Present Status of Iwamura Team

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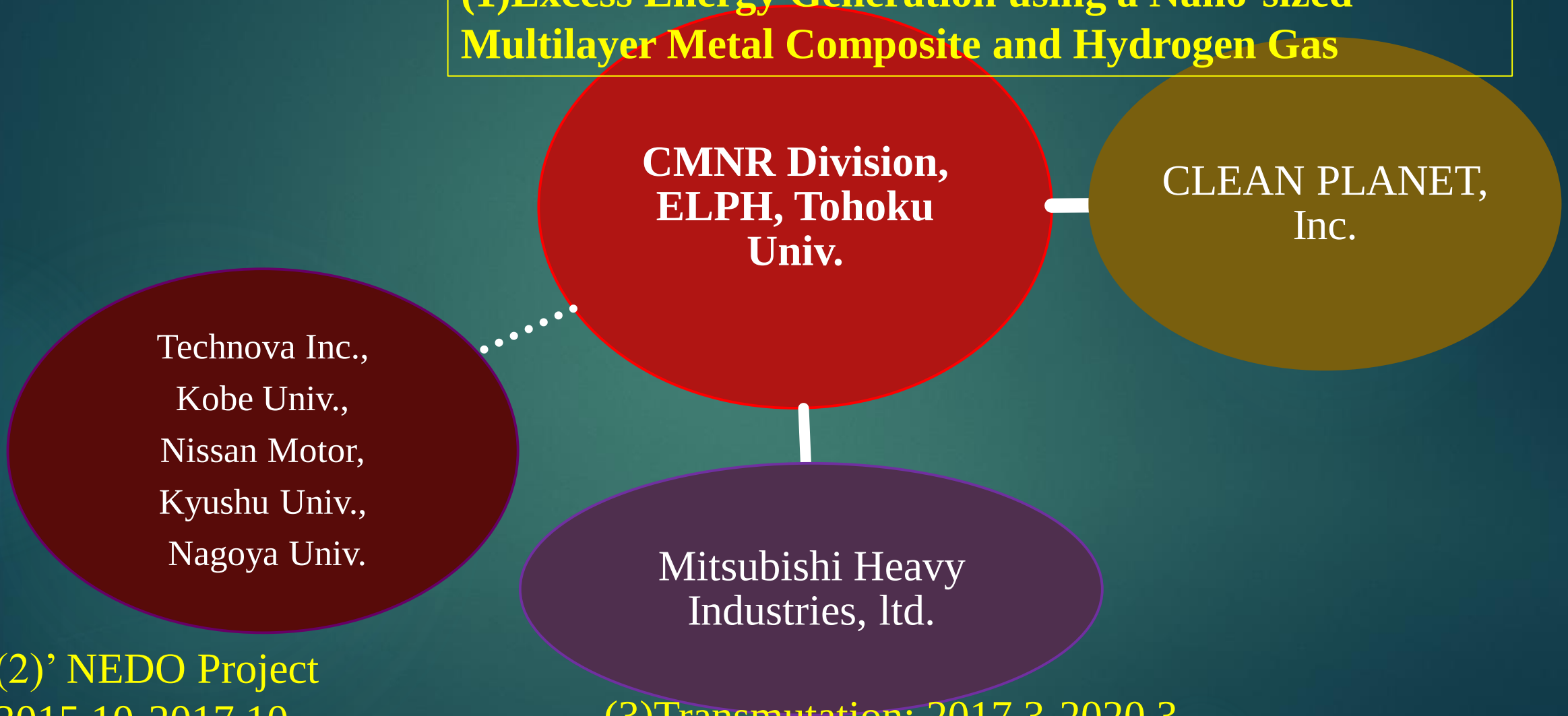
Present Collaborative Relationship

(1)Excess Energy Generation using a Nano-sized Multilayer Metal Composite and Hydrogen Gas

