



Chair of Sustainable Electric Networks and Sources of Energy



Smart Grid as Backbone of Smart City

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**Berlin High-level Dialogue on Implementing Rio+20 Decisions
on Sustainable Cities and Transport**

19 June 2013

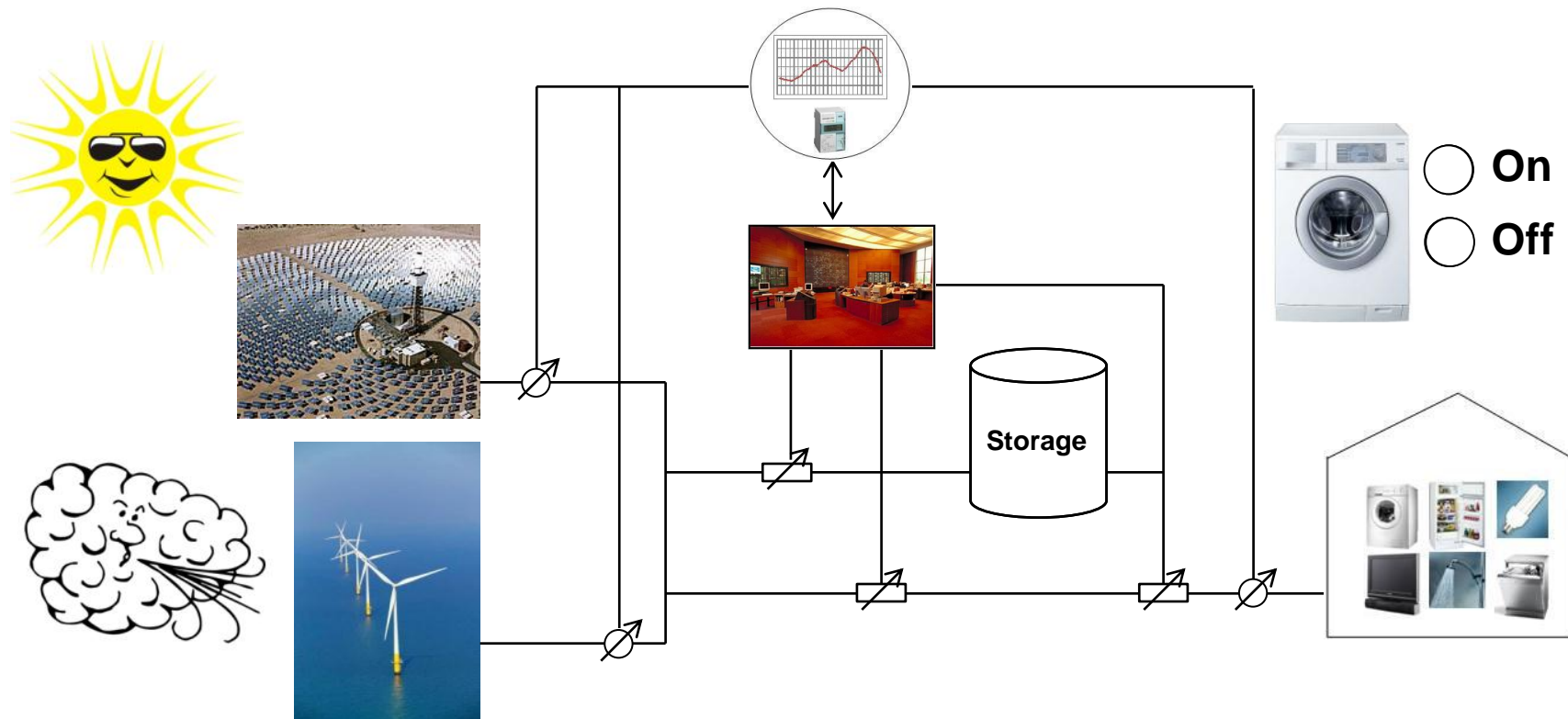


Overview

1. Introduction to Smart Grid
2. Modeling Smart Grid for Berlin 2037
3. Modeling Smart Grid for Emerging Cities
4. Wrap-up

1. Introduction to Smart Grid: Concept

- Increasing renewable power generation leads to change of paradigm
- From “Generation follows load” to “Load follows generation”
- Smart controls as enablers



1. Introduction to Smart Grid: Research Rank of TU Berlin School of Electrical and Computer Engineering

- The Centre for Higher Education (CHE) Development published the results of the research evaluation exercise for ECE Schools in 2008
- Indicators are funding, publications, inventions, and PhD graduates

