Beam WPT via Radio Wave in Japan
[MPT to Flying Drone Demonstration (2019.5.24)]

Frequency : 5.8GHzCW, Tx MW Power : 1.6kW, Distance : 30m, Rx DC Power : 42W

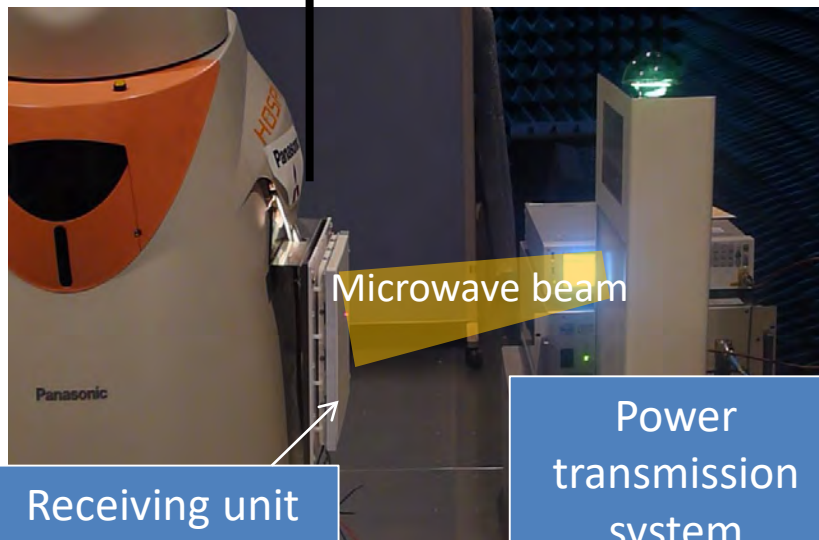Developed by Mistubishi Electric, IHI Aerospace, conducted by J-Spacesystems, funded by METI

Shinohara is a chair of steering committee

Microwave power supply system for moving object (Project of 'Center of Innovation' supported by JST)
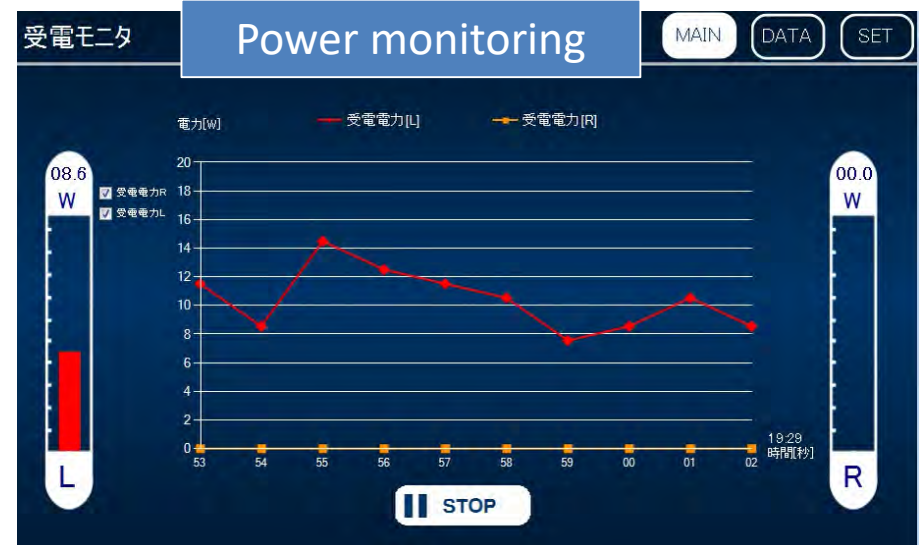

by Kyoto University with Panasonic co. from 2013
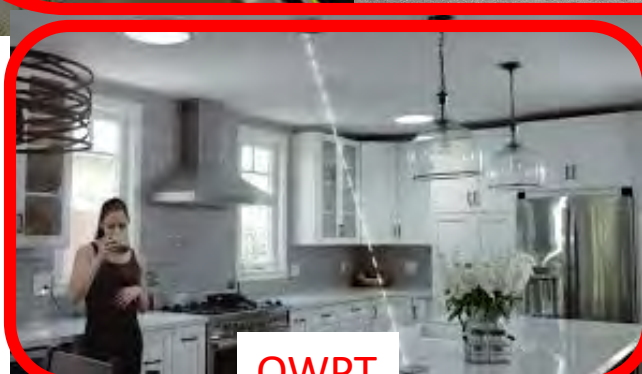
Microwave beam control for moving object