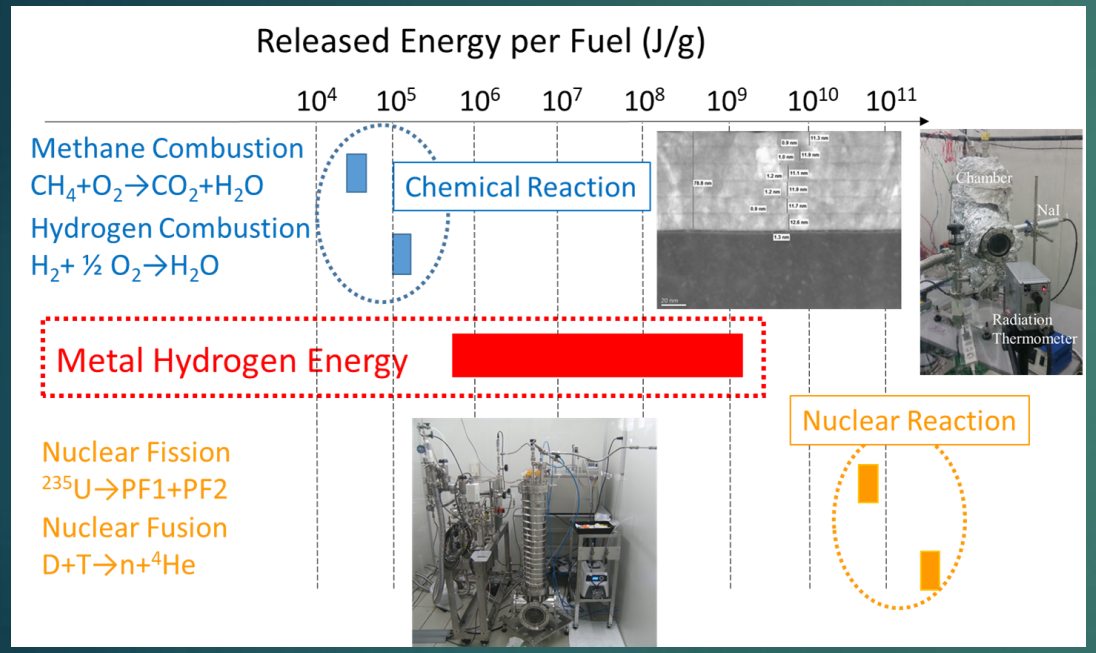


(2)’ NEDO Project
2015.10-2017.10

(3)Transmutation; 2017.3-2020.3
: Stopped due to COVID-19

Results from FY2015 to 2018 & Research Plan from FY2019 to 2022

1.Results from FY2015 to 2018



- Observed Anomalously Large Heat Generation Phenomena that cannot be explained by any known Chemical Reactions
- Good Reproducibility

2. Plan of FY2019 to 2022

	FY 2019	FY 2020	FY 2021	FY 2022
Heat Generation Experiments	**R&D on Taking out Excess Heat Energy**			
	Conversion to Electric Energy			
			R&D toward the Realization of a New Energy Source	

- Continue Clarification of the mechanism of Condensed Matter Nuclear Reaction
- Continue the research on the Transmutation of Radioactive Isotopes for Nuclear Waste Decontamination

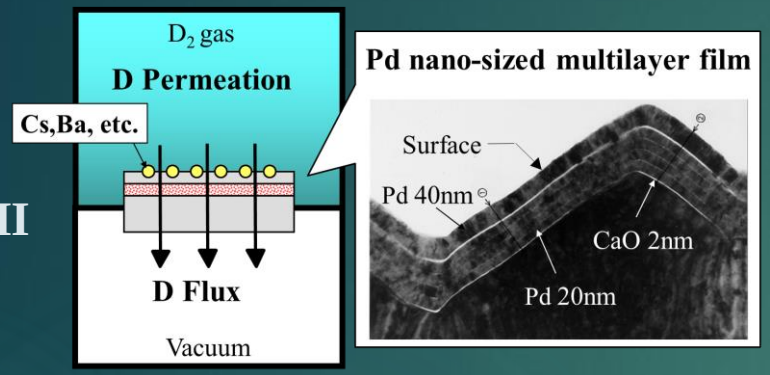
(1)Excess Energy Generation using a Nano-sized Multilayer Metal Composite and Hydrogen Gas

-Collaborative Research with Clean Planet Inc.-

Background & Motivation

Permeation-Induced Transmutation with nano-sized multilayer thin film

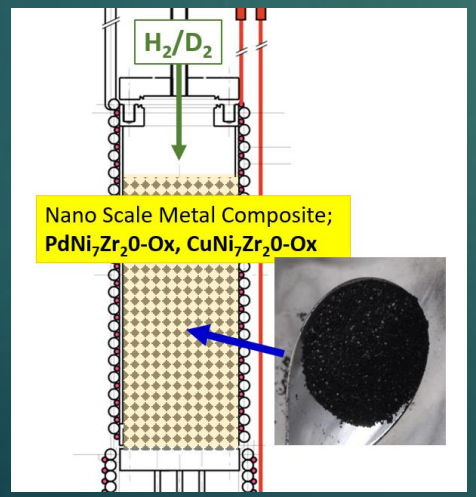
MHI



$$^{133}_{55}\mathrm{Cs} + 4\mathrm{d} \rightarrow {}^{141}_{59}Pr + 50.5MeV$$

Excess Energy with nano-sized Metal Composite Particles

NEDO Project
Mizuno Exp.



