End user attitudes towards microCHP

Centre for Renewable Energy Sources

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OVERVIEW

1. Current status
2. Roadmap for microCHP usage
3. End user profiles
4. Highlights-Japan
5. Conclusions

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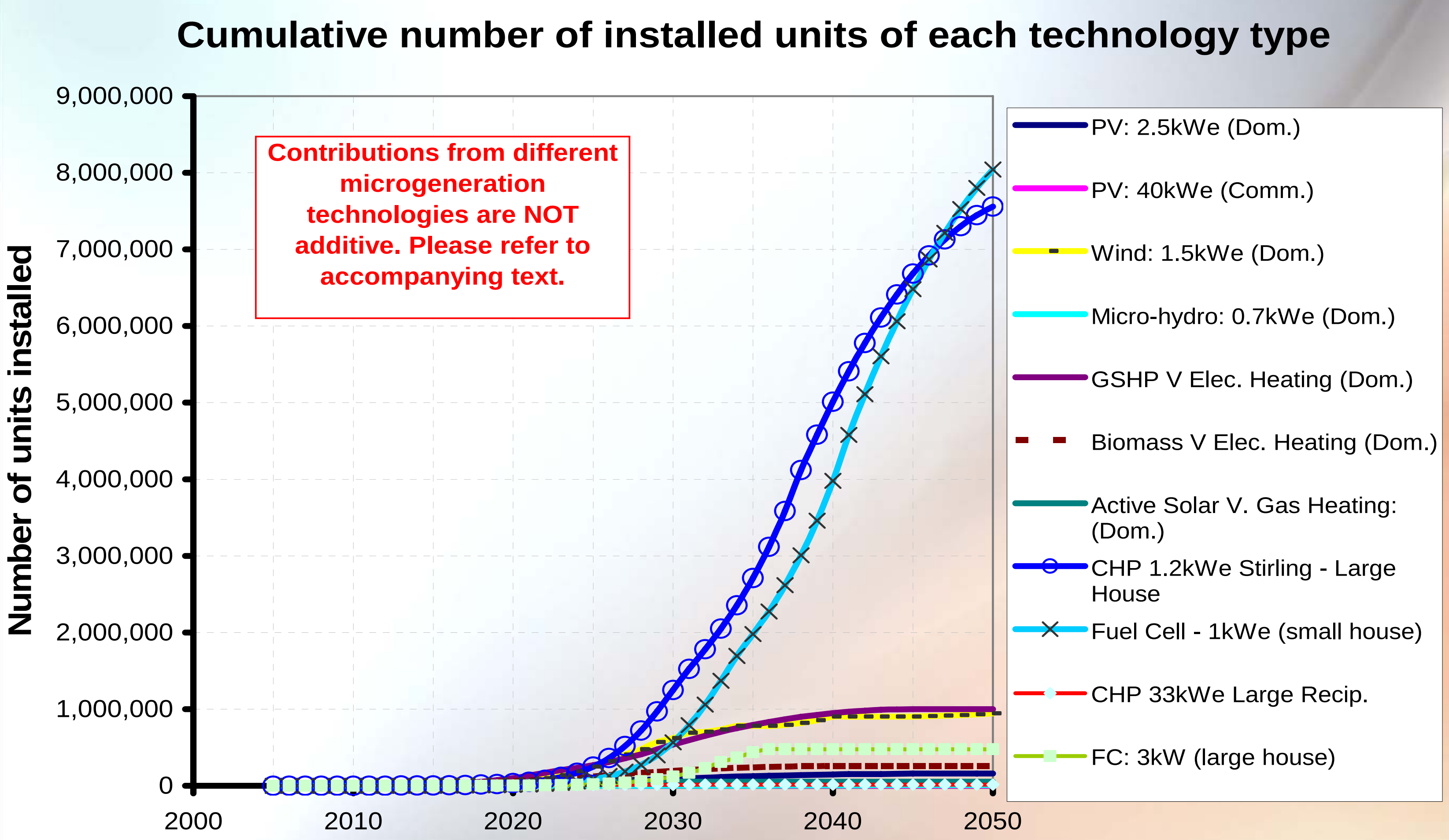
microCHP : still on the introduction phase



