GJS2012
“The Influence of ICT on Energy Efficiency: Perspectives from Germany and Japan”

ICT Innovation for Global Energy Efficiency

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Possible ICT Contribution for Global Energy Efficiency and Sustainability

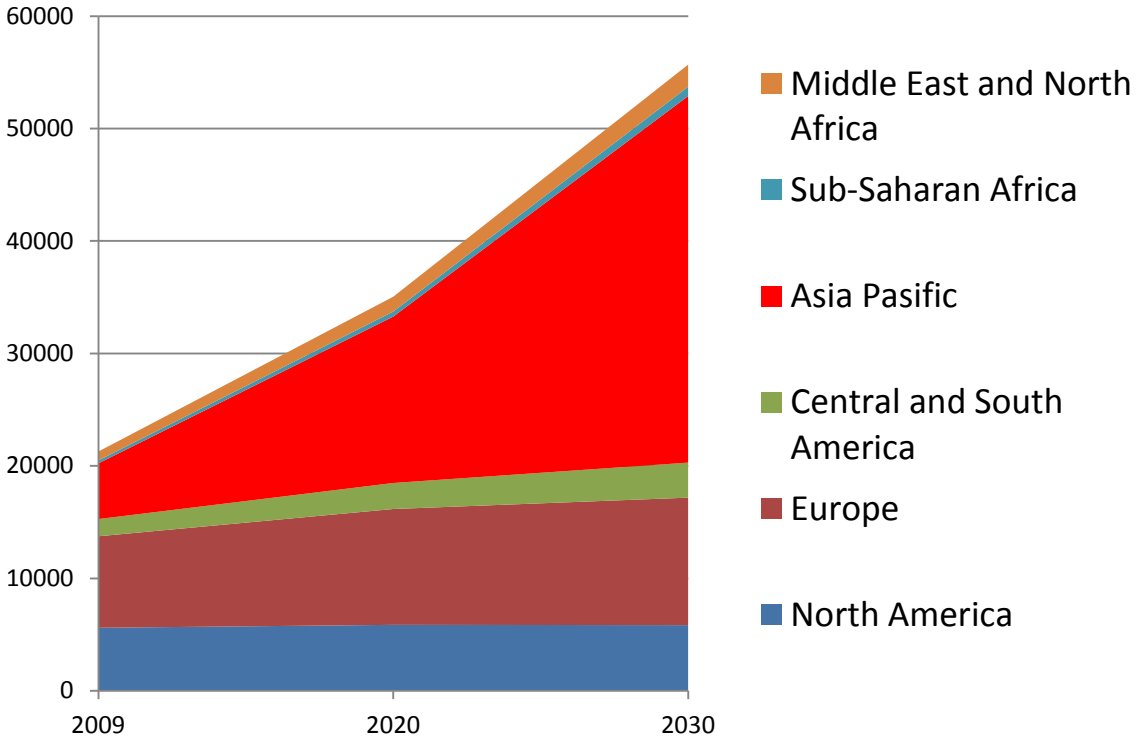
- Reduce Energy Consumption
  - Reduce Inefficient Energy Consumption
    - Energy production inefficiency
    - Energy consumption inefficiency
  - Restructure Energy Consuming Activities
    - Ex) Restructure economic activities for reducing the energy consumed for transportation
  - Reduce Energy Consumption Increase
    - Innovation for developing countries' economies not to become energy-intensive
- Increase Available Energy Source
  - Utilize Renewable Energy Source
    - Requirements for developing countries' grids are different from the ones for developped countries
  - Explore New Energy Source
- Reduce Ill Effects of Energy Consumption for Environmental Sustainability

ICT Contribution estimated in SMART 2020

Developing countries are increasing global energy consumption per year by more than 90 %

Middle Class Consumption

Billions of 2005 PPP$ (purchasing-power-parity)

