



# IEA DSM Task 17

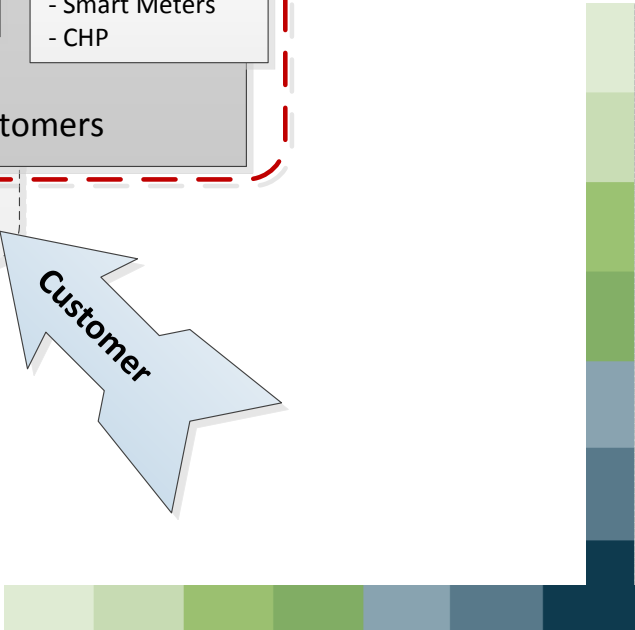
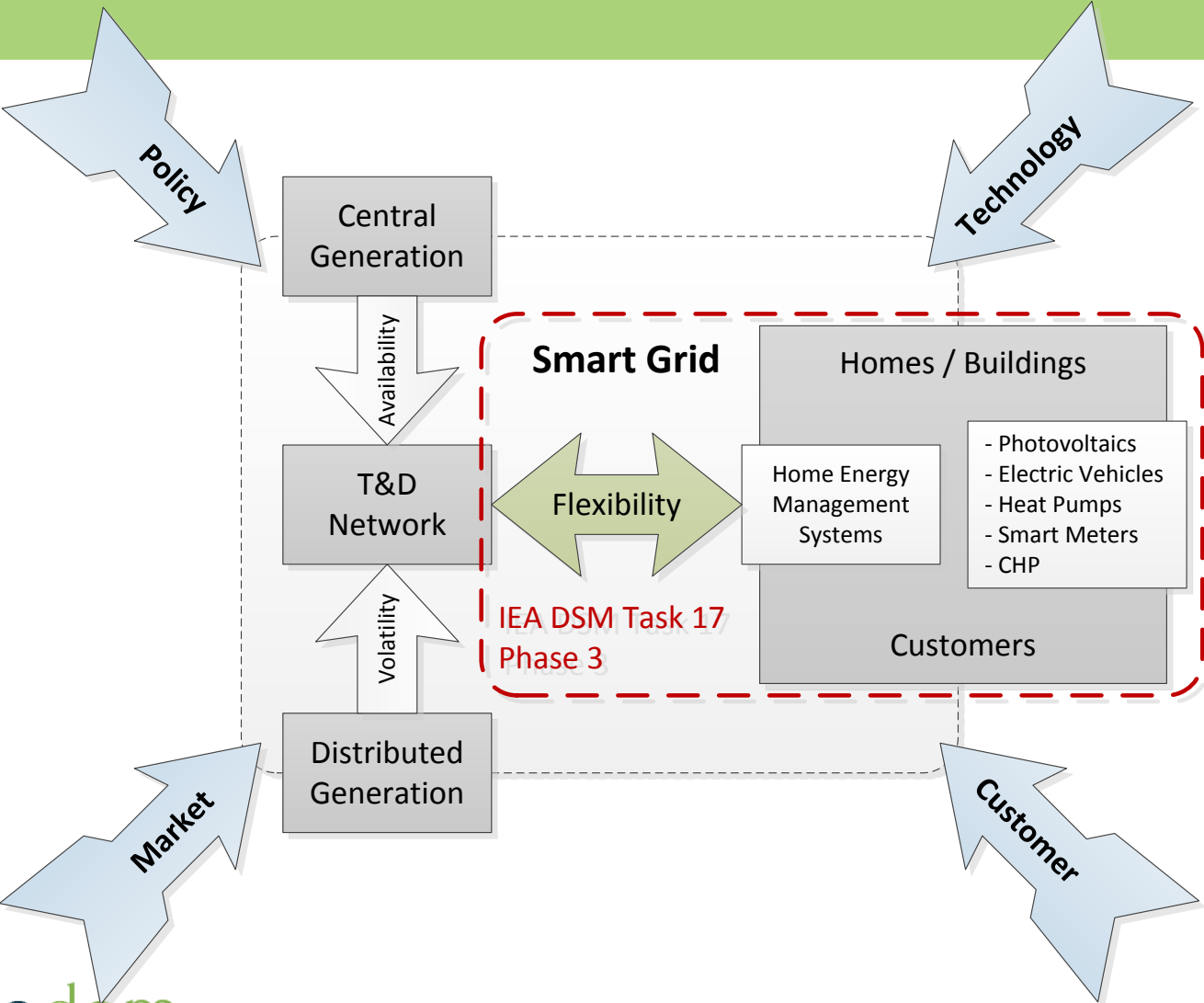
## Status ExCo Meeting Stockholm