Source: energy saving trust ™

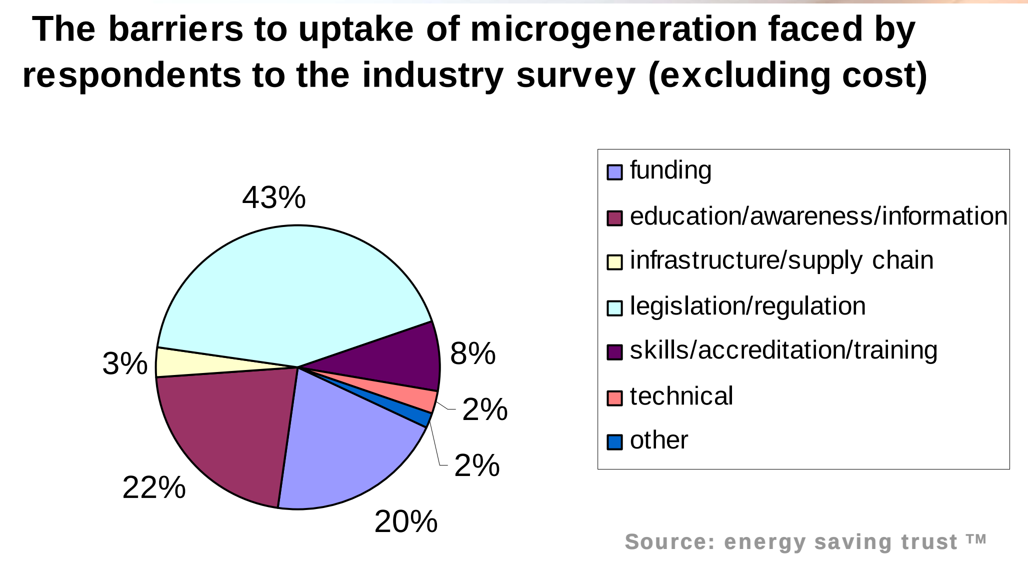
microCHP : still on the introduction phase

Barriers

High cost: relation with grant schemes & subsidies / however such mechanisms cannot be treated and planned as long term ones

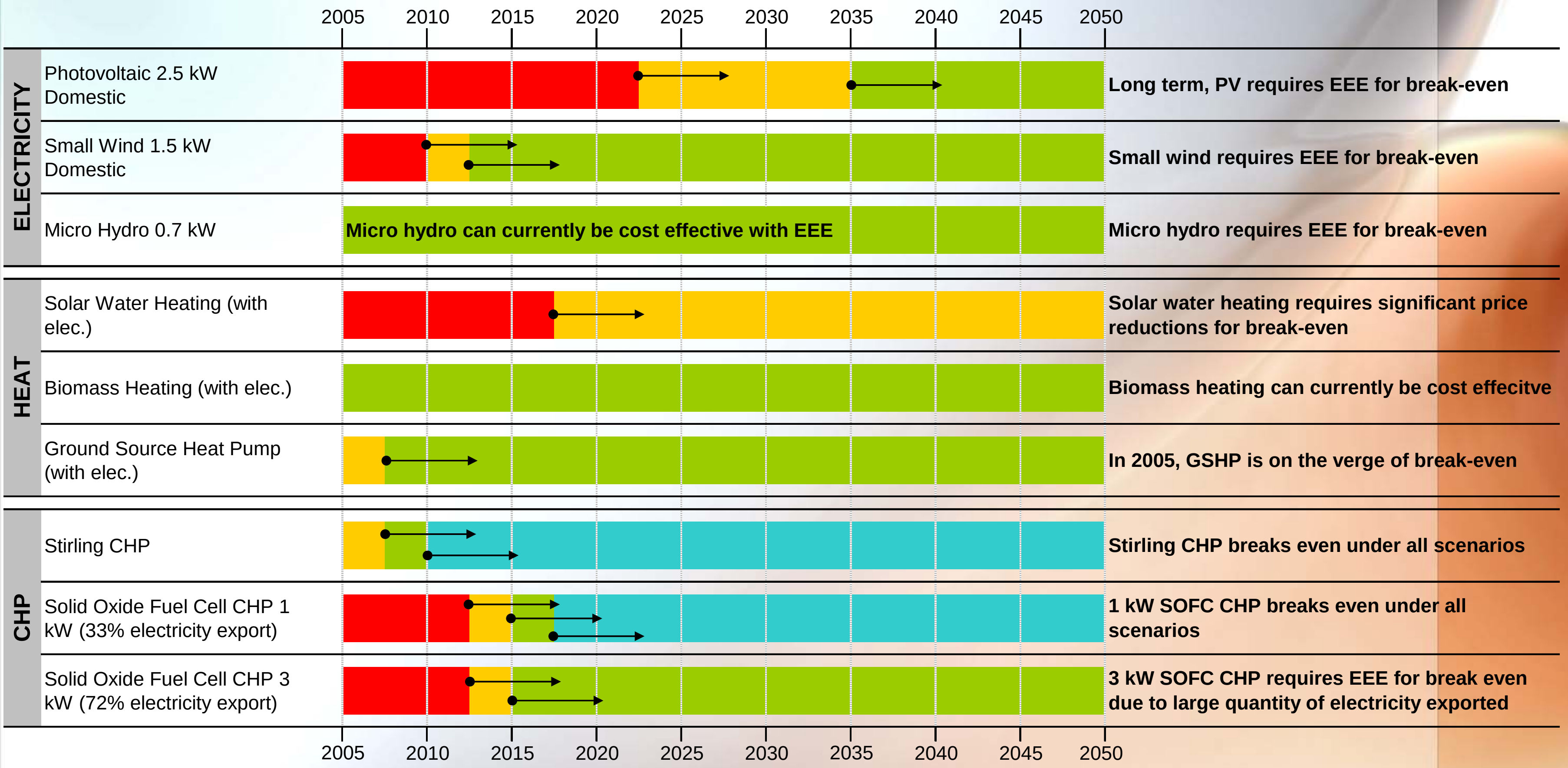
Legislation: problems with planning, price of exported electricity, lack of long term incentives for renewable heat