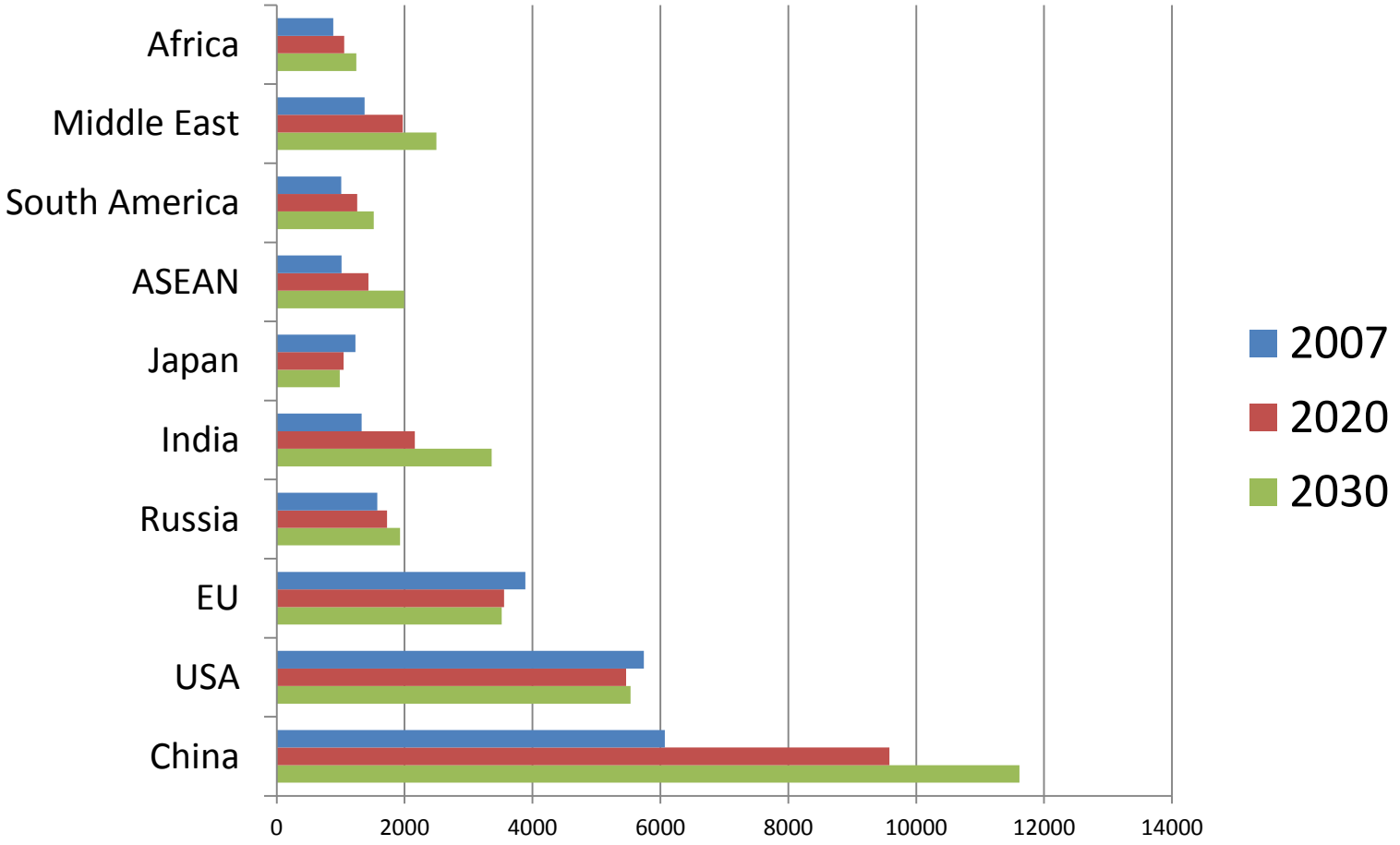


Top 10 Countries
(billions of 2005 PPP$ and global share)

2030		
India	12,777	23%
China	9,985	18%
United States	3,969	7%
Indonesia	2,474	4%
Japan	2,286	4%
Russia	1,448	3%
Germany	1,335	2%
Mexico	1,239	2%
Brazil	1,225	2%
France	1,119	2%