*Matthias Stifter, AIT*

*René Kamphuis, TNO*



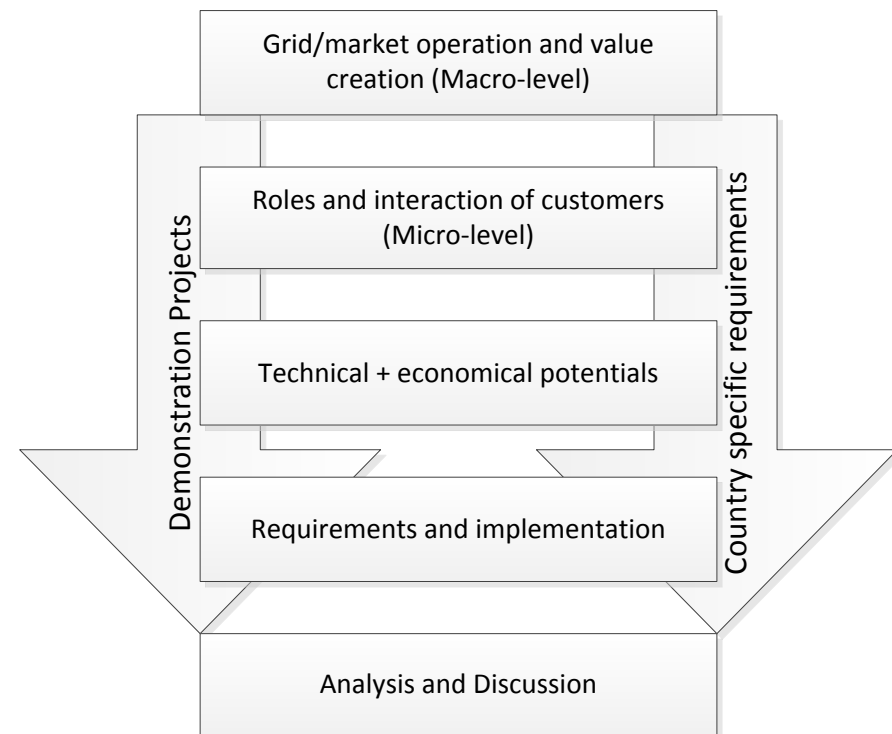
# Overview: Systems view on enabling the Smart Grid



# Progress Subtask 10 - Role and potentials of flexible consumers

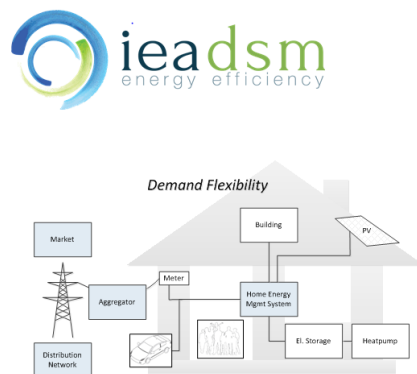
## Approach

- Requirements for processes from the **micro** and **macro perspective**. The macro perspective includes power distribution and commercial operation.
- An important aspect of this is the virtual **aggregation** and **service provisioning**.
- Analysis of **demo projects**
- **Country** and **regional** specific differences



# Subtasks

- Subtask 10 - Role and potentials of flexible consumers
- Subtask 11 – Impact on Grid and Markets
- Subtask 12 - Sharing experiences / finding best practices
- Subtask 13 – Conclusions and Recommendations



## IEA DSM Task 17

*Roles and Potentials of  
Flexible Consumers and Prosumers  
Distributed Demand Response in Households and Buildings*

*Matthias Stifter, René Kamphuis, Matthias Galus, Marijn Renting, Arnoud  
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Brodén, Niclas Ehn, Tara Esterl, Stephen Galsworthy*



# *Progress of Subtasks*







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## *Progress of Subtasks*

Overview of Progress:

<b>Task 17.3 Progress</b>	
Subtask 10	 90%
Subtask 11	 50%
Subtask 12	 80%
Subtask 13	 50%