Awareness: need for information programmes, training, advisory bodies



Typically the two main technological targets remain:
system cost of 300-400€/kW and 40k operation hours

microCHP : break – even projection



Key **Scenario** (EEE: Energy Export Equivalence - Placing a higher value on microgen electricity exported to the grid)

- Not cost effective
- Earliest break even (with EEE for elec. technologies)
- Median break even (with EEE for elec. technologies)
- Median break even (with no EEE for elec. technologies)

Source: energy saving trust ™

microCHP : technologies of the future

Fuel cell CHP : commercialisation depends on maintenance cost, lifetime, overall cost (production & installation), market uptake around 2015.

after cost effectiveness is reached this technology could be the dominant microgen system

Stirling engine : market uptake around 2010, after cost effectiveness another 10 years until mass installation of such systems

Different dwellings
(**size, location, climate, building type, new vs retrofit**, etc)
stimulates/promotes different technologies as
the best solution

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Roadmap for microCHP usage

Several studies have been performed towards market assessment and microCHP market uptake

Conclusions:

- Integration and implementation of microCHP systems at end user sites through pilot programmes / national plans
- Investment on a diverse but targeted portfolio of R&D projects
- Facilitation & Establishment of technology transfer partnerships (cost shared R&D projects, pilot projects)
- Optimisation of systems focusing on performance stability, reliability, endurance, installation cost

Roadmap for microCHP usage

Conclusions:

- Need to speed up the industry capability to scale up production capacity
- Existence of prompt and competent service and maintenance
- Mandatory procurement rules and capital grants
- Internalise all other costs and secondary benefits of the microCHP systems at the Price of exported electricity (resulting to a higher price of sold electricity to the grid)
- Information and awareness campaigns towards end users, utilities, constructors, engineers
- Regional / national energy priorities (energy efficiency, environmental emissions), policy interventions, adaptive fiscal measures

Roadmap for microCHP usage

- Climate
- New vs retrofit
- Location
- Premium power
- Building type
- End user profile

Defining markets

Developing Technology

roadmap

Accelerating Acceptance

- Energy storage
- Cooling / Trigeneration
- Controls
- Smart metering
- Integration
- Lifetime span
- Maintenance

- Pilot programs
- Targeted campaigns
- Mixed schemes (manufactures & utilities: ESCO's)
- Measurable benchmarks / milestones
- Standards
- Reviewing of exported electricity price / internalisation of costs

Roadmap for microCHP usage

Targets:

- **Cost effective**
  (5 year simple payback, cost of <400€/kW)
- **Flexible**
  (tailored systems, control on thermal & electrical output, smart metering, monitoring consumption)
- **Reliable**
  (reliable and stable heat or cooling and electric power)
- **Efficient**
  (standards)
- **Transparent**
  (emissions, noise, footprint)

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Categories of Consumer / End User Profiles