H. Kharas, “The Emerging Middle Class in Developing Countries,” Brookings Institution, June 2011.

China's 2030 CO2 Emission Will be 30% of the World Total's

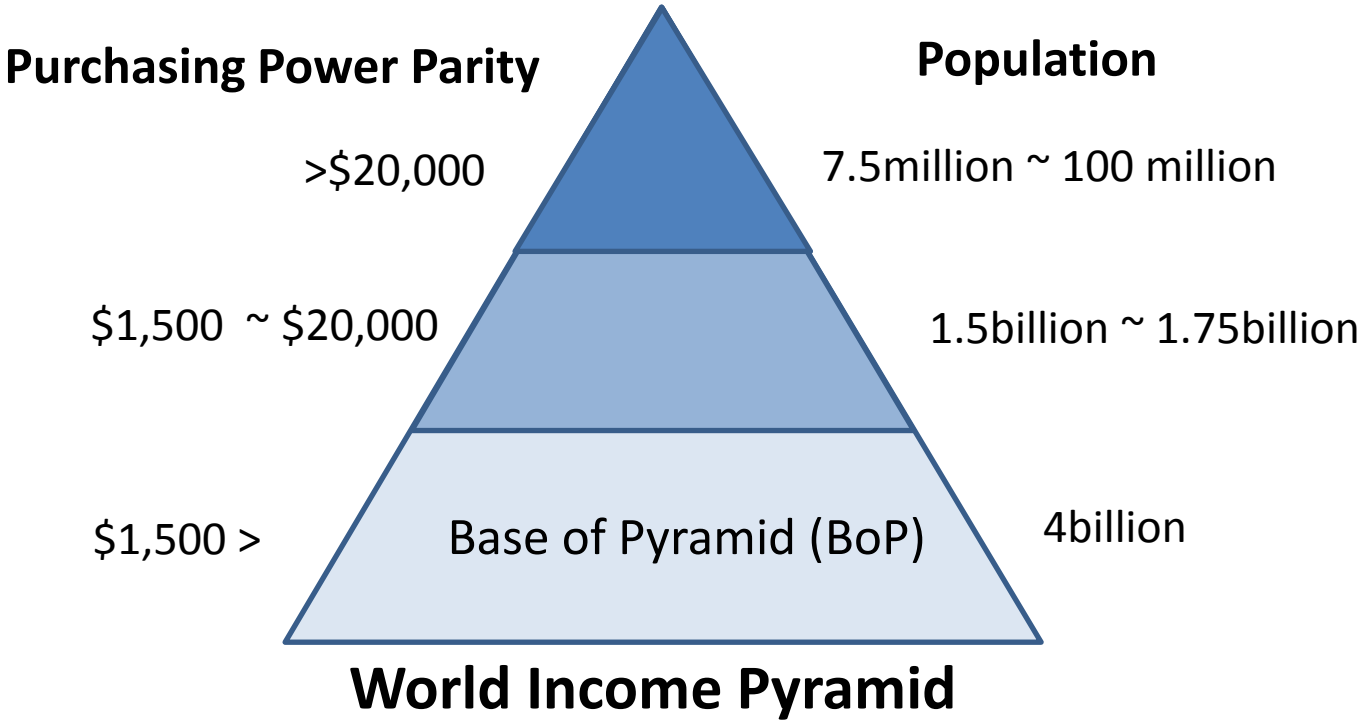


IEA "World Energy Outlook 2009"

Targeted Market of theULP Integrated System: BoP

Satisfying the needs of the Base of the Pyramid (BoP) is the only way for long-term sustainable growth of the world (S.L. Hart, "Capitalism at the Crossroads")

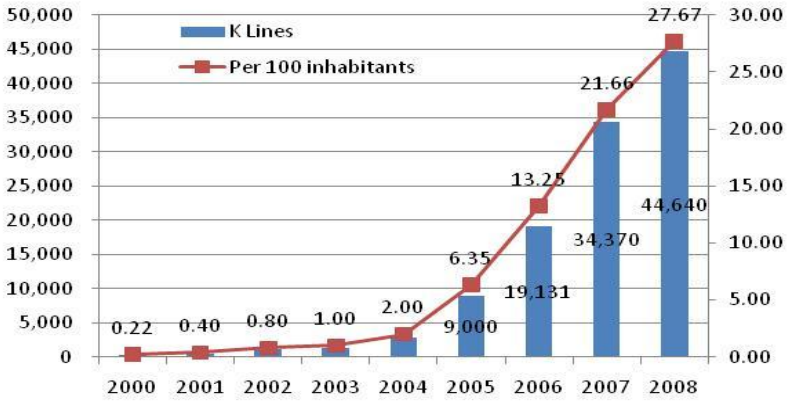
- Export oriented policies targeting at the wealthy class of developed countries led to excessive production and global deflation.
- The poor at the BoP live in high cost economies, with huge consumer surplus.
- BoP is often ideal markets for destructive technologies.



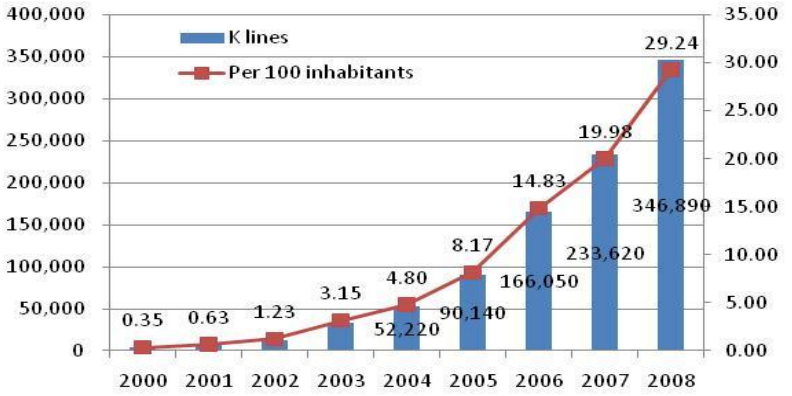
S. L. Hart, "Capitalism at the Crossroads –Aligning Business, Earth and Humanity," Perason Education, 2007.