University	Achieved top positions	Compared to 2004	Absolute				Relative			
			a	b	c	d	a	b	c	d
RWTH Aachen	6	++	•	•	•	•		•		•
TU Berlin	7	+	•	•	•	•	•	•	•	
TU Darmstadt	6	++	•	•		•	•	•		•
TU Dresden	6	++	•	•	•	•	•		•	
Uni Freiburg	5	+		•	•		•	•	•	
Uni Karlsruhe	6	++	•	•		•	•	•		•
TU München	6	++	•	•	•	•			•	•

a Third-party funds
b Publications
c Inventions
d Ph.D. graduates

2. Modeling Smart Grid for Berlin 2037: Co-operation Project

- Project title: Sustainable Urban Infrastructure – Intelligent Energy Supply for Berlin 2037
- Partners: TU Berlin, Siemens, Vattenfall

2. Modeling Smart Grid for Berlin 2037: Introduction

- The year 2037 is when Berlin celebrates its 800th birthday
- Scenarios were developed for that time
- Consideration of 6 different and complementary Berlin areas
- Determination of potential for improvement of energy efficiency and CO₂-reduction potential
- Extrapolation of results to Berlin-scale



2. Modeling Smart Grid for Berlin 2037:

Assumptions for East German System Around Berlin in 2037

Wind power

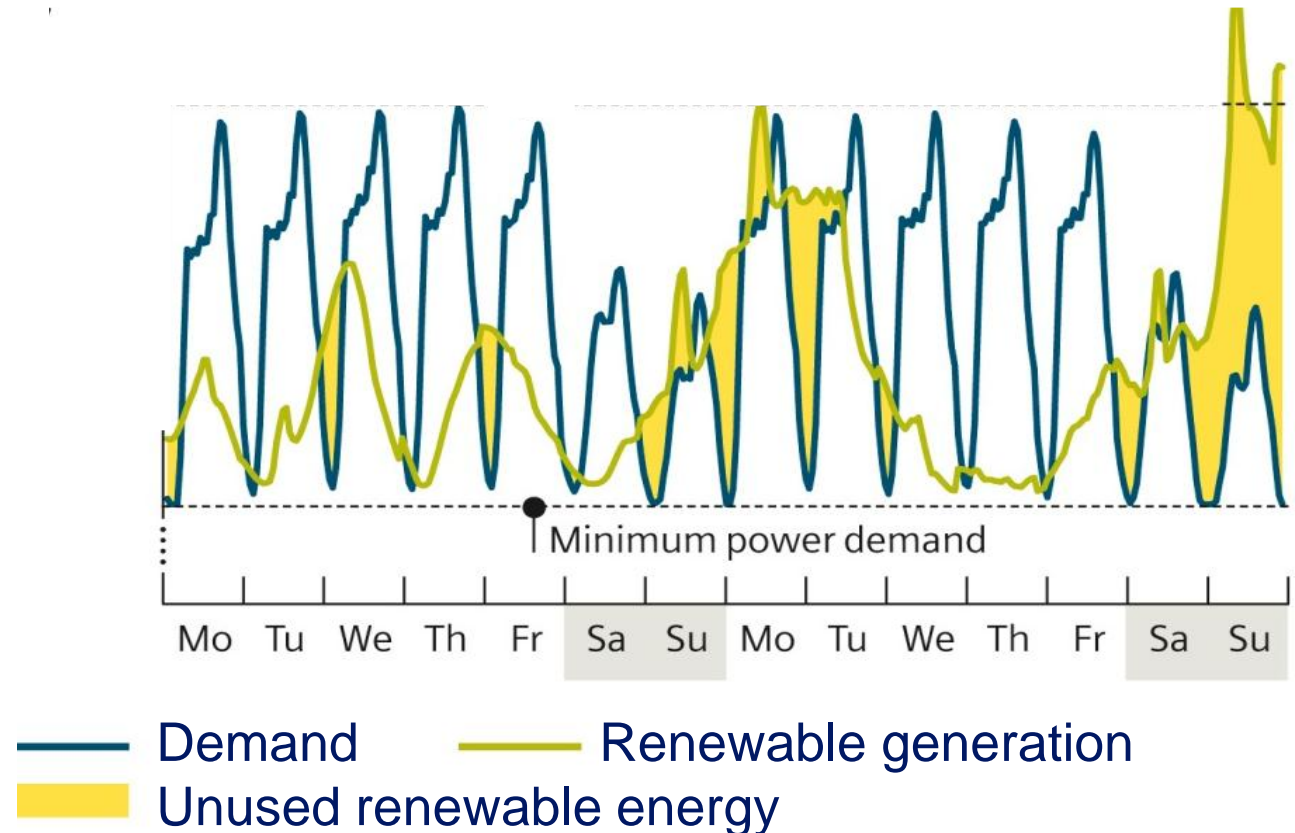
- 19 GWp installed capacity in Eastern zone