## *Progress Subtask 10 - Role and potentials of flexible consumers*

### **Objectives**

- Assess the concepts and implementations of customer and home energy management systems (CEMS/HEMS), possibly linked to the smart meter, in different (participating) countries

### **Deliverable**

- Roles, Potentials and Interactions of Flexible Consumers and Prosumers

### **Progress:**

- Discussion of consolidation of final comments at the expert meeting

### **Timeplan:**

- Inputs from Experts and update from OAs within 3 weeks and final review until mid April

# Progress Subtask 10 - Role and potentials of flexible consumers

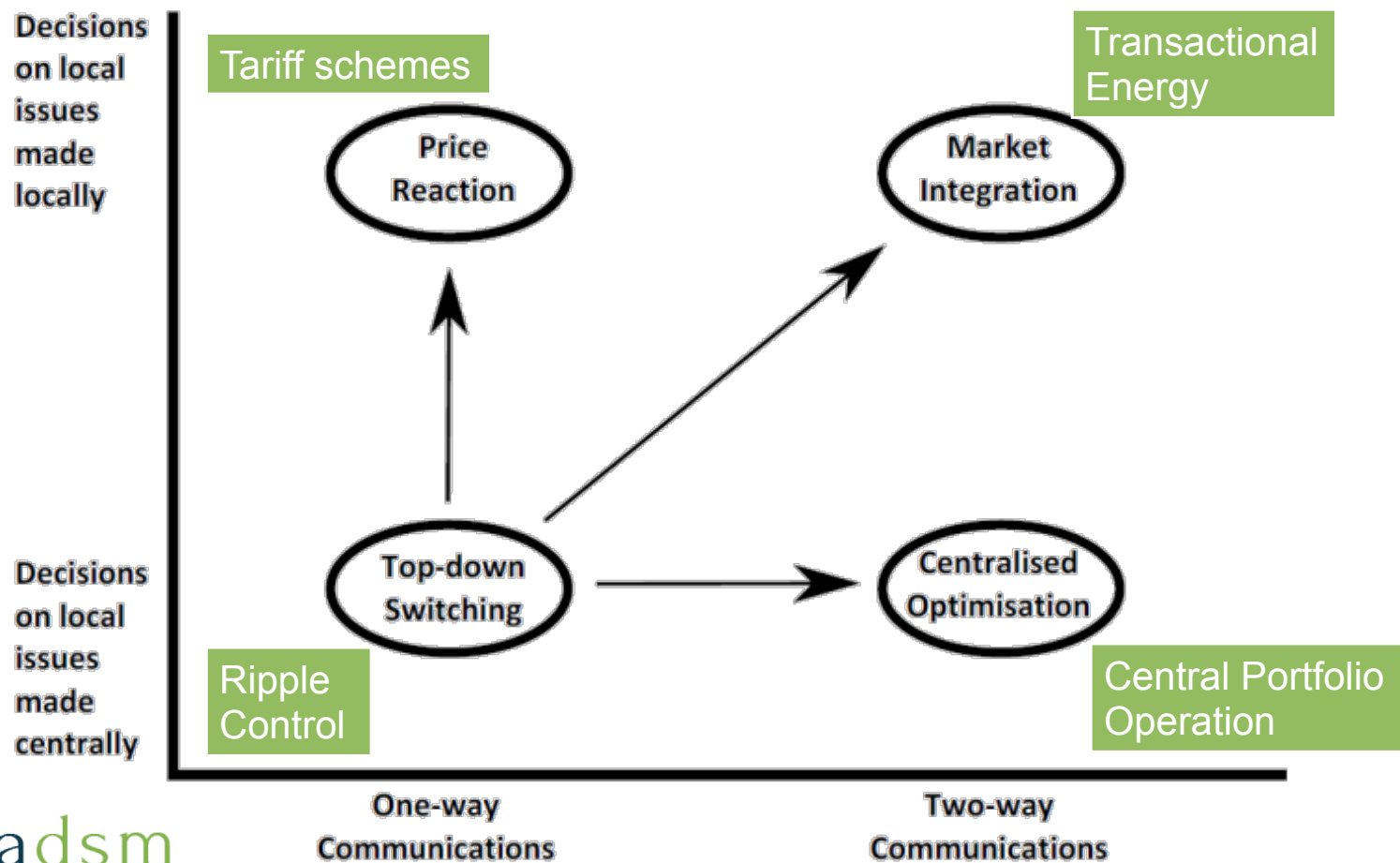
## Structure

- + 1 Introduction
  - + 1.1 Background
  - + 1.2 Motivation to Engage Flexible Resources
  - + 1.3 Policy Influences
  - + 1.4 Document Structure
- + 2 Residential DR in a Modern Grid
  - + 2.1 Existing and New Roles in System Operation
  - + 2.2 DR-related Actors
  - + 2.3 Application of DR in the Electric System
- + 3 Assessing models of Residential DR Resources