Mobile Phones Have Proved To Increase BoP Peoples' Income

Bangladesh



India



10% increase in mobile penetration leads to a 1.2% increase in GDP in the long-run across developing countries. (2006-2007, GSM Association)

H. Ogata, "Success Factors of Mobile Operators in BoP Markets, German-Japanese Symposium, Sept. 2010

ICT Innovations for BoP Rural Areas Key to Global Energy Efficiency

- Developing countries are rapidly increasing global energy consumption by their industrialization and urbanization
  - Innovations are needed to decrease energy consumption by industrialization and urbanization of developing countries.
  - Economic growth by agriculture is more desirable than by secondary industries.
    - Agriculture requires less energy than secondary industries.
- Global energy efficiency and sustainability will be much improved by Innovations for people in rural areas of developing countries to improve the agricultural productivity and their living standards.
- ICT infrastructures are indispensable for the innovations, but are missing in large part of BoP rural areas.

ICT SYSTEM APPLIED WITH ULTRA LOW POWER (ULP) TECHNOLOGIES

The Mission of ULP Integrated System Project

5 to 10 years after the completion of ULP Research Area

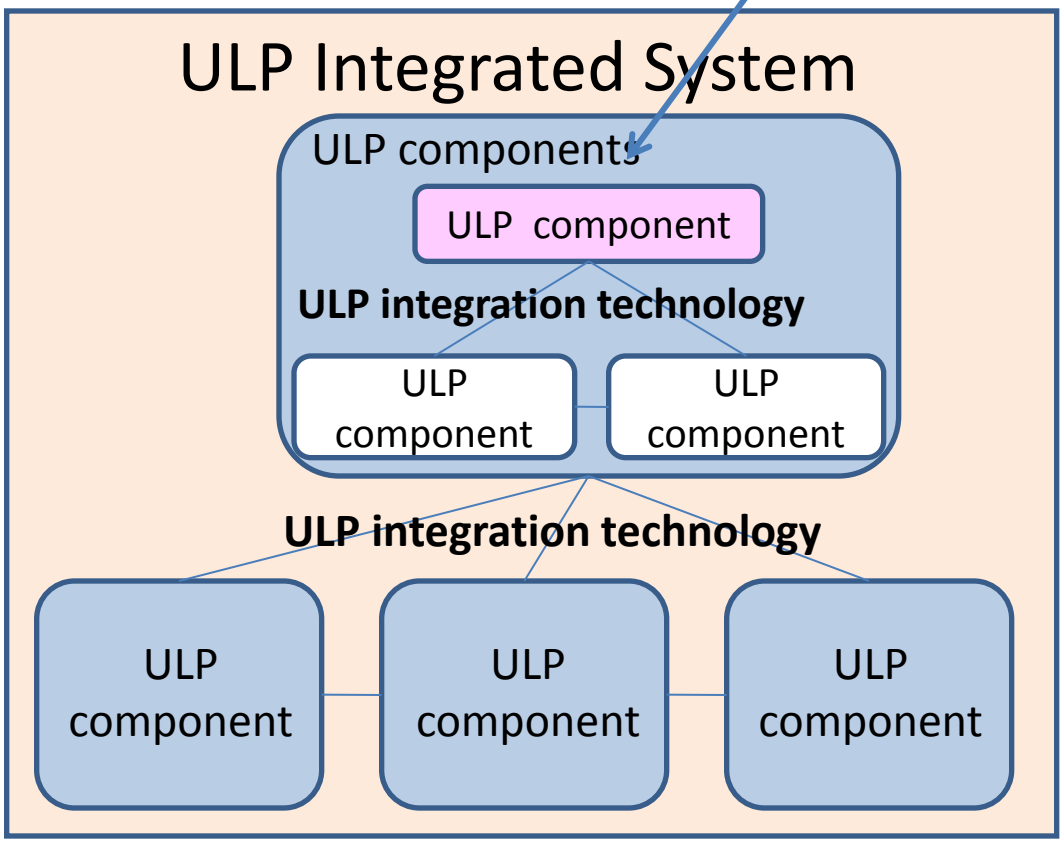
ULP components to which the results of ULP Research Area are applied

Reducing ICT electric power consumption

Resolving problems for humanity

Strengthening Japan's industrial competitiveness

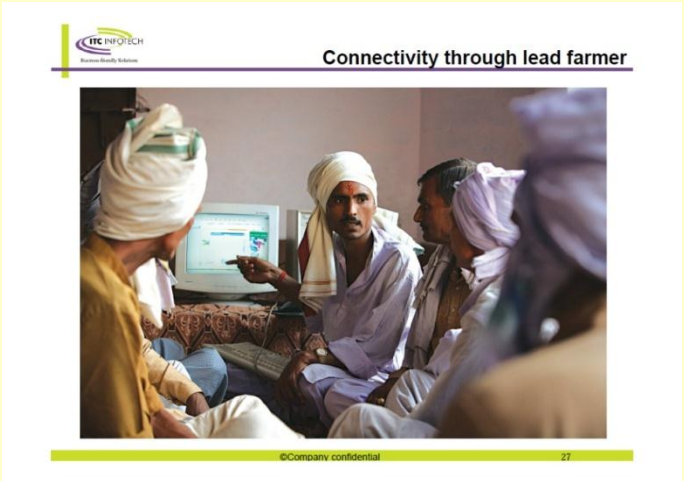
"Place & Play Informa-tion System"



Market?