Power monitoring

Microwave beam

Receiving unit

Power transmission system

Various Commercial Wireless Power Transfer (WPT) Products

Inductive WPT (Magnetic Field)

OWPT

WPT via Radio Wave (Microwave, UHF)

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Working Document Towards a Preliminary Draft New Report ITU-R SM.[WPT.WIDE-BEAM.IMPACTS] rev. (2019)

System specifications of beam WPT at the first step commercialization (2020)

| System		System 1	System 2	System 3
Spec.	Frequency	920 MHz bands (915-930 MHz)	2.45 GHz bands (2.40-2.499 GHz)	5.7 GHz bands (5.470-5.770 GHz)
	Output Power	1 W	15 W	32 W
	Antenna gain	6 dBi	24 dBi	30 dBi
	EIRP	4 W (36 dBm)	65 dBm	70 dBm
	Modulation	TBD	TBD	TBD
	Place of use	Indoor	Indoor	Indoor
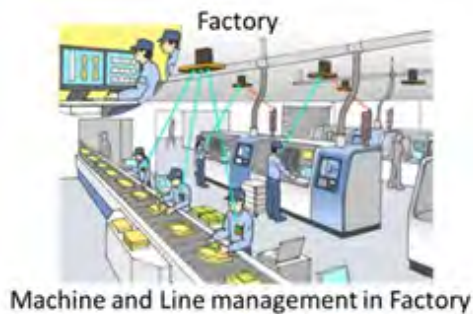
Application of wide-beam WPT technology for wireless powered sensor network (System1)

Application of wide-beam WPT technology for wireless charger of mobile devices (System2,3)