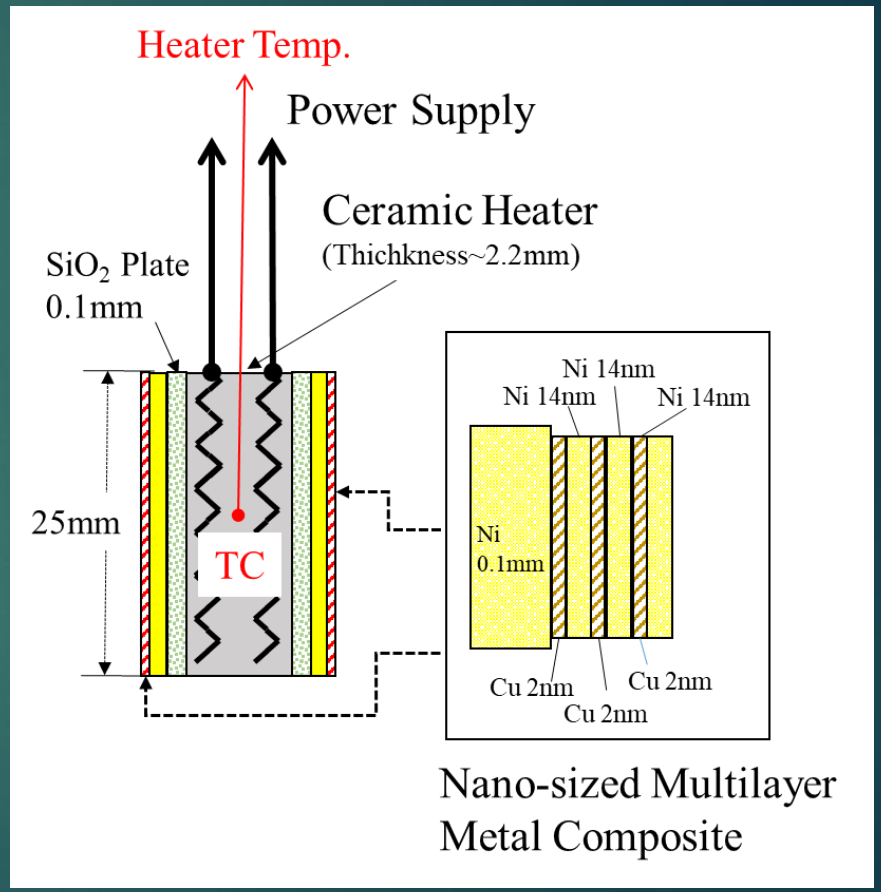
D Diffusion
Nano size
Multilayer
Elemental Analysis

Nano size
Particles

H/D Diffusion

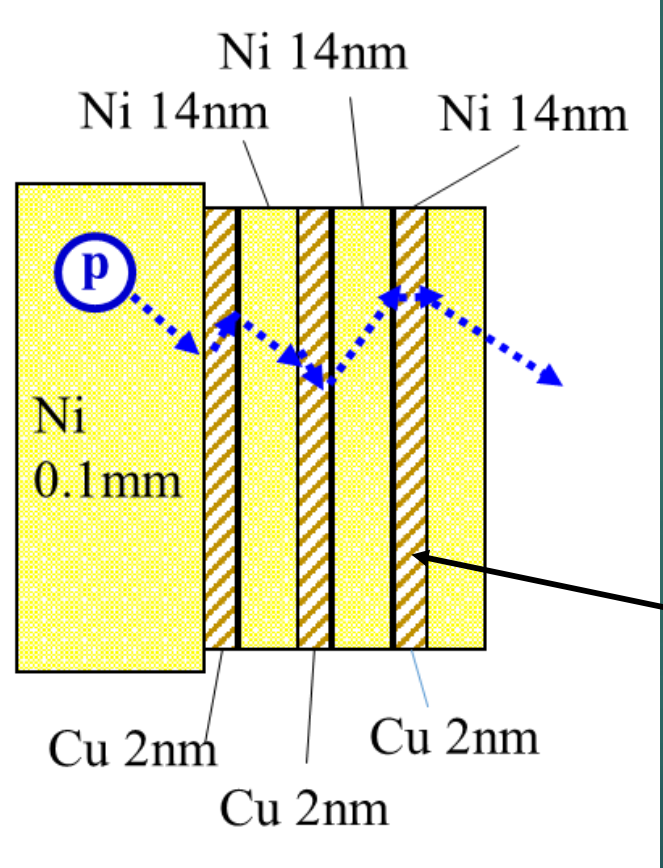
Heat Estimation

Excess Energy with Nano-sized Multilayer Metal Composite and Hydrogen Gas

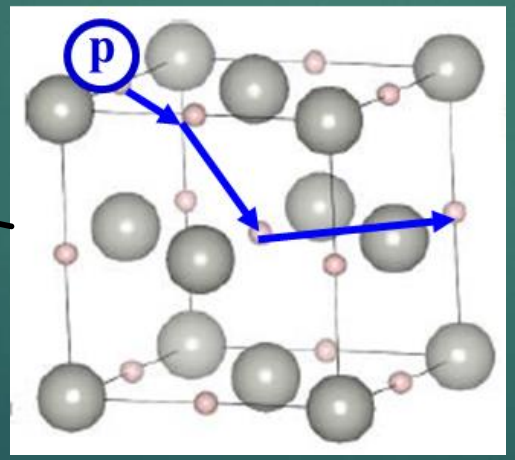


Larger excess energy per H obtained !

Diffusion of H through Nano-sized Multilayer Metal Composite in the present Experiment



Multilayer Metal Composite



Hopping from a site to site : Quantum Diffusion

Assumption

Diffusion of Hydrogen is one of the **key factors** to induce condensed matter nuclear reactions.