Function?

Place & Play-type Broadband Internet Systems with Poor Infrastructures



An example of the rural villages in India (Sharing internet terminal in a village)

An image of P&P System providing broadband internet services to villagers

Functional Concept of ULP Integrated System

Developed Countries

Internet Users

Network

Broadband Connectivity

Internet

Reliable Electrical Power Source

Developing Countries

Internet & Ubiquitous Network Users

ULP Integrated System

Internet Equivalent

Broadband Connectivity

Narrowband Connectivity

Internet

Electricity by Renewable Energy

An Example of Agricultural Productivity Improvement

1. Soil temperature and moisture
Weather, etc.

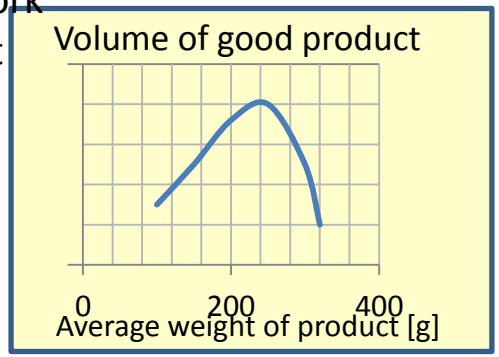
1. Agricultural work log

P&P Core System

5. Product selection and call

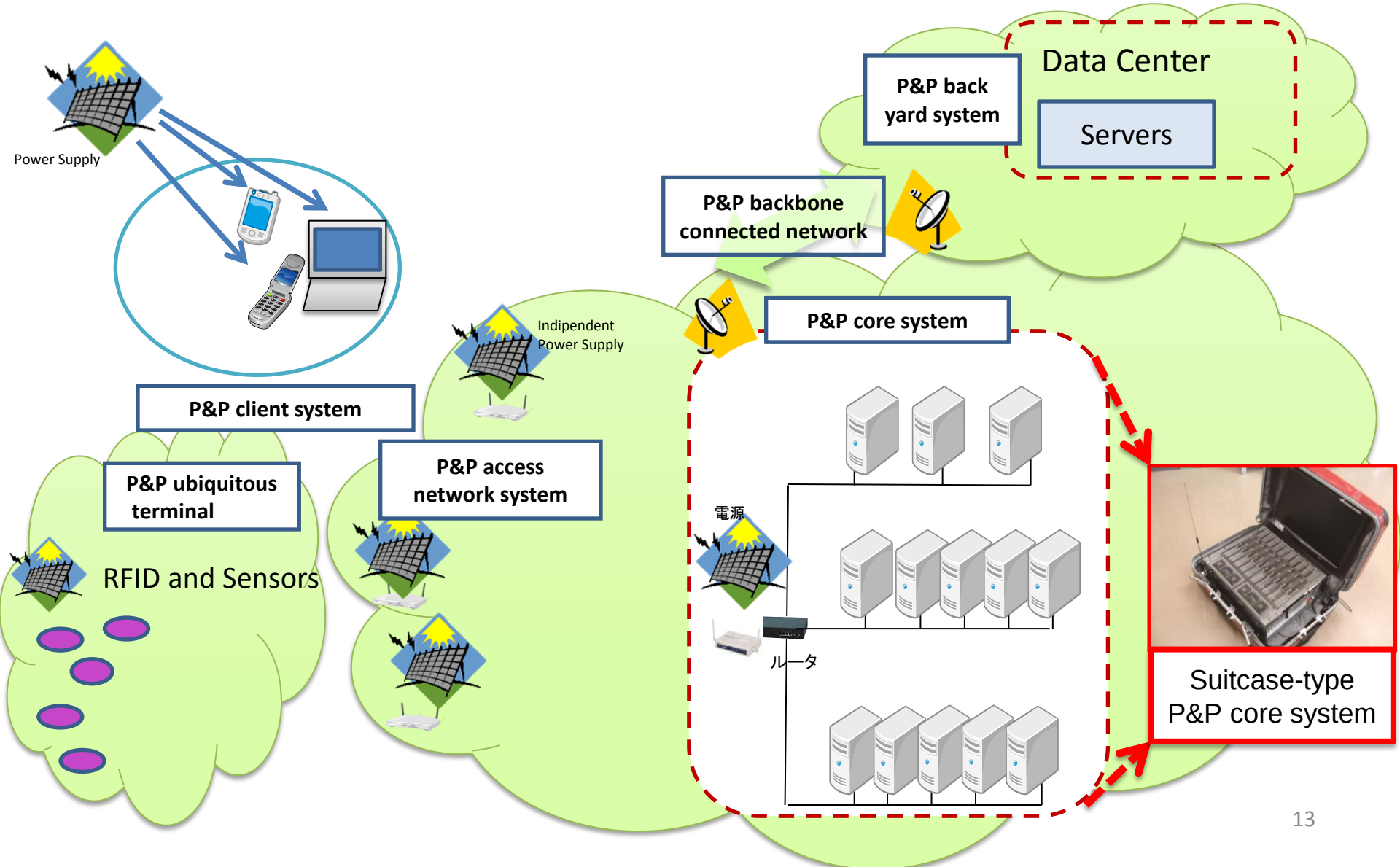
4. Product Info Upload

2. Design the best agricultural work
3. Find the best timing to harvest



Ref.1 http://igpf.gramweb.net/index.php
Ref. 2 T. Sugiyama, “Entrepreneurial Agriculture,” Tukiji-Shokan, 2005.

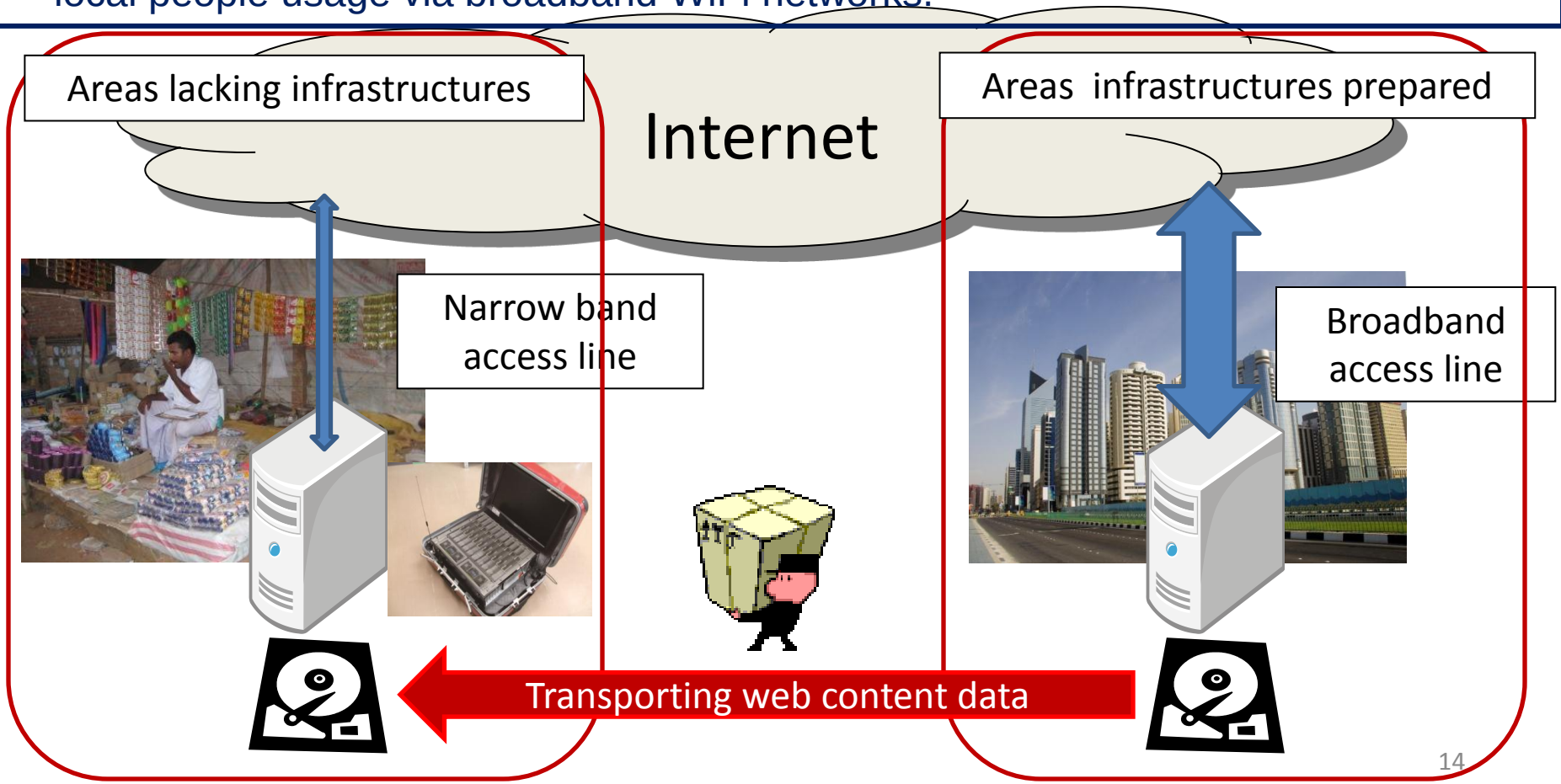
ULP Integrated System



P&P Internet System

Provide broadband internet services with poor social infrastructures:

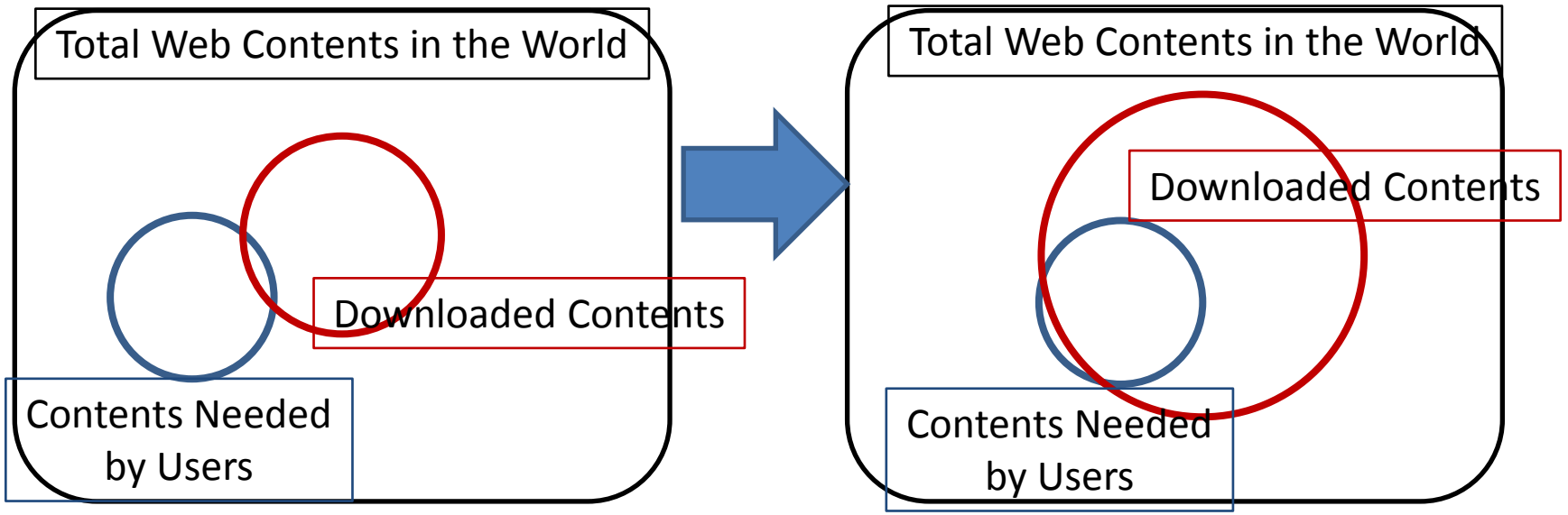
1. Store web contents in storage devices at places where broadband internet access is available.
2. Transport and mount the storage devices to the local P&P Core System for the local people usage via broadband WiFi networks.



Challenges for P&P Internet System

Estimation and Download of Contents Needed by Users

- Download as more contents including contents needed by users as possible
- Download as more contents as possible within a given minutes

