



## **Japan National Project: Dynamic Wireless Power Transfer System for Electric Vehicle Considering Safety and Interoperability**

**February 10, 2020**

**Park City, UT**

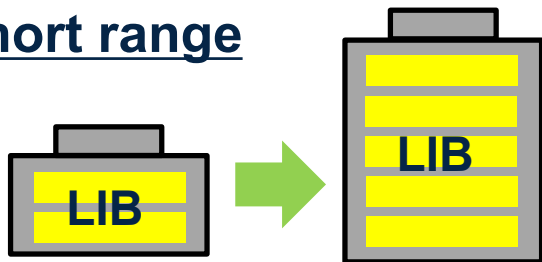
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**JARI**

# Background and Objective

## Issues for the spread of EVs

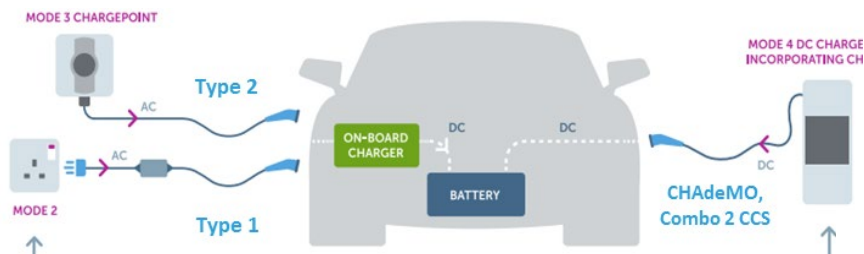
### 1. Short range



One solution is increasing the capacity of LIB\*<sup>1</sup>

- Increase in LIB cost
- Li supply becomes a problem.

### 2. Low convenience of charging



### Requires

- operation of charger and connector
- handling of long charging cables

### Advantages of D-WPT\*<sup>2</sup>

- Reduction of on-board LIB capacity
- Automatic charger operation
- Wireless charging

**Objective: R&D of D-WPT system in a five-year plan from FY2018.**

# Overview and Goals of the Project

## Theme 1: Safety and interoperability

⇒ Establish metal foreign object detection method and interoperability of 70 % or more at rated power.

## Theme 2: D-WPT

⇒ Develop basic technology that achieves a rated efficiency of 90 % with a 30 kW class power supply when driving at 60 km/h

## Theme 3: Economic feasibility

⇒ Study the cost-benefit and issues of introducing the D-WPT system by scenario and create business models



Evaluation equipment for metal foreign object detection and interoperability



D-WPT system  
(The university of Tokyo)

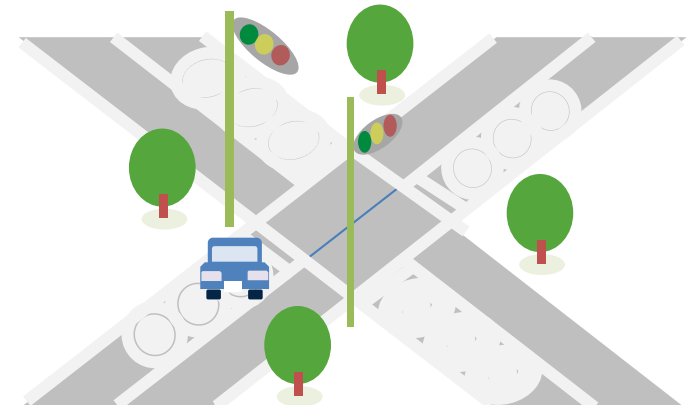


Image of D-WPT system installation at intersection

# R&D Framework

Overall management



## Theme 1: Safety and interoperability

Management

R&D of testing equipment  
Standardization



Study of safety and interoperability



R&D of power supply equipment



Investigation and analysis of  
resonance circuit

## Theme 2: D-WPT



Research on high-efficiency power  
supply control during driving,  
R&D of wireless in-wheel motor



Parallel two-  
wire system



Wireless in-wheel  
motor (IWM)



Requirement specifications,  
performance study

## Theme 3: Economic feasibility

Management

Investigation of cost-benefit  
and business model



Provision of information

# R&D Method (Theme 1: Safety and Interoperability)

## (1) Safety against electromagnetic fields

Develop the technology for

- **detection of foreign object** near the coil
- **reduction of leakage magnetic field**



e.g.

Battery inside toy  
⇒ Metal in the air

Ground coil

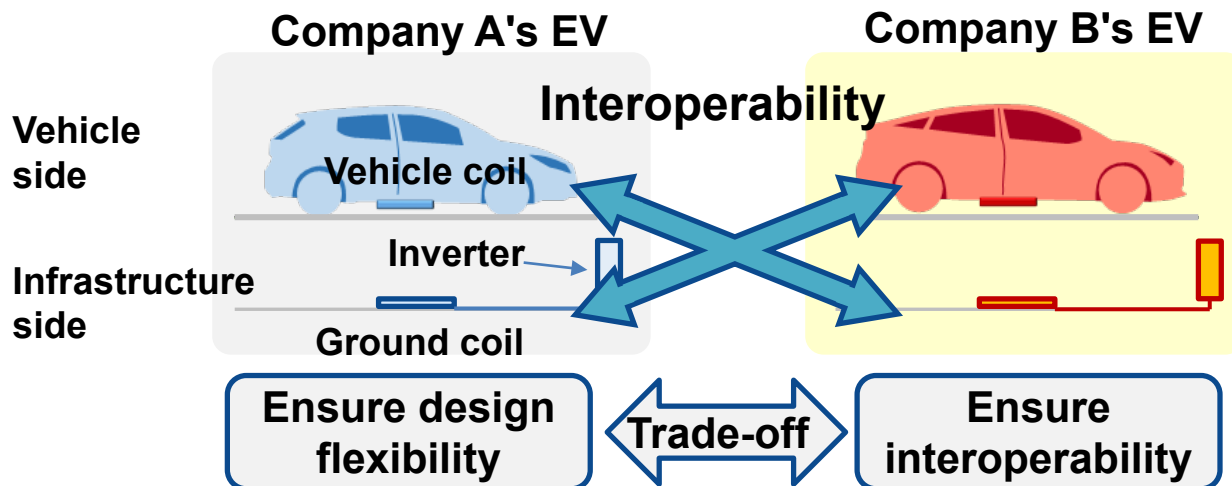
## (2) Interoperability

Develop the **"circuit matching technology"** to achieve interoperability while maintaining design flexibility of each company