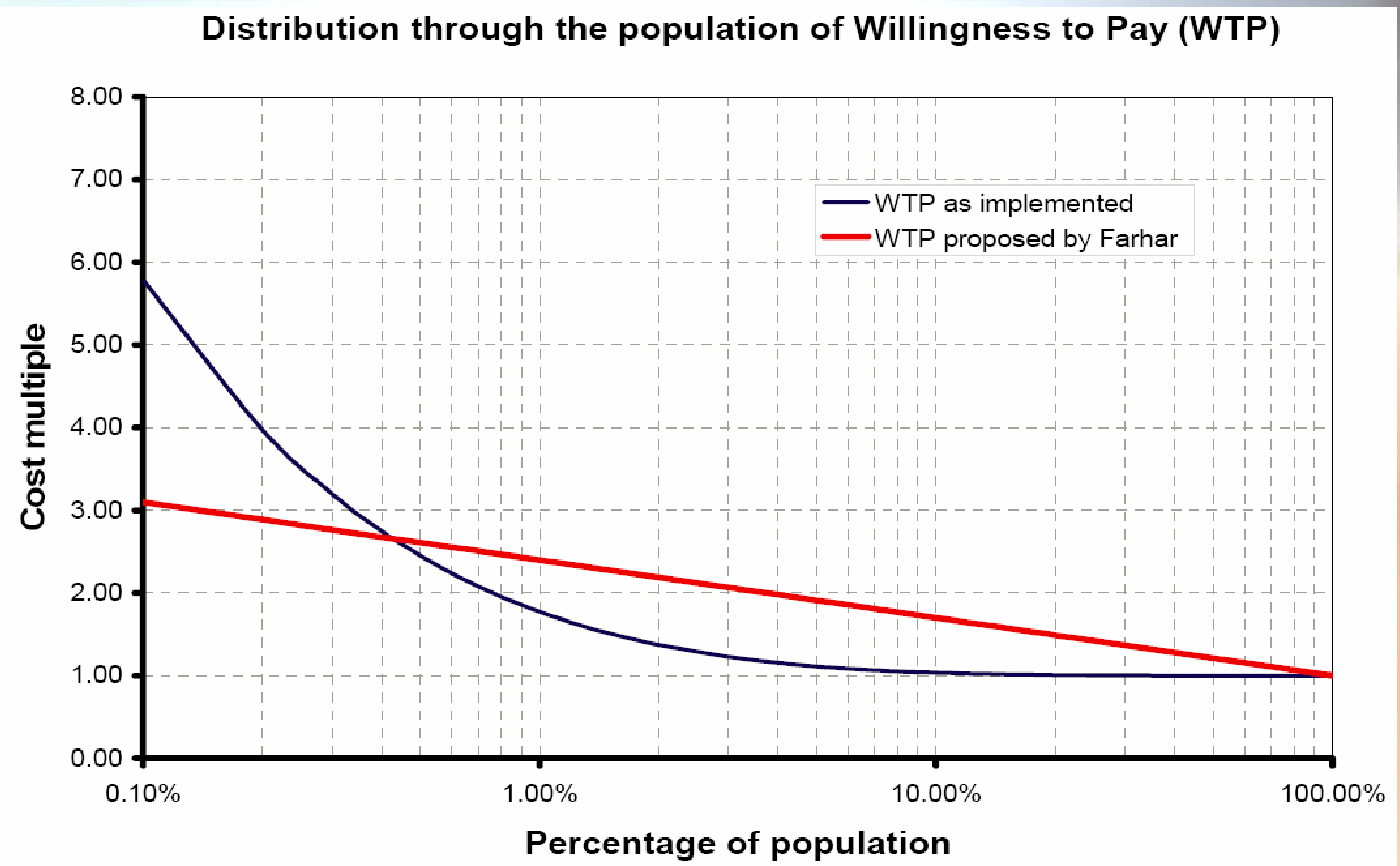
- average/base consumer: investment at CM(PO)=1 and 8% interest rate over the life of the equipment