  - + 3.1 General Characteristics of DR Resources
  - + 3.2 Specific DR Equipment Capabilities<sup>[RK44]</sup>
- + 4 Assessing Potential Capacity of Residential DR
  - + 4.1 DR Potential Capacity Categories
  - + 4.2 General DR Potential
  - + 4.3 DR Potential in Households
- + 5 Implementing Residential DR
  - + 5.1 ICT Enabling DR Automation and Integration
  - + 5.2 Consumer Participation and Automation
  - + 5.3 Aggregated Behavior of DR Resources
  - + 5.4 Evaluation, Measurement, and Verification
  - + 5.5 Challenges to Implementation

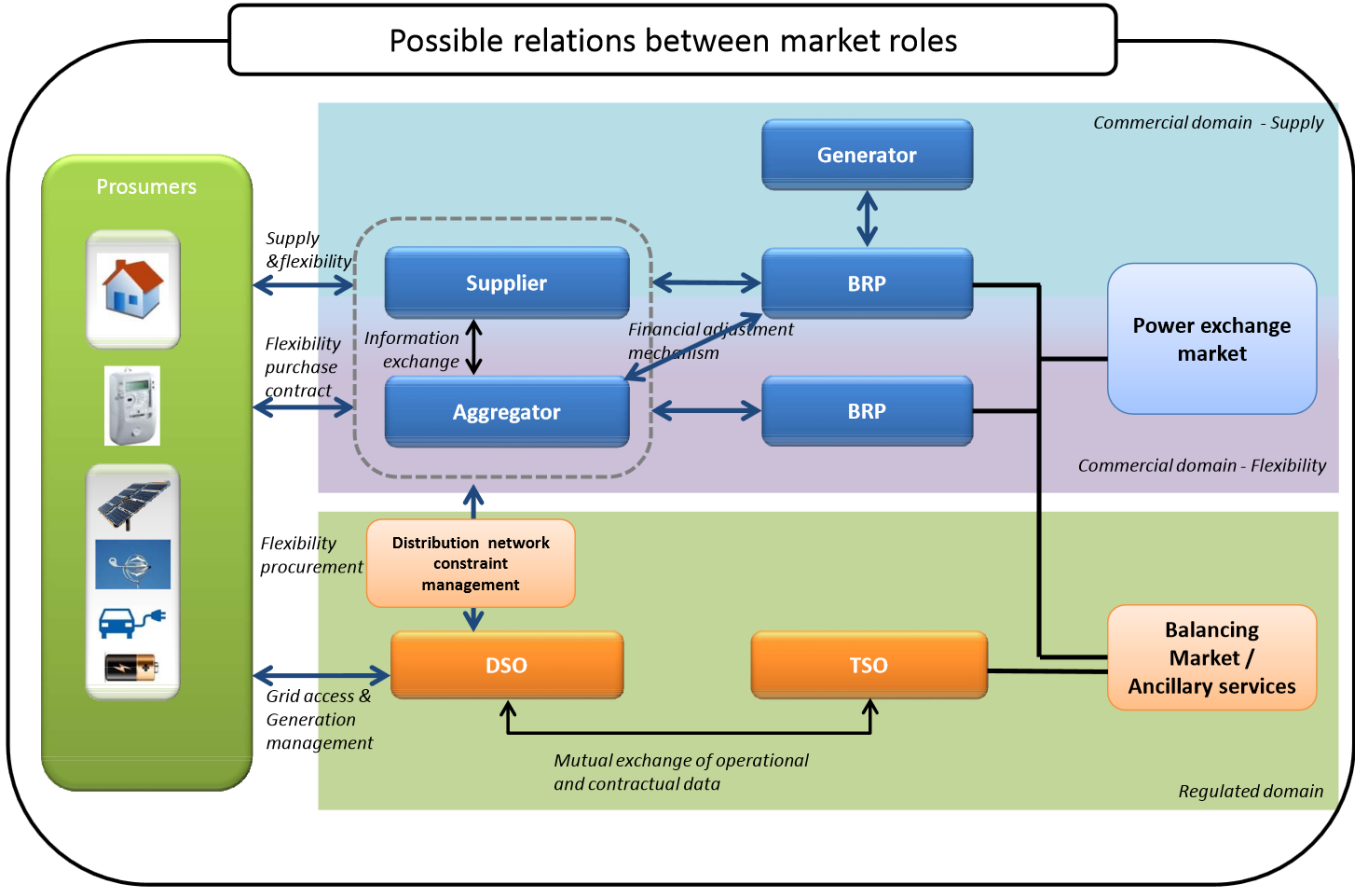


## Subtask 11 Evolution of residential DR

- Evolution of ICT Architecture for enabling Flexibility



# Subtask 11 - Changes and impacts on grid and market operation



SG EG 3 – Regulatory Recommendations for the Deployment of Flexibility

# Progress Subtask 11 - Changes and impacts on grid and market operation

## Objectives

- Assess the impact on grid and market operation based on technology penetration scenarios developed in subtask 5 and 9 (developed in phase 2).