In Japan, we start discussion for new WPT regulation and will decide it before the end of 2019
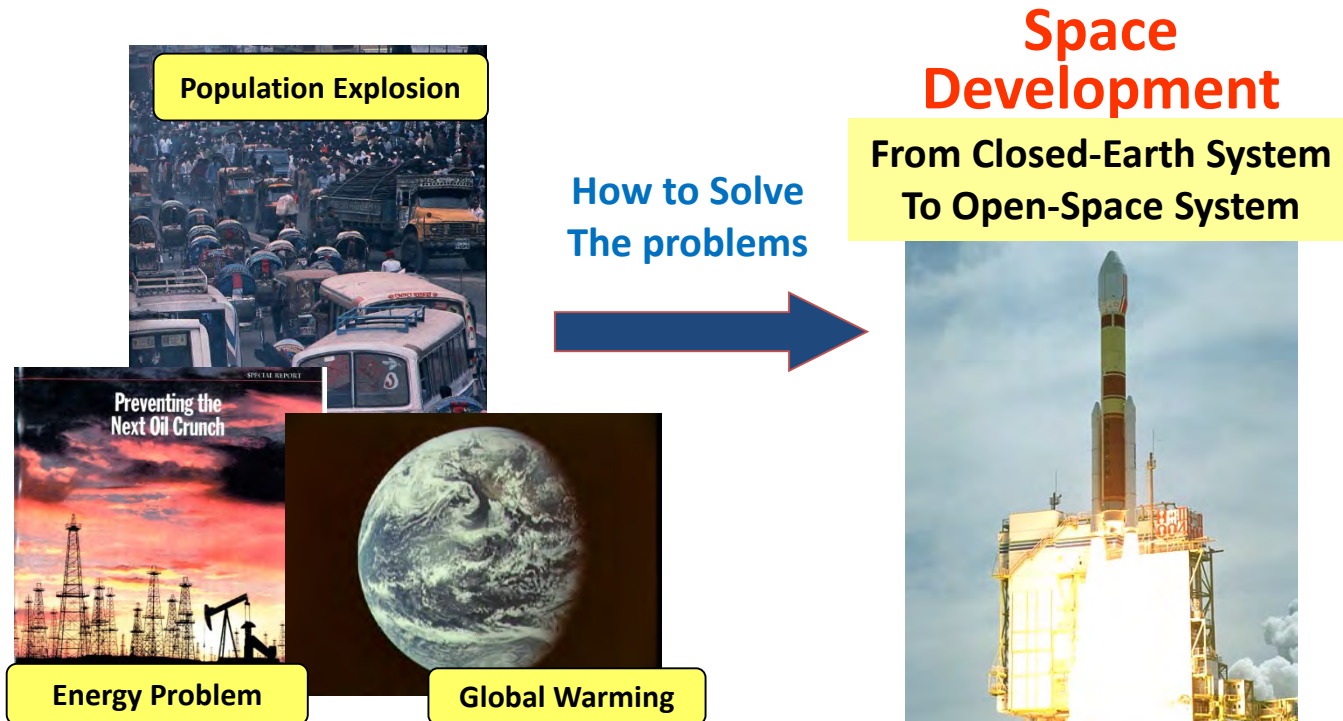