Diffusion of Hydrogen caused by

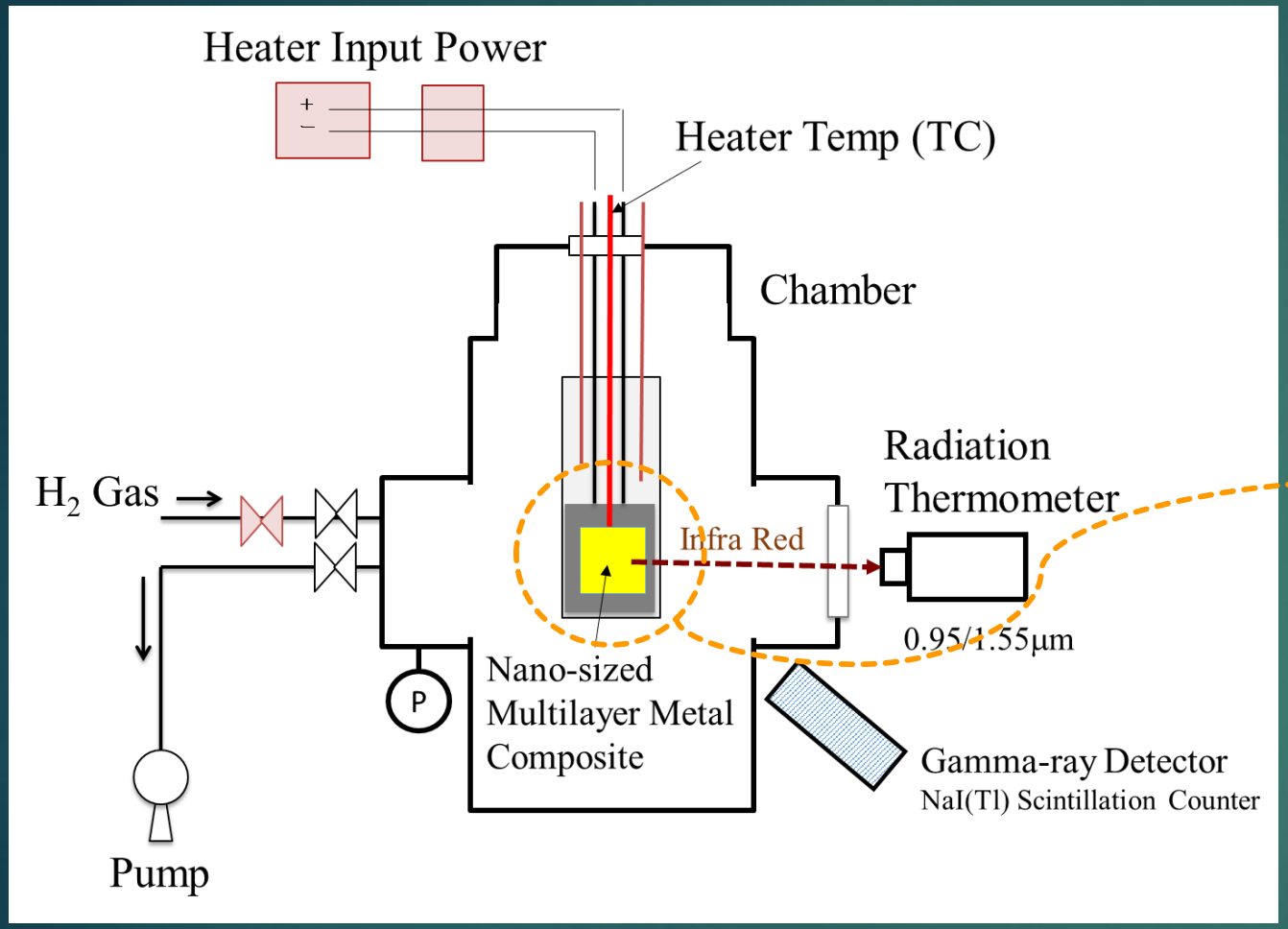
∇C_H Evacuation, Permeation

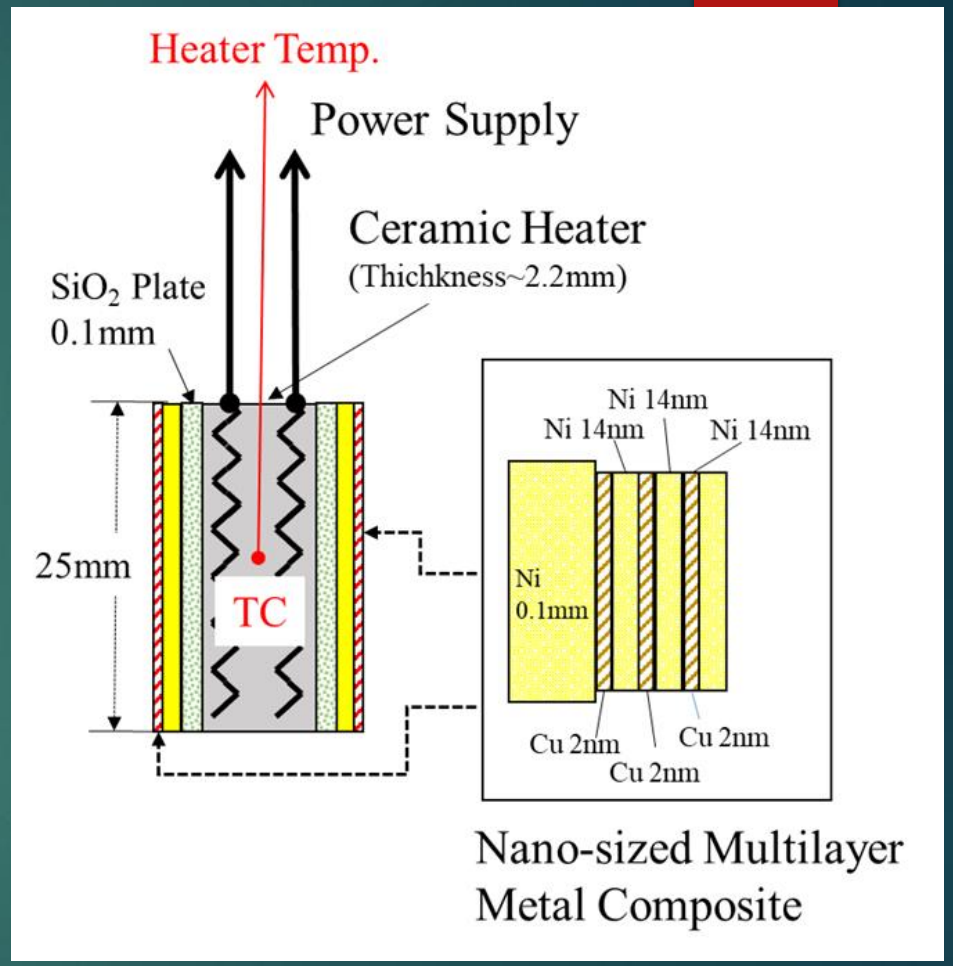
∇T Heating, etc.