- reluctant consumer: investment at CM(PO)=0.8

- highly sceptical consumer: investment at CM(PO)=0.8 and loan length=5 years

- deep green consumer: investment at CM(PO)=1.1

Categories of Consumer / End User Profiles



Source: energy saving trust ™

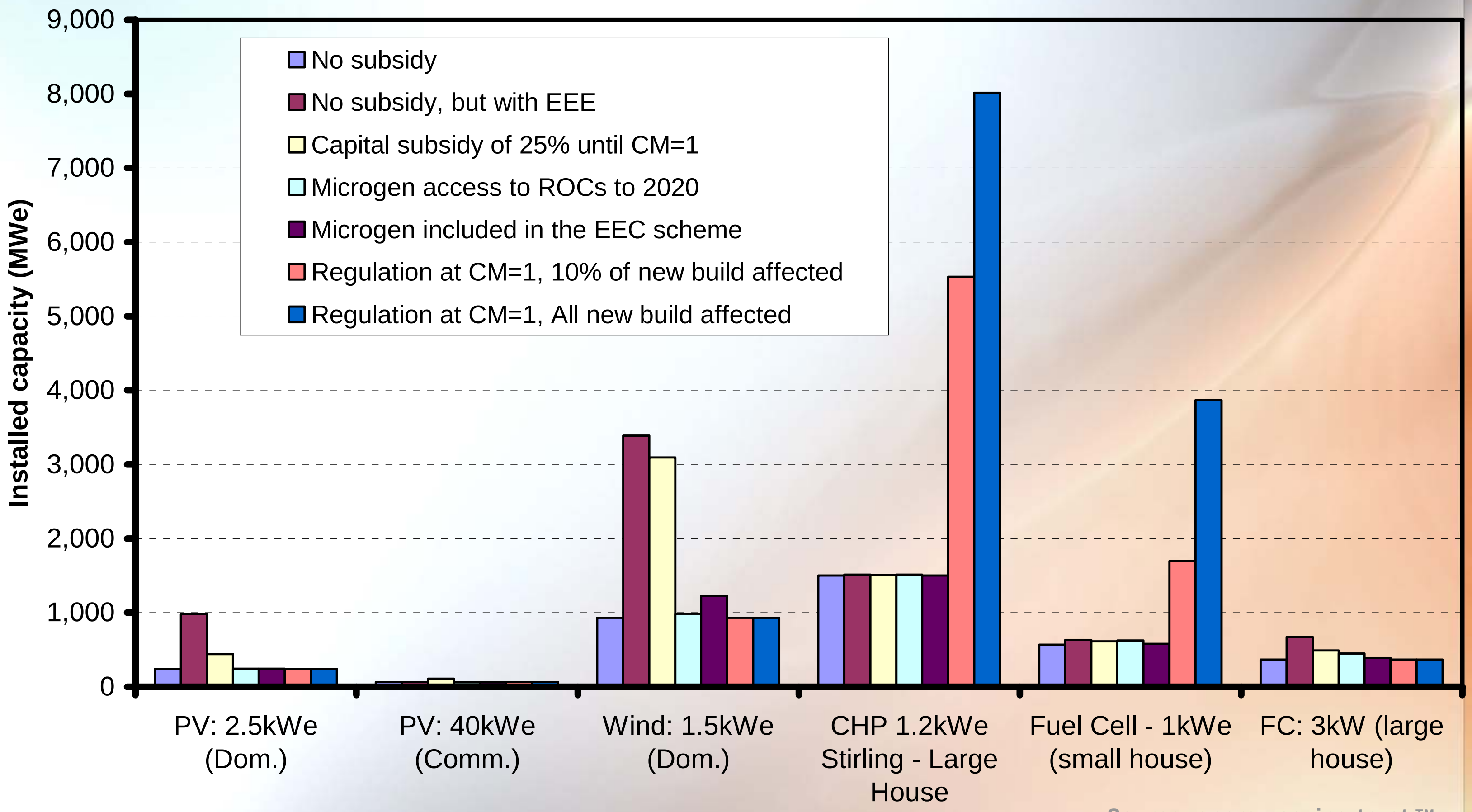
Categories of Consumer / End User Profiles

Key points

- The average consumer seems unbundled from environmental benefits and investments to profit (extreme behaviours)
- Cost effectiveness of the technology does not justifies direct investment on the technology (other issues such as reliability, familiarity are key elements)
- Capital threshold for investment per household
- Investment and Deployment at the consumers sites of microgeneration systems relates with level of education, publicity and national policies (link with environmental awareness and participation of the utilities)
- Regulatory measures should be examined in all cases

Categories of Consumer / End User Profiles

Cumulative installed electrical capacity for each microgeneration technology under a variety of subsidy schemes (in 2030).