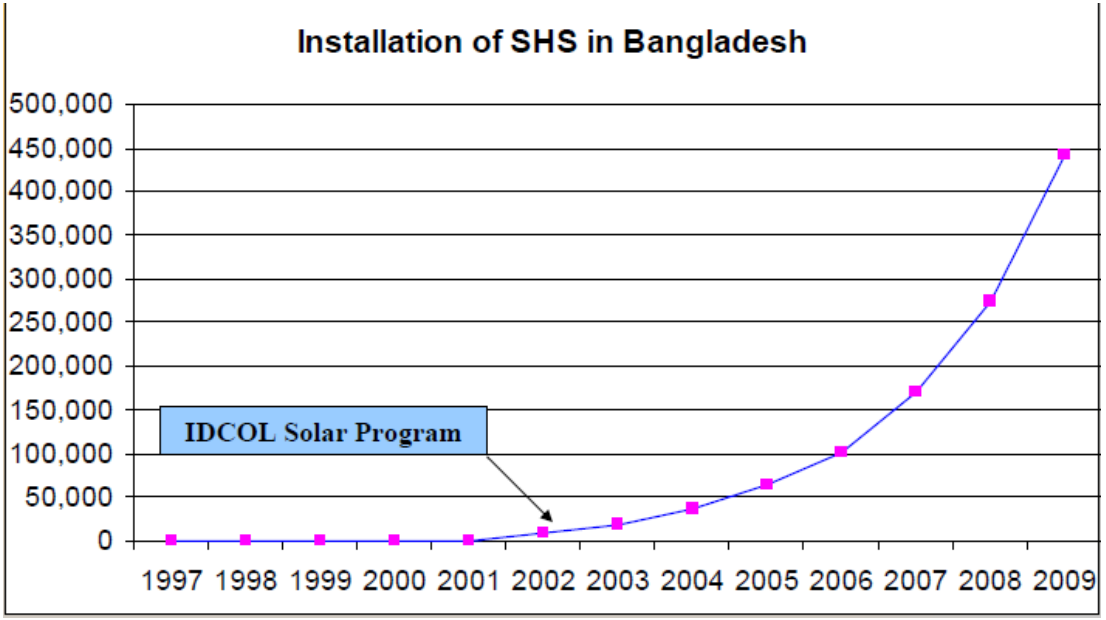


ARE SMART GRIDS FOR BOP THE SAME AS FOR DEVELOPED COUNTRIES?

Smart Grid for BoP

- Large Population Not Covered by Power Grid
  - Ex) Percentages of households with electricity power supply in Bangladesh in 2008 (Ref. JETRO report, 2011)
    - Average 41%, Urban Area 76%, Rural Area 28%
    - Enhancement of the power grid has been stopped because of the demand-supply gap expansion
  - Applications requiring electricity have different priorities, and acceptable energy costs are different
    - Mobile phone > Lighting > TV, Radio> ..
- Other Social Infrastructures Also Poor
  - Infrastructures for Communications, Transportation, Water
  - Integrated design of the infrastructures suitable for BoP?
    - Ex) Infrastructure for power grid and transportation using electric vehicles
- Application Oriented Power Grid
  - Power sources suitable for applications
  - Power grids suitable for applications
  - Internetworking of power grids for applications rather than general power grid

Installation of Solar Home System in Bangladesh



Female Workers Producing SHS Control Panels

SHS Installed House

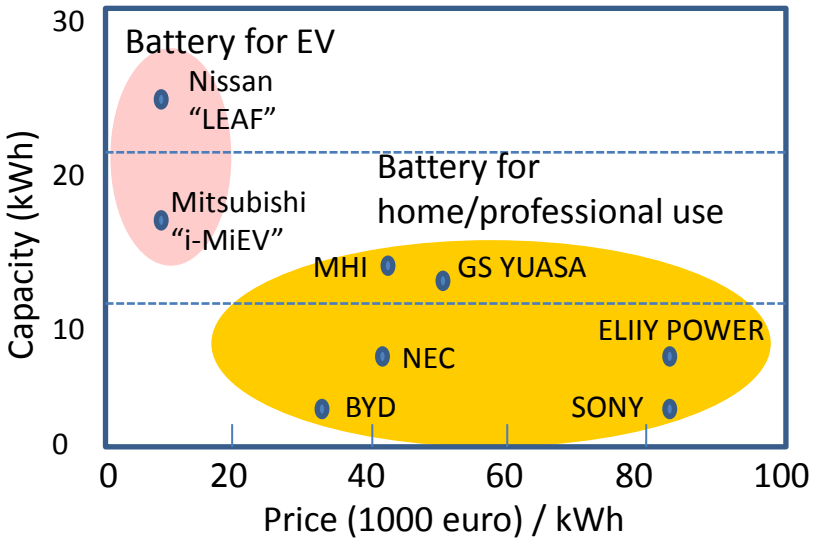
- 50 Wp SHS costs $440.
- A commercial-scale rooftop system could be reduced to $1.20 per Wp by 2020 from $2.90 per Wp ub 2012. (McKinsey estimation)
- This will accelerate the SHS installation in BoP.

Ref. IDCOL, “IDCOL Solar Energy Program,” March 201.

Batteries for EV: Useful for Power Grid using Renewable Energy in Developed Countries

- Cheap: Battery storing 30kWh for one household will cost less than 30,000 euro in 2020
- Large Capacity: Tens of kWh
  - Short term (min. to tens of min.) fluctuation of 100 kW solar batteries can be absorbed by 25 kWh battery of one EV
- Large Output: Tens of kW
  - Long term (hours) fluctuation of power generation by 4 kW solar battery for one to two households can be absorbed by 25kWh battery of one EV
    - 30% of surplus power generated by 4kW solar battery can be stored in 10kWh battery.

- Ref.: Electricity Consumption by Typical Family
  - 295kWh / month
  - 30kWh / day
  - Maximum power consumption: 5kW



Ref.: Automotive Technology 2011.11, p46

Summary

- Reduction of Energy Consumption by Developing Countries Key to Global Energy Efficiency
- R&D efforts including long-term R&D are required to enable developing countries
  - To use energy efficiently for industrialization and urbanization
  - To generate electric power efficiently for its application
  - To improve the agricultural productivity and the living standards at rural areas
- Developed countries would obtain enormous business opportunities by such R&D efforts