$$\mathbf{J} = \mathbf{J}_{diffusion} + \mathbf{J}_{drift} = -nD\nabla c + ncM\mathbf{F}$$

$$= -nD(\nabla c + \frac{cQ^*\nabla T}{k_B T^2}) \qquad Q^* : \text{Heat of Transport}$$

Experimental Method

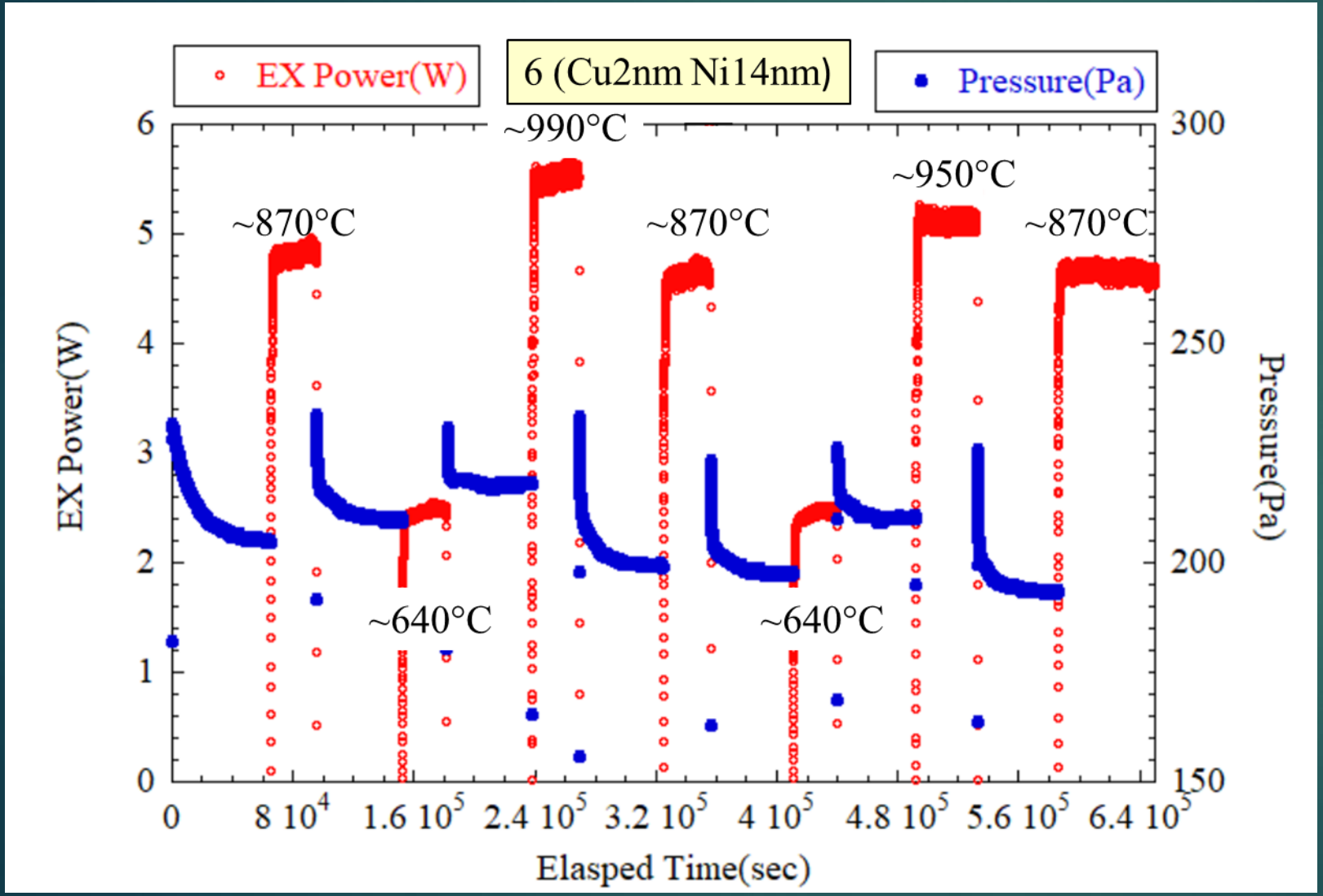


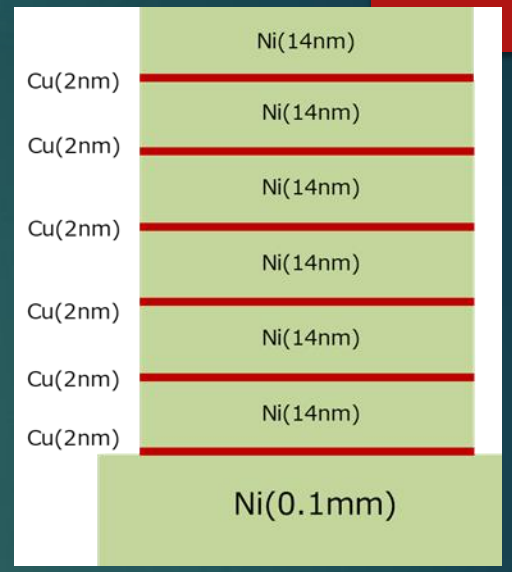


Procedure

1) Introduce samples into a Chamber
2) Baking of the samples
3) H_2 Absorption (250°C,～230Pa)
4) Evacuate the Chamber by TMP
5) Heat up the samples up to 500°C
6) Observation of Excess Power
7) Cool down the samples
8) Repeat the process from 3) to 6)