## Deliverable

- Financial and maturity assessment of technologies for aggregating DG-RES, DR and electricity storage systems
- → *Valuation analysis of residential demand side flexibility*

## Progress:

- Discussion on content, structure and contributions at the expert meeting

## Timeplan:

- OA (AIT) prepares revised draft within 2 weeks
- Inputs from Experts with 6 weeks from now
- Next iteration End of April

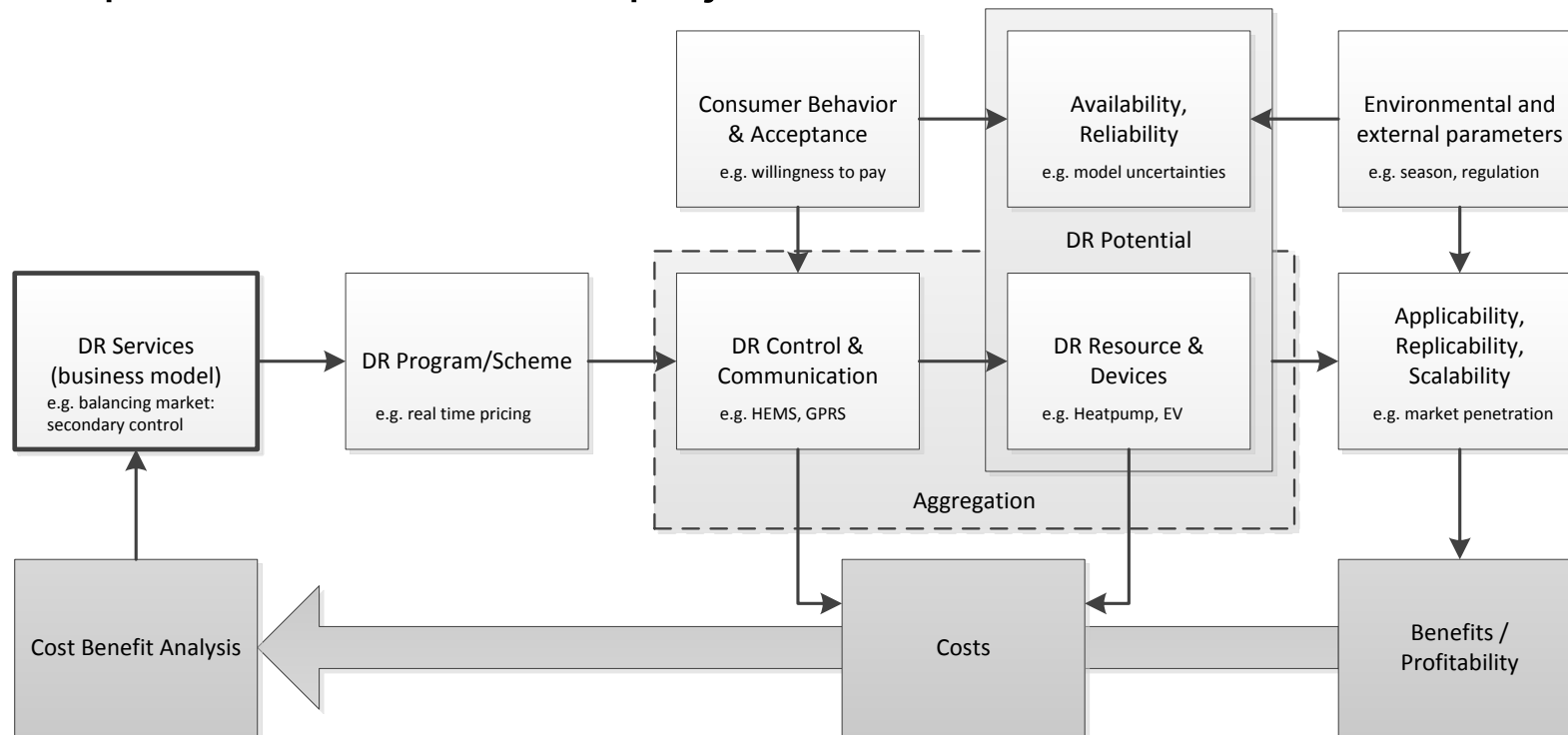
# Progress Subtask 11 - Role and potentials of flexible consumers

