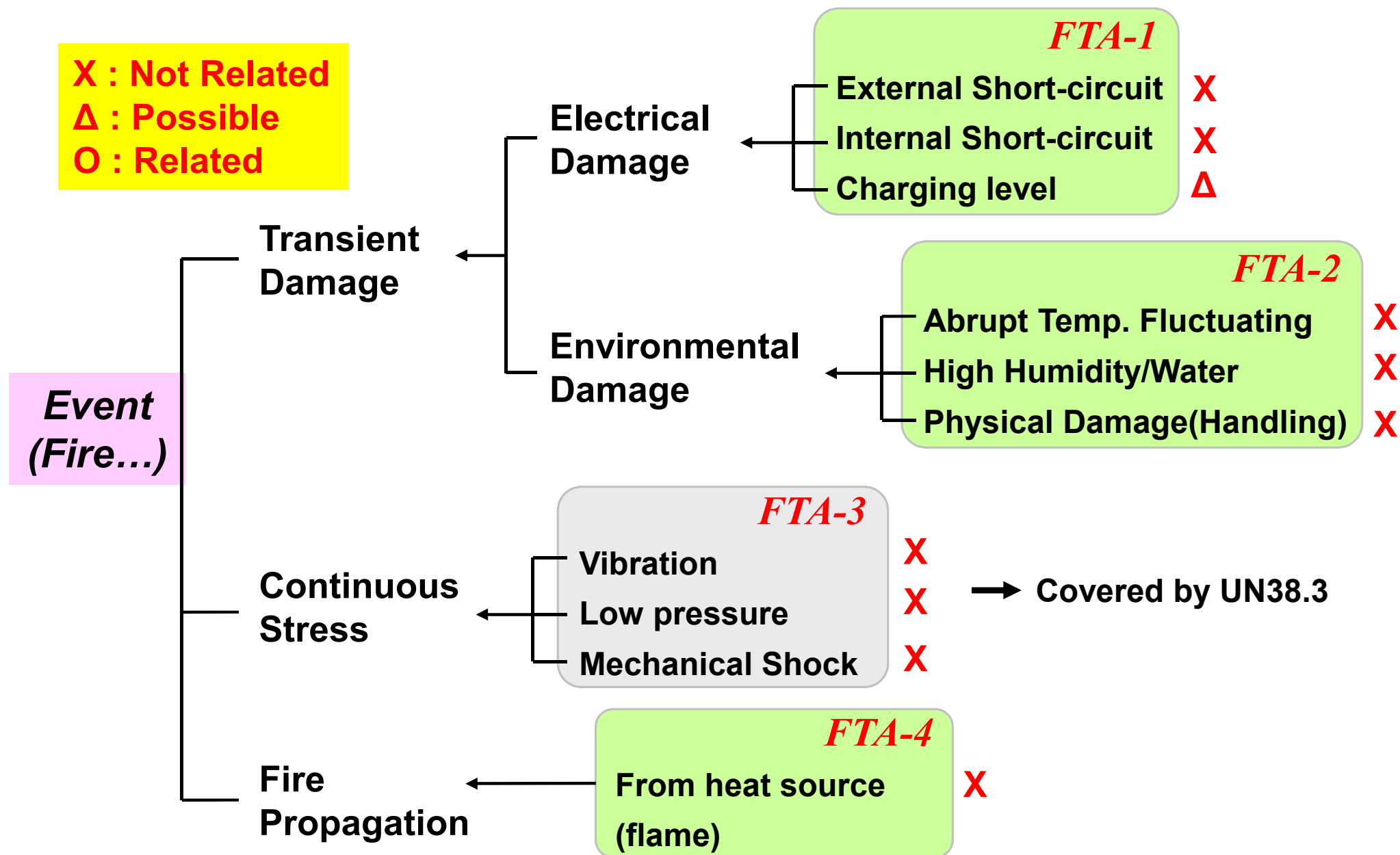
FTA(Fault Tree Analysis) for LIB



FTA-2 Test	Condition	Result	
Immersion Test	Pure water, 1 min	No Fire	
Package drop	Height : 3.7 M, Drop to Concrete	No Fire	
Package Crush	Pressure 150 KN	No Fire	
Impact	Using impact tester to expose the internal materials of the cell	No Fire	