Example of Excess Heat Generation

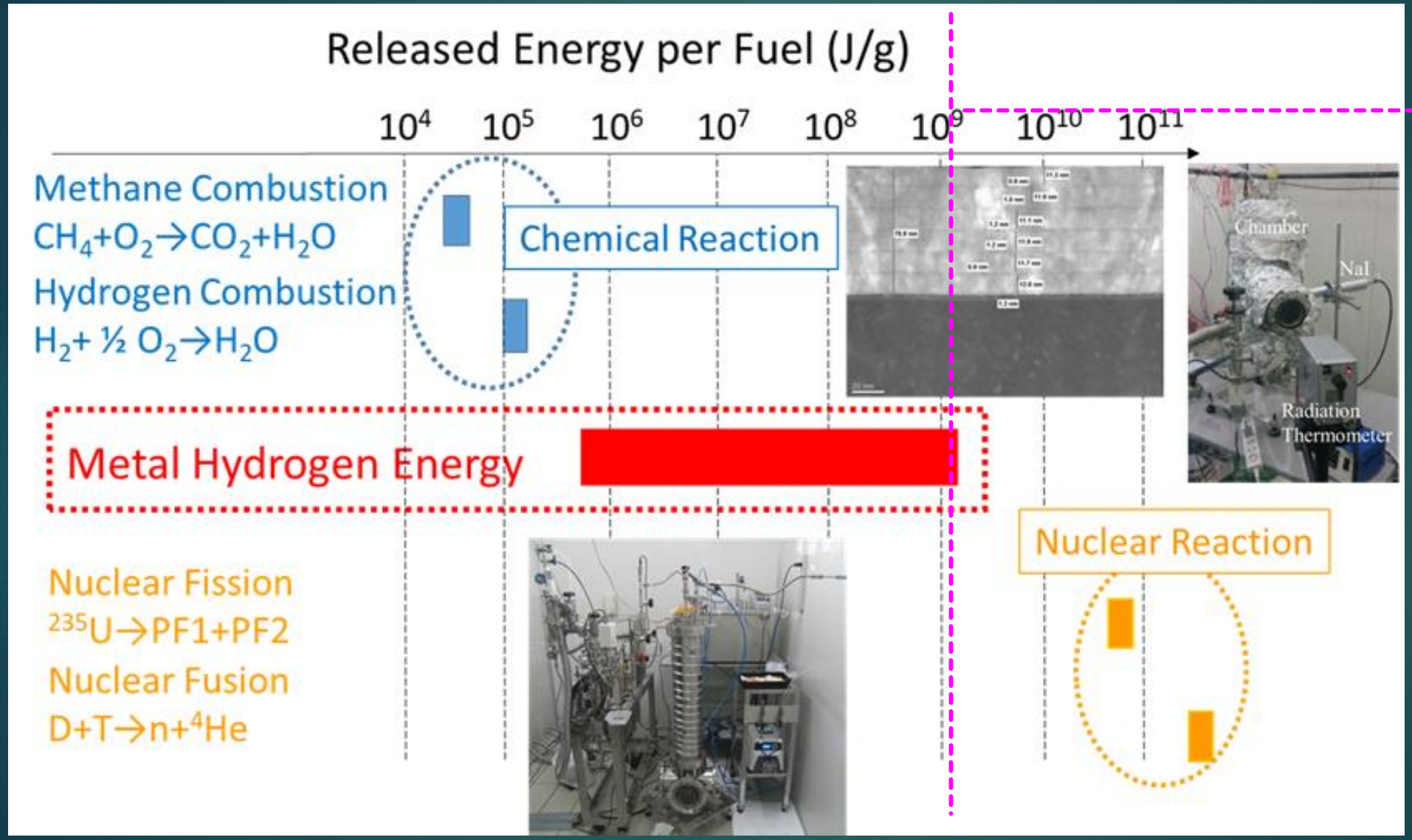




Absorbed H [mol]	7.3E-04
Number of absorbed H	4.4E+20
Total Released Energy [J]	1.1E+06
Released Energy per Absorbed H [J/H-mol]	1.5E+09
Released Energy per Absorbed H [eV/H]	1.6E+04

Very Large！（Chemical Reactin~ eV/H）

Released Energy per Fuel; Research with Clean Planet