## Structure

- + 1 Introduction
  - + 1.1 Background
- + 2 Value creation for flexibility <sup>[ET14]</sup> in electricity systems
  - + 2.1 Overview about business cases for flexibility and needed dynamics
  - 2.2 Value <sup>[ET23][ET24]</sup> creation for society
  - + 2.3 Value creation in the electricity market
  - + 2.4 Value creation for the transmission system
  - + 2.5 Value <sup>[ET29]</sup> creation for the distribution system
  - 2.6 Value creation for the customer
  - + 2.7 Mapping of the technologies to the business cases
- + 3 Examples (An integrated approach <sup>[SEW30]</sup> for the future <sup>[SM31][sam32][LN33][SM34][SM35][ET36]</sup>)
  - + 3.1 Country-specific examples
  - 3.2 Discuss similarities and differences
- + 4 Valuation analysis for demand side flexibility projects
  - + 4.1 Methodology for valuation of flexibility
  - + 4.2 Valuation of DR projects
  - + 4.3 Lessons learned from CBA projects
- + 5 Maturity assessment -> TRL
- + 6 References

# ST 11 Valuation Methodology

- Concept for valuation of DR projects



→ Input from CBA Analytical Framework (ST12)

# ST12 - Sharing experiences and best practices

- CBA Analytical Framework further developed
  - based on Masterthesis, EcoGrid EU experiences and JRC CBA framework
- Inputs:
  - HiT (AIT)
  - EcoGrid EU (AIT)
  - Power Matching City II (TNO)
  - Smart Grid Gotland (KTH)
  - U.S.
  - India DR pilot project

Analytical Framework for Cost Benefit Analysis		Answers
<b>DR Service / business model / objective</b>		
Market	Energy only: day ahead, intra-day, shifting	
	Balancing market: (primary, secondary, tertiary)	
	New market concept	
	Capacity market: long term market products	
Network	Balancing group / Reduce Imbalance cost	
	Network congestions	
Consumer	Network ancillary services (e.g. reactive power)	
	Peak shaving (import from network)	
	Self-optimization	
<b>DR Program/Scheme</b>		
Price signal	Type	
	Price base	
	Duration of one price step	
	Price validity	
	Price steps	
	Tariff basis: Height of tariffs / base for tariffs	
Direct	Priced spread - Height of tariffs	
<b>Communication and Control concept</b>		
Enabling Technology	direct control	
	Control and management (central / decentral)	
	Optimization	
	Signal	
	Data communication	
	Interoperability (vendor independent)	
<b>DR Resource and devices</b>		
Device	type of resource	
Parameters	power, duration, reduction, shifting, ramp, interval	
Potential	Load shifting potential	
	availability	
<b>Aggregation</b>		
Pooling	reliability	
<b>Customer Participation</b>		
Motivation	acceptance	
	participation	
	willingness to pay	
<b>Applicability</b>		
Realisation	regulatory and legislative framework	
	scalability, market penetration	
	replicability (region specifics)	
<b>Benefit</b>		
Quantitative	profitability	
Qualitative	comfort	
	additional service (monitoring)	
	environmental benefits	
<b>Costs</b>		
Single	Communication	
	Control	
	Devices (upgrade)	
Rollout	Scaling / Economies of scale	
	Aggregation	
	Adaption	

## *Progress Subtask 12 - Sharing experiences and finding best practices*

### **Objectives**

- Based on the collected **pilots** and **case studies** from the previous subtasks, the results and findings of the finished projects in term of **successful implementations**, **barriers** and **effectiveness** will be analyzed.

### **Deliverable**

- Best practices in applying aggregated DG-RES, DR and Storage for retail customers

### **Progress:**

- Important and representative projects have been collected from the expert's presentation and inputs.
- The selected pilot projects are taken for the analysis part of the deliverable from Subtask 10.
- Additional input from international workshops have been gathered and compiled for the document.

### **Timeplan:**

- Structure for ST12 document from OAs
- Draft ST12 within 3 weeks.



## *ST12 - Sharing experiences and best practices*

- DR Project List
- Expert presentations from workshops and country updates
  - Structure for document needed
- Methodology and Analytical Framework for Project Assessment
  - Masterthesis
- Extended CBA Analytical Framework  
Inputs so far:
  - HiT (AIT)
  - EcoGrid EU (AIT)
  - Power Matching City II (TNO)
  - Smart Grid Gotland (KTH)
  - ?





## *Progress Subtask 13 - Recommendations*

### **Objectives**

- Recommendations will arrived at in close interaction with the experts' opinions and will at least provide a ranking based on impacts, costs and likely future penetration of the technologies.