Roadmap to SPS by METI (2017)
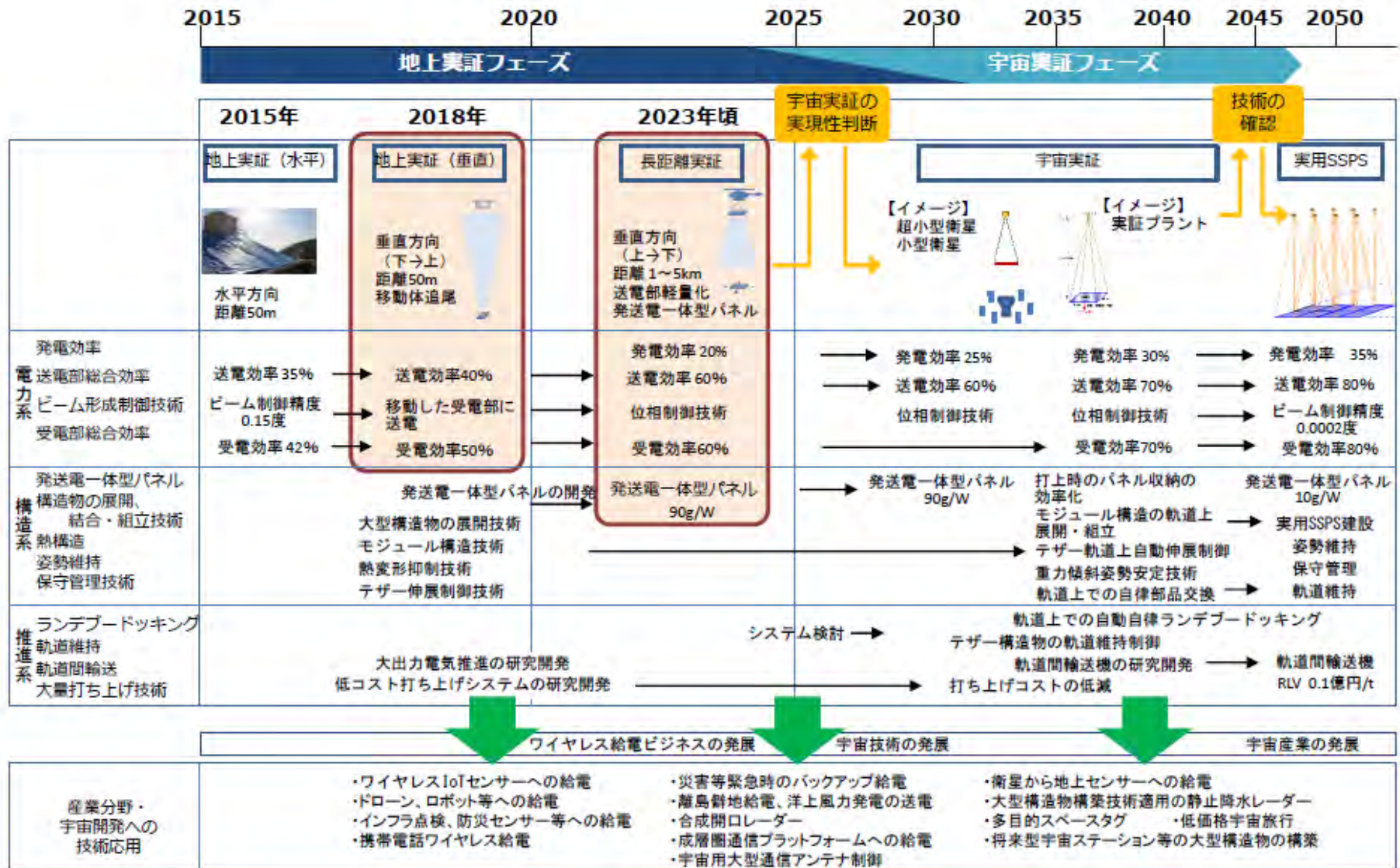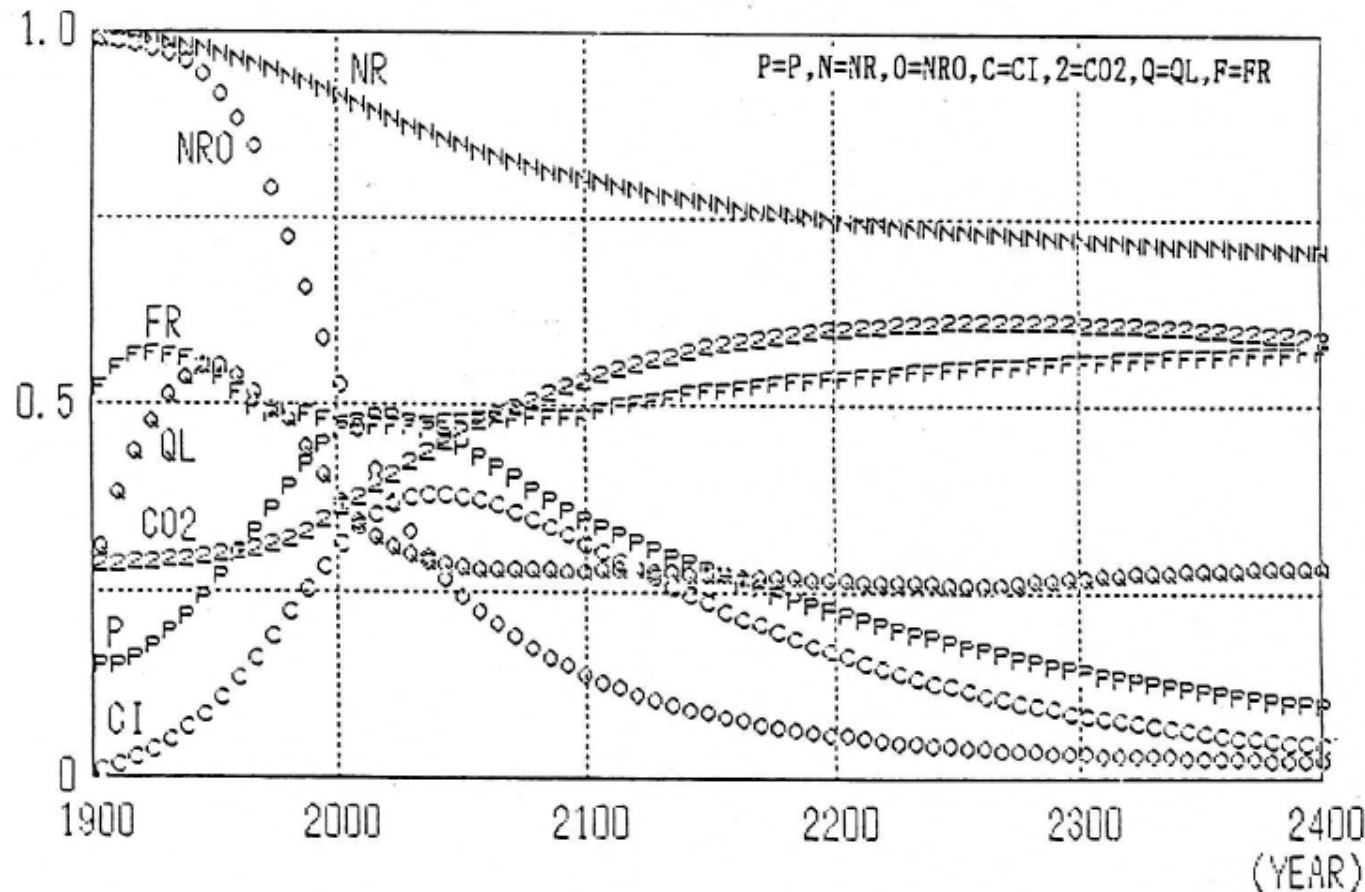
Significance of SPS