100kWh Electric Energy can be suppled by 1g Hydrogen !

(Efficiency of Thermal to Electric Conversion ~ 30%)

(2) Anomalous Heat Generation Experiments Using Metal Nanocomposites and Hydrogen Isotope Gas

- NEDO Project: 2015.10-2017.10 -

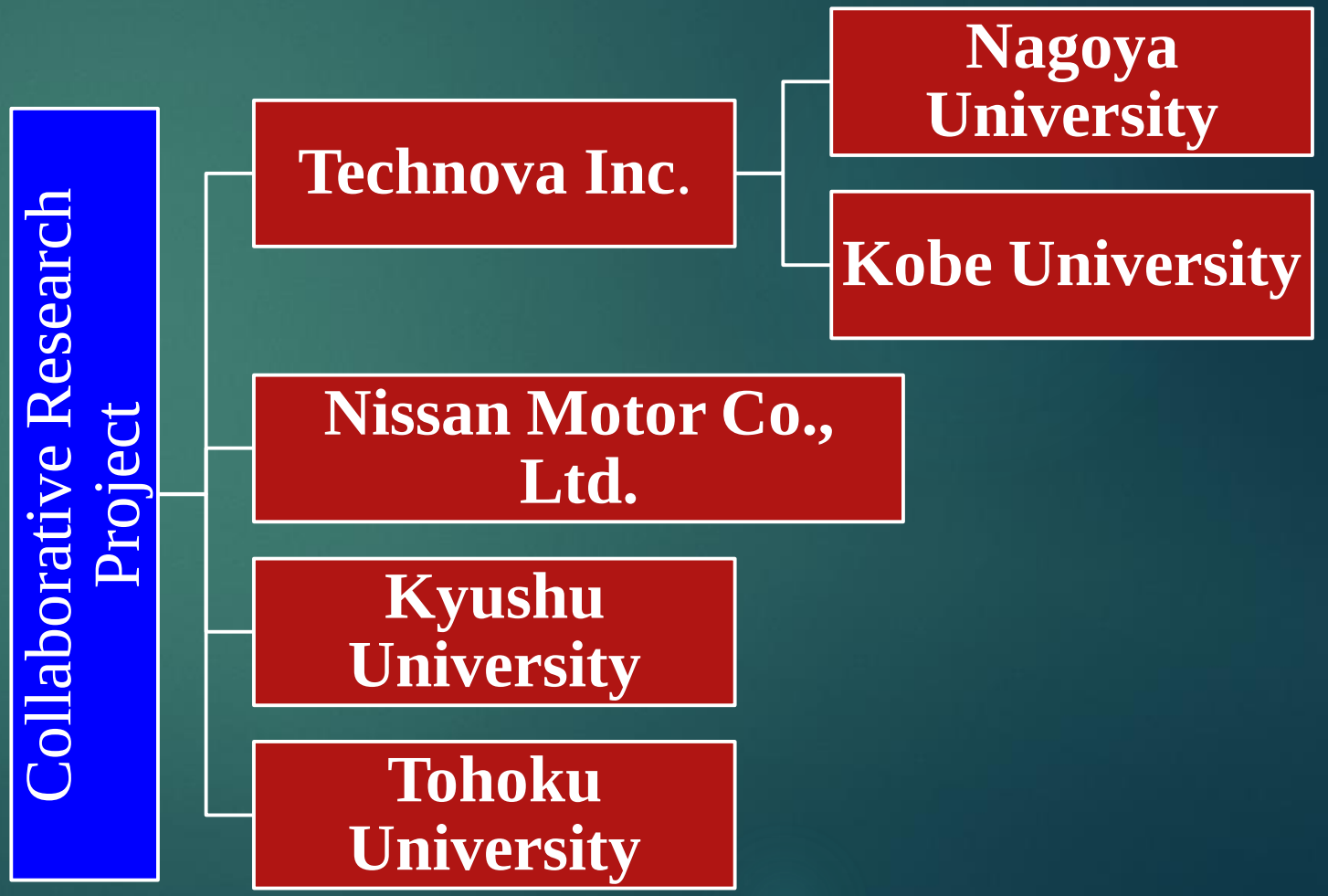
Collaborative Research Project (2015.10-2017.10)