### **Deliverable**

- Final recommendations.
- Could be integrated into other deliverables

### **Timeplan**

- Derive recommendations after finalization of deliverables starts at end of April

## Progress Subtask 13 – Preliminary Recommendations

1. **Community creation supports user activation** as the sense of belonging to a community influences the engagement and participation
2. **Variable tariff models need to offer an added value** for an acceptable price to attract consumers
3. Based on the visualized electricity consumption data **consumers can be incentivized with premiums and other rewards** to participate in DR programs
4. **Data protection, privacy & security aspects need to be considered** when ICT infrastructures and systems are designed and participation agreements with consumers concluded
5. The institutional and regulatory transformation of the energy market requires the **introduction of new market players** that develop services attractive for consumers
6. **Detailed cost-benefit-analyses** are crucial for defining the added value of business models; financial advantages for consumers are quite low. Thus, aggregators respectively companies, who offer aggregation services, need to concentrate on key messages on a broader level in order to attract consumers
7. **Standardization and interoperability of technologies proved to be a basic condition** for interaction of technical appliances and enabling technologies.

# *Status, Outreach and Planning*



# Meetings and Seminars

## Meetings

Date	Place	# of Experts	Type of meeting	Government	Industry	Academic
09-02-2016	Webmeeting	8	Web	1	2	5
14/15-3-2016	Stockholm	12	Real	1	2	9

Date	Place	Participants	Type of meeting	Government	Industry	Academic
22/23-10-2015	Paris	15	Exchange meeting with IEA/DESIRE task	6	3	6
1.3.2016	Paris	35	IEA Smart Energy Systems Roadmap	20	10	5
12-02-2016	Graz	50	Conference	10%	50%	40%
16.03.2016	Trondheim	30	Webconference ECB Annex 67	-	-	-

# Meetings and Seminars

## Seminars

Date	Place	Participants	Type of meeting	Government	Industry	Academic
22/23-10-2015	Paris	15	Exchange meeting with IEA/DESIRE task	6	3	6
1.3.2016	Paris	35	IEA Smart Energy Systems Roadmap	20	10	5
12-02-2016	Graz	50	Conference	10%	50%	40%

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# Objectives for the upcoming months

## Reports

- **Subtask 10 - Role and potentials of flexible consumers**
  - Finalize Deliverable of Subtask 10: *Roles and Potentials of Flexible Consumers and Prosumers*
- **Subtask 11 - Changes and impacts on grid and market** Finalize Deliverable of Subtask 11: *Valuation analysis of residential demand side flexibility*
- **Subtask 12 - Sharing experiences and finding best practices**
  - Finalize Deliverable of Subtask 12: Update and Analyse projects.
- **Subtask 13 – Recommendations**
  - Finalize Deliverable of Subtask 13.

# Planned Meetings and Seminars

## Meetings

Date	Place
May 10 <sup>th</sup> 2016	Linz, Austria

## Seminars

Date	Place
May 9 <sup>th</sup> 2016	Linz workshop with other IEA-tasks parallel to Smart grids week