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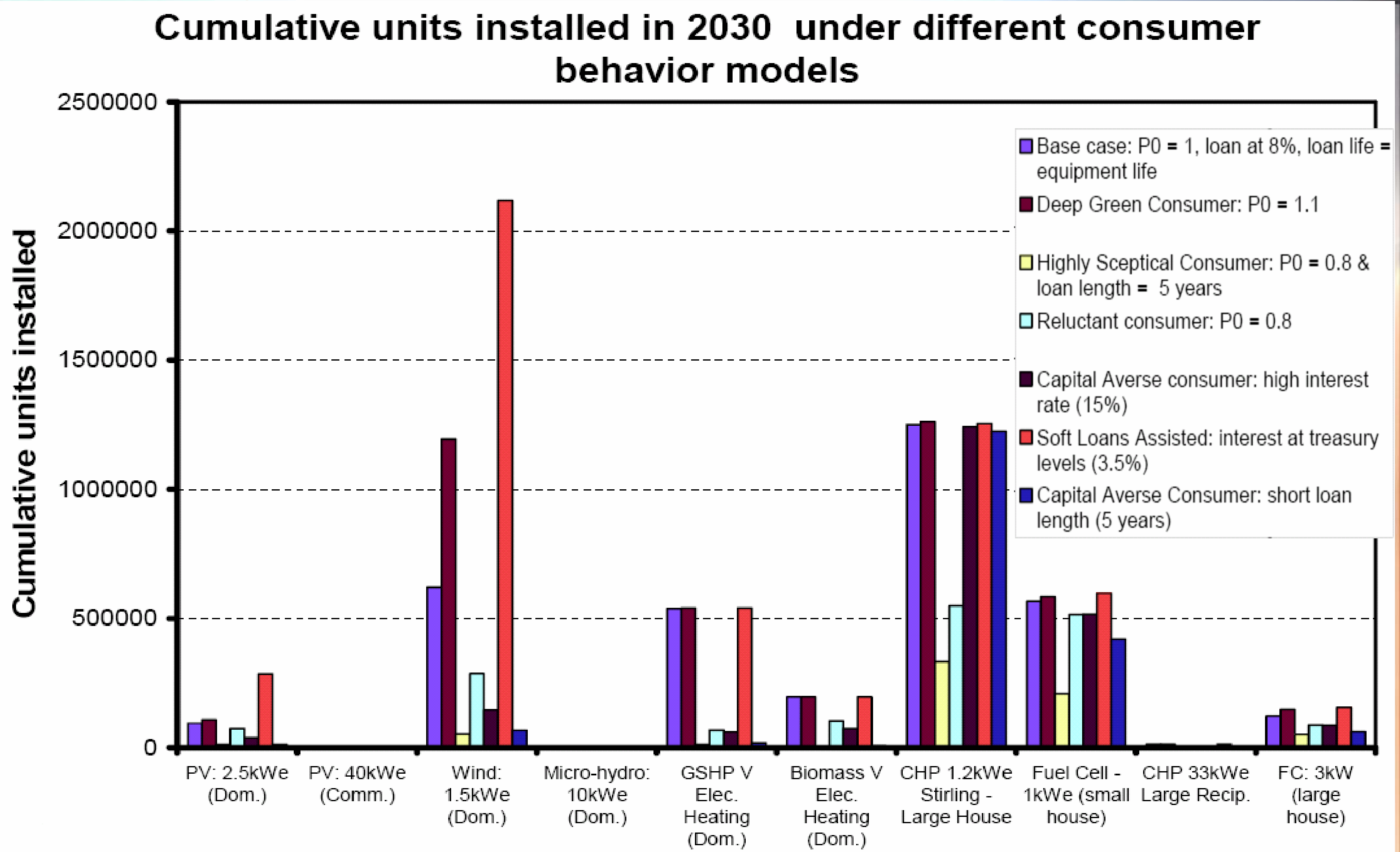

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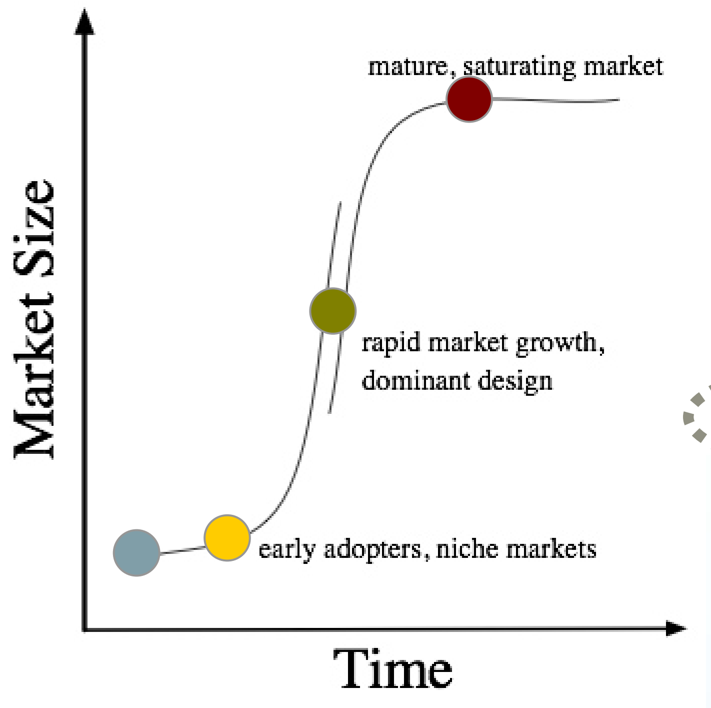
Categories of Consumer / End User Profiles