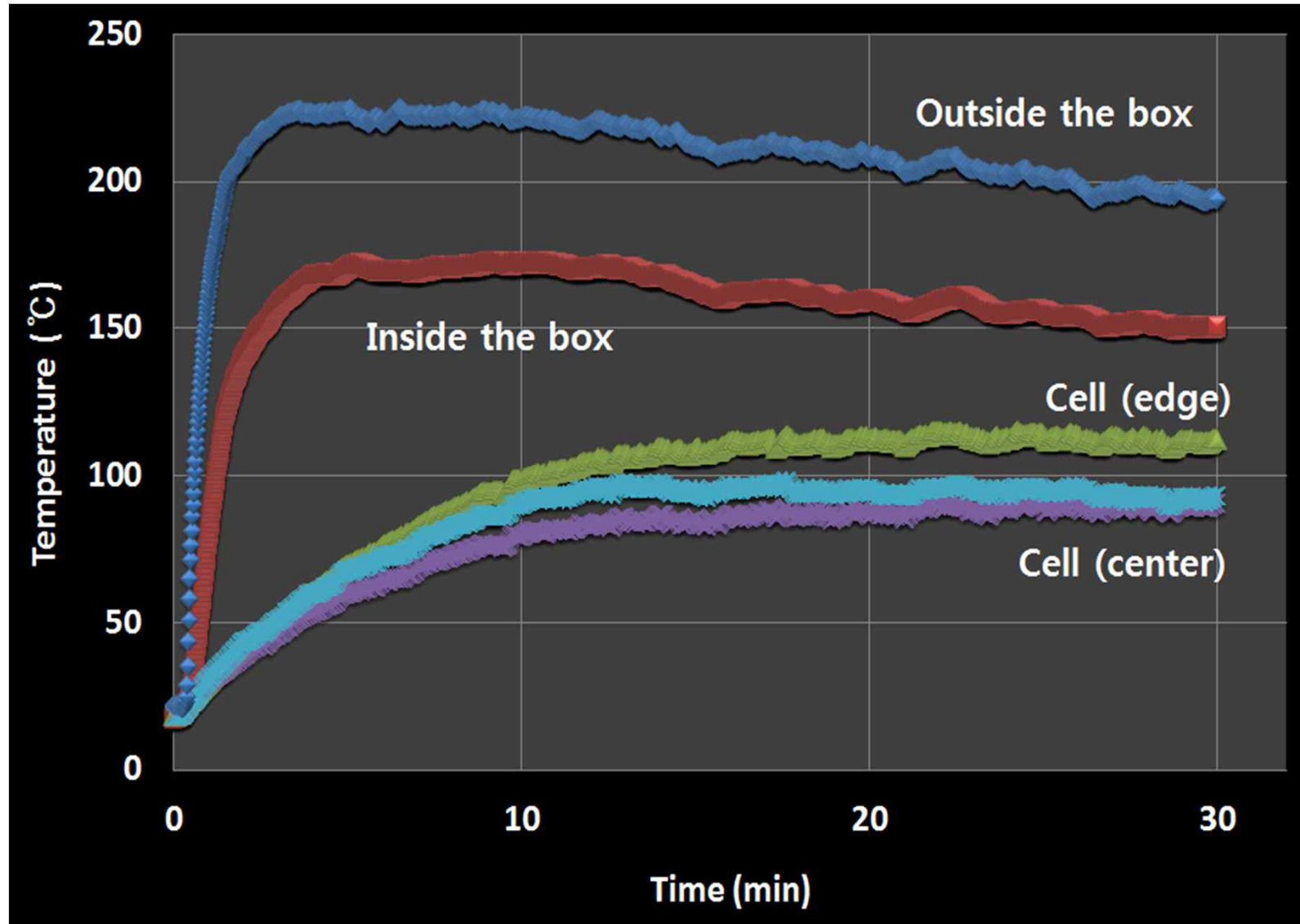
7. Safety Test Report in ICAO

FTA(Fault Tree Analysis) for LIB



7. Safety Test Report

FTA(Fault Tree Analysis) for LIB



8. ISO 18300

● NP from Korea

1. Scope

This standard specifies the lithium-ion battery systems combined with lead acid battery or electric double layer capacitor, to be used for automotive applications in class A voltage systems.

It specifies configurations, test procedures, and requirements for such combinations.

4. Symbol and abbreviated terms

LIPB lithium-ion battery pack or system combined with Lead acid battery

LICA lithium-ion battery pack or system combined with electric double layer capacitor

5. Type of connection with LIB cell and battery

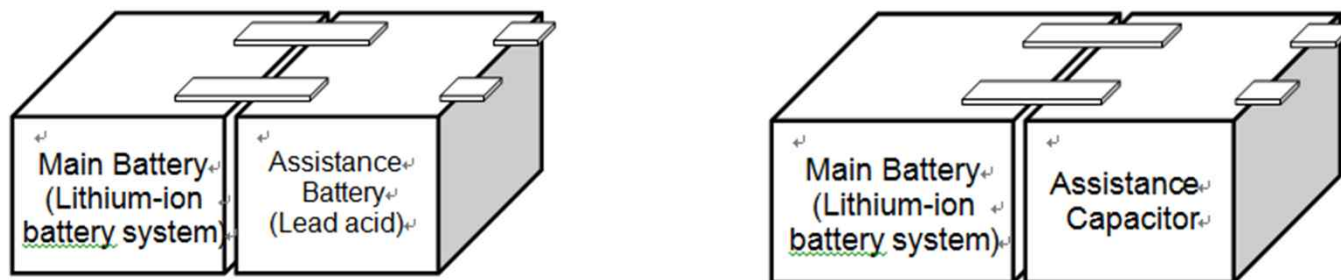


Figure 1- type of configuration of LIPB

8. ISO 18300

● NP from Korea



ISO TC22/SC21/WG3 Status 2014-09-01

TC22/SC21/WG3

Approved Projects:

ISO 18300:

Electrically propelled road vehicles -- Specifications for lithium ion cell and battery coupled with other types of battery and capacitor



- ✓ New project approved at 2012-08-27
- ✓ CD registered at 2013-08-27
- ✓ DIS registered at 2014-08-27 (submission on 2014-08-30)
- ✓ Publication scheduled for 2016-08-27

IV. Summary

Summary

- The goal of LIB Technology development for Long distance by 1 charge and low cost of pack system
- Another issue is transportation such as Air, Marine for battery
- The battery Safety and Cost are the most important things for xEV

KBIA (Korea Battery Industry Association)

Members of KBIA

Battery manufacturers (12)

SDI, LG Chem, SK Innovation, Kokam, Sebang etc.

Parts & materials companies (31)

GS Energy, POSCO Energy, Ecopro, Panaxetec etc.

Equipment/ system companies (11)

Hyundai MOBIS, PNE Solution, WooJin, Hanwha etc.

Others (3)

KETI, KIER, KERI



감사합니다.