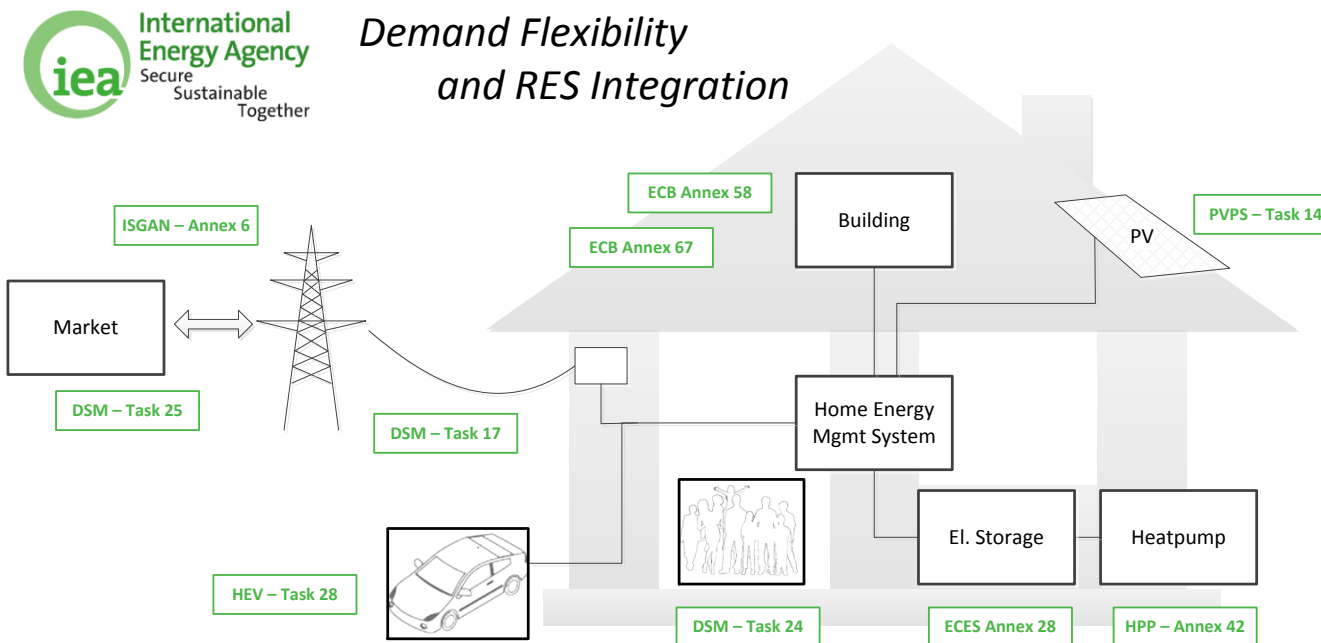


## Outreach

- Energy Innovation Conference at TU Graz:
  - Lessons Learned from European Pilot Projects – Recommendations on Market Access Requirements for Electricity Consumers
- Ongoing exchange with “contributing” countries
  - Contact with Australia, India, Finland
- ECB Annex 67 on Smart Buildings
  - Webconference / Exchange
- HPP Annex 42 on Smart Heatpumps –
  - Exchange
- IEA Workshop on Roadmap to Smart Energy Systems
  - Contribution on Steering Group?

# Symposium and Expert Meeting

- Workshop Linz May 9th 2016
  - IEA-DSM Flexibility symposium: <http://www.smartgridsweek.com/workshops.html>
- Program / IA commitments



# *Symposium Program - IEA Energy Experts Exchange*

- **Demand Response and Flexibility**

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IEA Demand Side Management – Task 17: Integration of Demand Side Management, Distributed Generation, Renewable Energy Sources and Energy Storages

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IEA DSM - Task 24 Closing the Loop: Behaviour Change in DSM – From Theory to Practice

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IEA DSM - Task 25 Business Models for a more effective market uptake of DSM energy services

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IEA HPP Heat Pump Program – Annex 42: Heat Pumps in Smart Grids

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IEA ECES Energy Conservation through Energy Storage – Annex 28: Distributed Energy Storage for the Integration of Renewable Energies<sup>2</sup> (DESIRE)

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IEA ECB Energy in Buildings and Communities - Annex 58 – Reliability and Energy Performance

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IEA ECB Energy in Buildings and Communities - Annex 67 – Energy Flexible Buildings

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ISGAN – Annex 6 Power T&D Systems

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IEA PVPS - Task 14 High Penetration of PV Systems in Electricity Grids

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IEA Hybrid & Electric Vehicle – Task 28: Home grids and V2X technologies

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# Participation

Country	Commitment
Austria	Y
Switzerland	Y
Swede	Y
Copper Alliance	Y
The Netherlands	Y
USA	Y
Italy	N
Belgium	N
Serbia	N
India	N
Germany	N
Finland	N
Australia	N

# Questions

<b>AIT Austrian Institute of Technology</b>	<b>TNO Netherlands organization for science and technology</b>
<b>Matthias Stifter</b>	<b>René Kamphuis</b>
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# *Backup*





## *Subtask 10 - Role and potentials of flexible consumers*

- **Controllability requirements** (generation and consumption)
- **Opportunities, challenges and barriers** for flexibility services (providers and technologies)
- Energy and power balancing **potentials**
- **Smart technologies** (SM and Customer Energy MS)
  - VPPs
  - EV charging
  - DG-RES integration and storage
  - Integrating heat pumps and thermal storages



## *Subtask 11 - Changing to new roles for actors*

- Methodology development for **assessing / quantifying impact**
- Grid, market and customers (prosumer/consumer)
- Sharing common benefits/losses
- **Optimization** potential (e.g. building management system)
- **Regulatory** and **legislative** requirements
- Cost Benefit Analysis for DR





## *Subtask 12 - Sharing experiences / finding best practices*

- **Collection of data**
  - Workshops, Reports
- **Lessons learned** from existing pilots
  - EcoGrid-EU Bornholm, PowerMatchingCity I and II, Linear, Greenlys, Building2Grid, SmartCityGrid: CoOpt, eEnergy, ...
- **Country specifics differences** in the implementation and applicability
- **Extrapolation of the results** from previously collected projects on **applicability**



## *Subtask 13 - Conclusions and recommendations*

- Based on the experts' opinion
- Will provide a **ranking recommendation** based on
  - Impacts
  - Costs
  - Future penetration of the technologies