Mile Stone toward Future Space Development
(Huge Space Satellite (Structure))

Future Stable Solar Power Station without CO_2
(Huge Solar Power from Satellite)

Space Development

Population Explosion

How to Solve The problems

From Closed-Earth System To Open-Space System

Preventing the Next Oil Crunch

Energy Problem

Global Warming

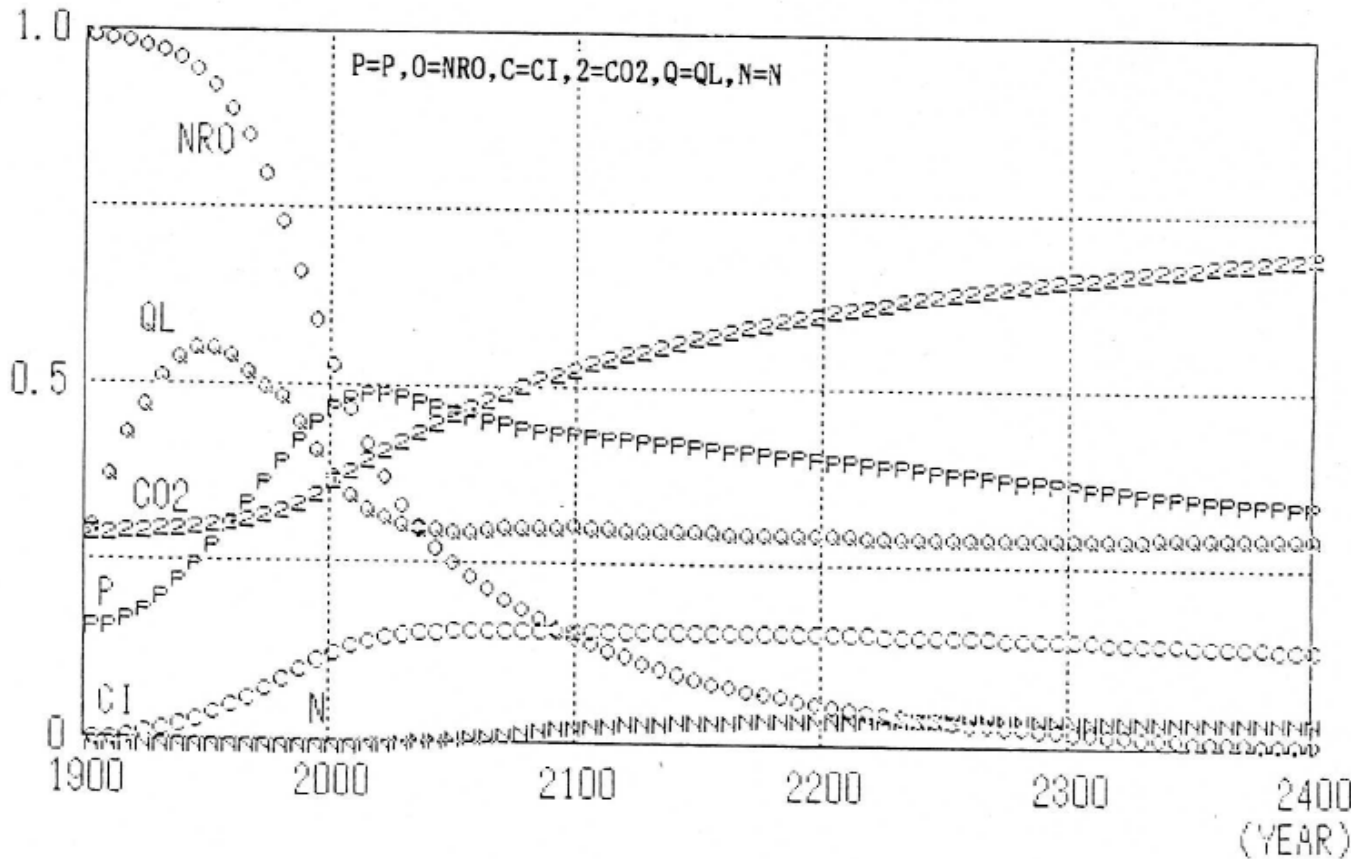# The Limits to Growth by Rome Club
WORLD-2 Model Simulation