Objectives

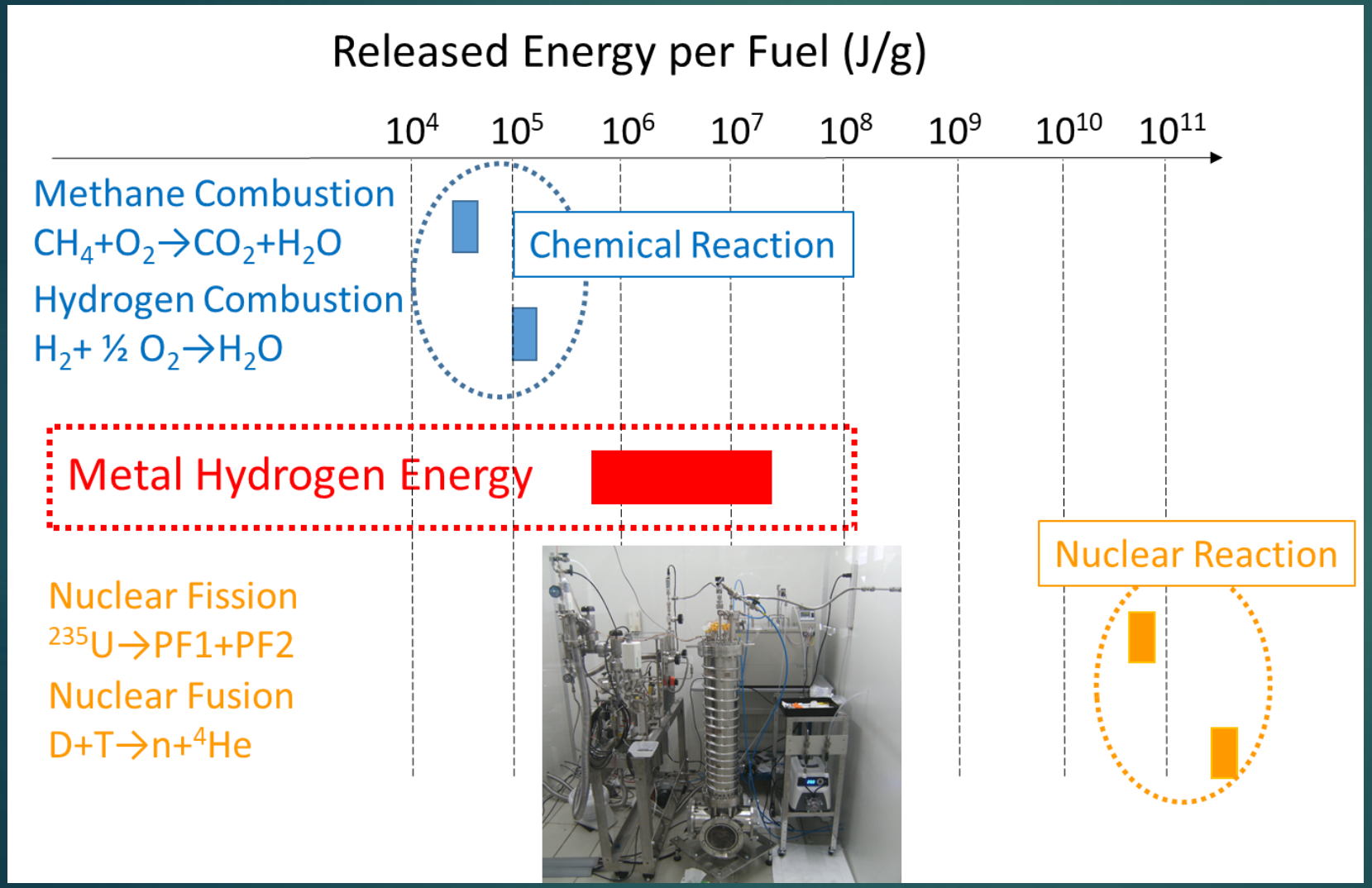
To clarify the **existence of the anomalous heat generation** phenomena

Setup of a new **national project** by obtaining guiding principles on how to control the anomalous heat generation phenomena .

Organization



Released Energy per Fuel; NEDO Project



Released Energy ranges was larger than the energy by Chemical Reactions.

Comparison

	Period	Results	Power/ Metal	Energy / Absorbed Hydrogen	Energy / Absorbed H atom
Results of NEDO Project	2015-2017	～10W @ 100g Nano-Particle	～ 0.1W/g	～10MJ/g ～3kWh/g	～100eV/H
Results of Research with Clean Planet	2017-2019	～5W @ 1g Nano Multilayer Composite	～5W/g	～2GJ/g ～600kWh/g	～20keV/H
Reference			Nuclear Reactor ~30W/g	Gasoline ～12kWh/g	Chemical Reaction ~ eV Nuclear Reaction ~ MeV

Future Work towards Commercialization

Item	Target	Plan
Increase of Power	1kW Thermal Power	Development of Scale-Up Device
Controllability	Specify of Governing Factors	Experiments based on hypothesis
Development of practical material	Durability & Cost Effectiveness	Experiments and Simulation
Reaction Mechanism	Guarantee of Safety Operation	Encourage Participation of Young Researchers