End –user role / dimension

- Technology acceptance
- Technology handling
- Technology induced behavioural change
- Technology independent user behaviour

- Introduction phase
- Marketed directly to the end user

Categories of Consumer / End User Profiles



The adoption of technologies follows an S-shaped curve

Introduction phase → pioneers

Early growth phase → early adopters

Take off phase → average consumer

Maturity phase → mass market penetration, followed by market saturation

Categories of Consumer / End User Profiles

Introduction phase → pioneers

- Property ownership:
  home owners, end-user direct control over house technologies
- Property location:
  semi-urban and rural, grid connection issues, level of interactivity
- Socio-demographic characteristics:
  high household incomes, high education level, big families, 'high' social status, scientific / technological background, environment sensitiveness, male population

references on analogous cases

Categories of Consumer / End User Profiles

Introduction phase → pioneers

Motives

- autonomy:
  partial independence from the grid, security of supply, independence from utilities, self-control
- Interest in the new technology:
  see themselves as pioneers, admiration of novel technological achievements, followers of cutting-edge technology (fuel cells)
- Desire to promote:
  give positive example , advertise socially themselves through technology promotion
- Help environment:
  emission reduction, abandon fossil fuels & nuclear energy, efficiency gains
- Economic benefit:
  reduce energy cost, cost effectiveness in the long run

Pioneers' satisfaction

- Feedback on performance
- Functionality of the system
- Reliable information
- Administration of support schemes

references on analogous cases

Categories of Consumer / End User Profiles

Introduction phase → **pioneers**

Early growth phase → early adopters

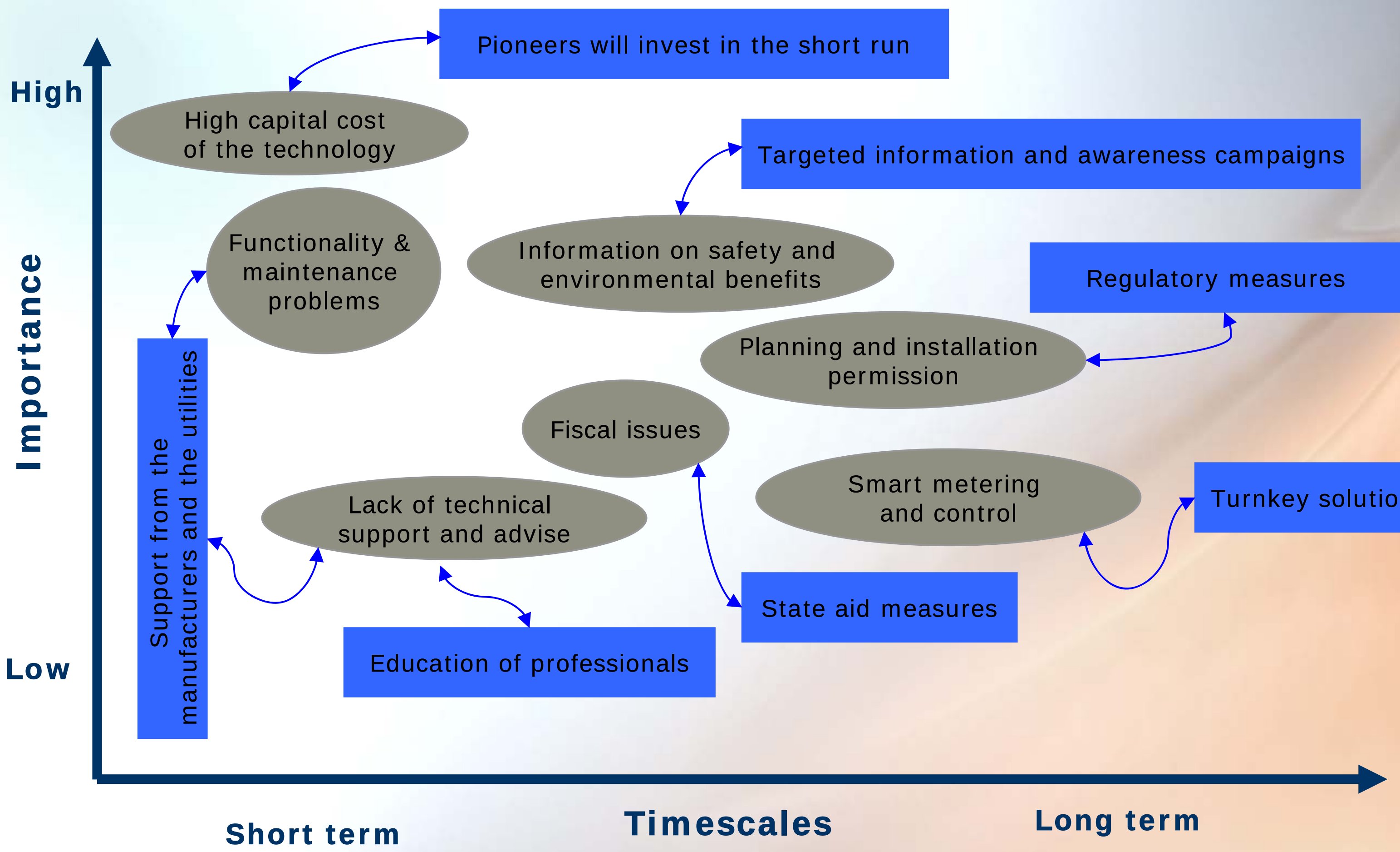
- Knowing the pioneers
- Design political programmes for the pioneers (awareness raising, substantial education)
- Develop support schemes/ mechanisms for the pioneers
- Information on safety, economic performance, reliability, green footprint
- Not raise false expectations
- Ensure functionality
- Identify both ‘blind spots’ and ‘windows of opportunity’