Introduce equipment for the evaluation of safety and interoperability of WPT system

- test bench
- electromagnetic shield

In the future, Following the standardization of ISO / IEC, it can be used for interoperability verification.



# R&D Method (Theme 2: D-WPT)

## Development items

- Compare D-WPT systems
- High power and high efficiency
- High vehicle speed
- Synchronization of all testing data



Ideal test track



Test vehicle

## Decision analysis of D-WPT infrastructure

Evaluation axis	Coil type	Type A	Type B
	a		
b			
c			
d			
...			

Considering OEM requirements, studying the optimal D-WPT system for social introduction

# R&D Method (Theme 3: Economic Feasibility)

The cost-benefit is evaluated for the each scenarios.

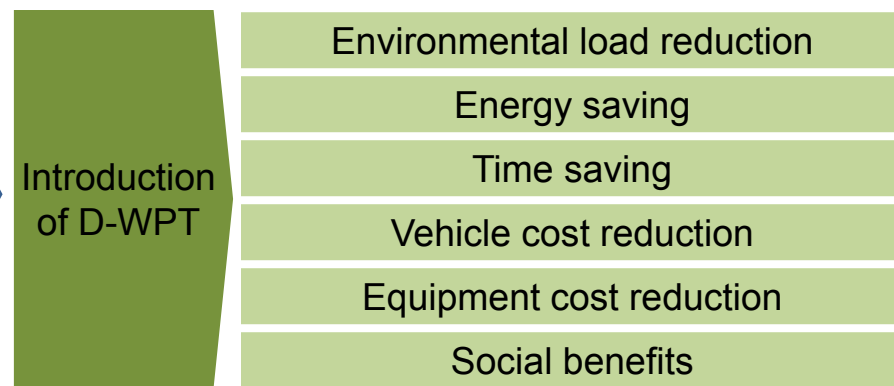
## (1) Proposal of introduction scenario

Step-by-step development

Stage	Introduction pattern	Introduction scenario
1	In limited areas	Large retail stores Corporate commuter bus Airport
2	Taxi, Bus pool, Bus stop	Taxi Bus pool Bus stop
3	Highway, Intersection	Highway Intersection

## (2) Realization of benefits

Identify the benefits of each stakeholder



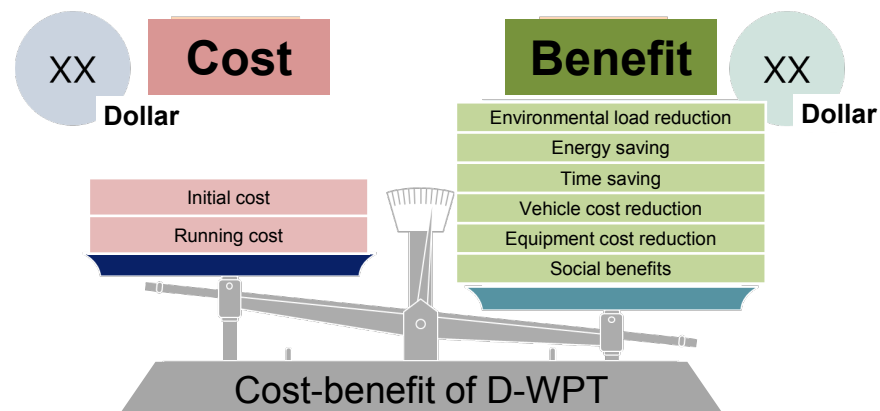
## (3) Estimation of cost

Estimate initial and running costs

Cost		Item
Initial	Equipment	Substation, roadside power supply equipment, cable
	Construction	Equipment installation, wiring, incidental facilities
	Other	Indirect construction, general administrative expenses
Running	Maintenance	Maintenance and security
	Fee	Electricity fee, insurance

## (4) Cost-benefit

Correct scenario after rough estimation





# Schedule

Fiscal year	2018	2019	2020	2021	2022
<b>1. Safety and interoperability</b>					
1-1. Development of common experimental facilities (JARI)	R&D of testing equipment				
1-2. R&D of interoperability technology and metal foreign object detection method (Toyota, Nissan, Honda, IHI, UTokyo)	Study of requirements for safety and interoperability, Development of power supply equipment, Analysis of resonance circuit, Development of Metal foreign object detection method			Study of interoperability between Static and Dynamic	
<b>2. D-WPT</b>					
2-1. Development of in-vehicle coil power receiving method (UTokyo, Daihen)	R&D of Spiral type and parallel two-wire type			D-WPT test	
2-2. Development of wheel coil power receiving method (UTokyo, NSK)	R&D of next-generation wireless IWM			Driving test with demonstration vehicle	
<b>3. Economic feasibility</b> (JARI)	Investigation of cost-benefit and legal issues by scenario				
				Study of business model	

Next stage