Computer Simulation
With Parameters
in 1970

•Meadows, D. H., D. L. Meadows, J. Randers, and W. W. Behrens III ; "The limits to growth - A report for THE CLUB OF ROME'S project on the predicament of mankind", Universe Books, New York, 1972

FIGURE 1: Simulation result of Forrester's WORLD-2 model (Modified version). **Full scale values of the levels:** Population: $P = 1 \times 10^{10}$ (PEOPLE); Capital Investment: $CI = 2 \times 10^{10}$ (CAPITAL UNIT); Total energy resources: $NR = 3.24 \times 10^{13}$ (BARRELS); Oil: $NRO = 2 \times 10^{12}$ (BARRELS); CO_2: $CO_2 = 1000$ (PPM); Quality of Life: $QL = 2$; Food Ratio: $FR = 2$.

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The Limits to Growth by Rome Club with SPS
WORLD-2 Model Simulation

P=P,O=NRO,C=CI,2=CO2,Q=QL,N=N

FIGURE 3: Simulation result of the world dynamics model with SPS. (low energy investment case). **Full scale values of the levels:** Population: $P=1 \times 10^{10}$ (PEOPLE); Capital Investment: $CI=5 \times 10^{10}$ (CAPITAL UNIT); SPS Number: $N=4000$; Oil: $NRO=2 \times 10^{12}$ (BARRELS); CO_2: $CO_2=1000$ (PPM); Quality of Life: $QL=2$; **Parameters:** Energy Investment in SPS: $Et=0.003 \times NRUR(MJ)$; Start Year of Energy Investment: $IYEAR=2000$; Year SPS cost reaches to improved value: $RYEAR=2100$; SPS CI Discard Normal: $SCIDN=0.01$.

Computer Simulation
With Parameters
in 1970

- Meadows, D. H., D. L. Meadows, J. Randers, and W. W. Behrens III ; "The limits to growth - A report for THE CLUB OF ROME'S project on the predicament of mankind", Universe Books, New York, 1972

- Yamagiwa, Y. and M. Nagatomo ; "An Evaluation Model of Solar Power Satellites Using World Dynamics Simulation", Space Power, vol.11, no.2, pp.121-131, 1992

+ SGDs with Space Development
(Open-Space System)

Key Mile Stone
: SPS

+

SDGs with Harmonization with Human and Nature
(on Closed-Earth System of Sustainable Humanosphere)

Not Enough!

SDGs : Sustainable Development Goals

The Moon Speech - John F. Kennedy at Rice University - September 12, 1962

"We choose to go to the moon. We choose to go to the moon in this decade and do the other things, not because they are easy, but because they are hard, because that goal will serve to organize and measure the best of our energies and skills, because that challenge is one that we are willing to accept, one we are unwilling to postpone, and one which we intend to win, and the others, too."

December 18, 2019, in Japan

"We choose to build **Solar Power Satellite**. We choose to start to build **Solar Power Satellite** in this decade and do the other things, not because they are easy, but because they are hard, because that goal will serve to organize and measure the best of our energies and skills, because that challenge is one that we are willing to accept, one we are unwilling to postpone, and one which we intend to win, and the others, too."