Broad diffusion depends highly on **economical** (cost effectiveness, capital cost, price of exported electricity)
&
technological (infrastructure space, connectivity to the grid, noise, visibility) barriers

Supplementary measures:

Enforcement of **regulatory** mechanisms to enforce consumer behaviour

Categories of Consumer / End User Profiles



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Japan : a 'sunny' example

	1999 actual result	2010 base case	2010 new policy case	2010: 1999 (approx.)
Clean energy vehicle	65000 units	890000 units	3,48 million units	53.5:1
Natural gas cogeneration	1520 MW	3440MW	4640MW	3.1:1
Fuel cell	12MW	40MW	2200MW	183:1

Source: new energy subcommittee, advisory committee for resources and energy

Japan : current situation

As of the end of March 2004, a total of 69 on-site PAFC systems with a combined power output of 11.6 MW had been introduced in Japan.

Reliability, which was a problem in the past, has improved to a practically acceptable level. The numerical target for the introduction of fuel cells by FY 2010 has been set to 2,200 MW.

The problem with fuel cells at the moment is their relatively high cost, which ranges from 400,000 to 700,000 yen/kW (from 3,333 to 5,833 USD/kW). When this comes down to the 250,000 yen/kW (2,083 USD/kW) mark as a result of mass production, fuel cells will become competitive against commercial power generation. In this regard, great hopes are pinned on early demand creation in the public sector.

Source: new energy foundation

Japan : strategy

	2005	2006	2007
Number of units	400	1000	5000
Max. subsidy (mYen/unit)	6	3	2
Cost target (mYen/unit)	4 to 7		<0.8

Objectives:

- FC systems from 700W to 1kWe output
- min 30% electric efficiency & min 65% overall efficiency
- min 27% electric efficiency & min 54% overall efficiency at 50% load operation over 2 year life

Japan : path to success

Objectives:

- Deployment of the programme with companies from both the manufacturers and the utilities
- Obligation to the companies to perform not only field tests but also pre-agreed targeted research (different fuels including kerosene)
- Companies will either lease for free their units or will charge a rent fee (on average 450€/y)
- Following the pattern of the solar roof programme that performed to a 75% fall of the average total system cost

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Conclusions

- Market & Technology readiness then address to the end-users
- Combination of market-based and regulatory instruments
- Educate end-users / increase environmental & energy saving awareness
- Aggregate end users for microCHP development and implementation
- Mobilise ESCO's towards microCHP and develop a variety of energy services agreements (lease schemes)
- Need for reliable turnkey systems
- Transparent & fair formula of payment for end-users

Thank you for your attention