Photovoltaic power

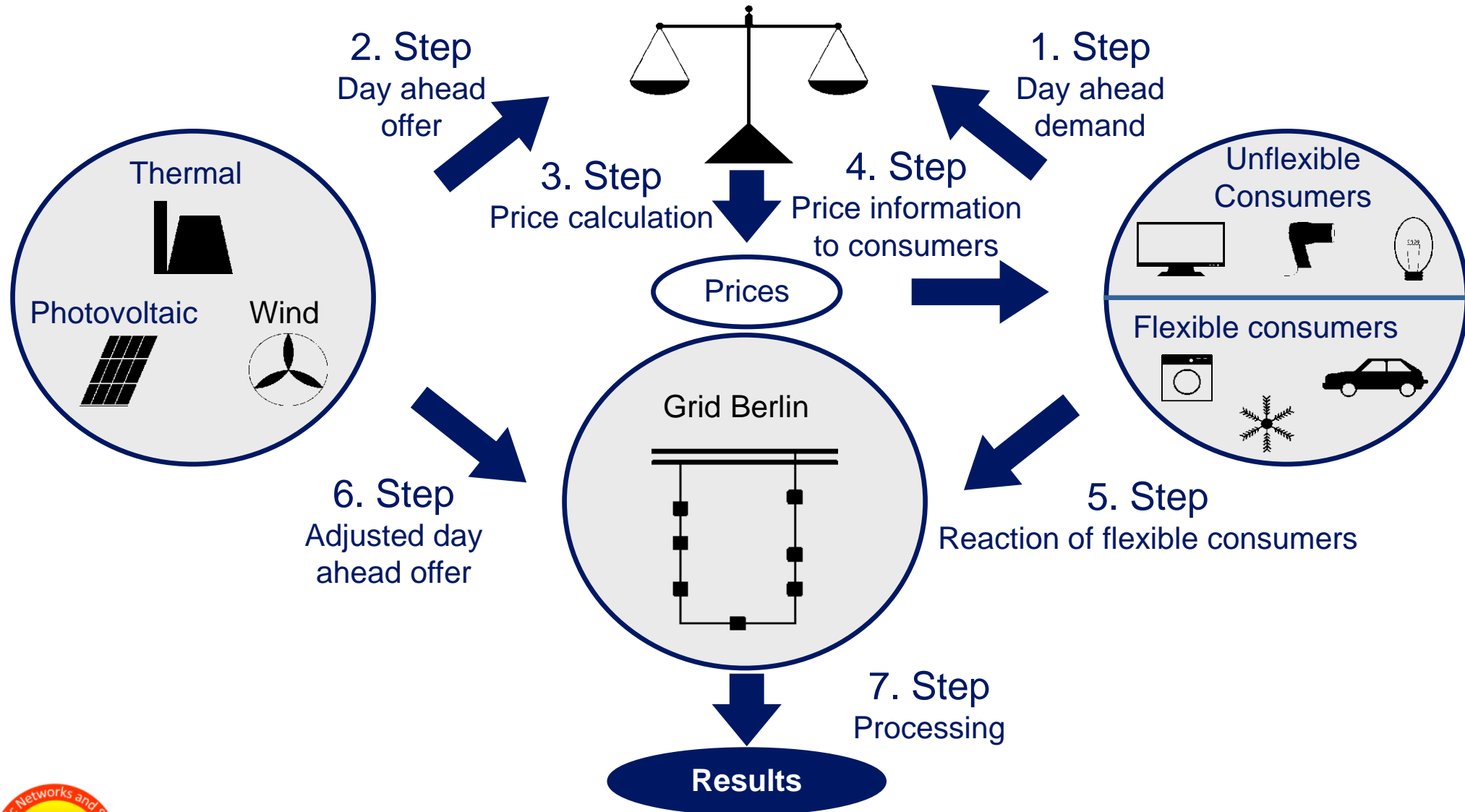
- 6 GWp installed capacity

Electrical demand

- -10% compared to 2009 – the high-efficiency-scenario

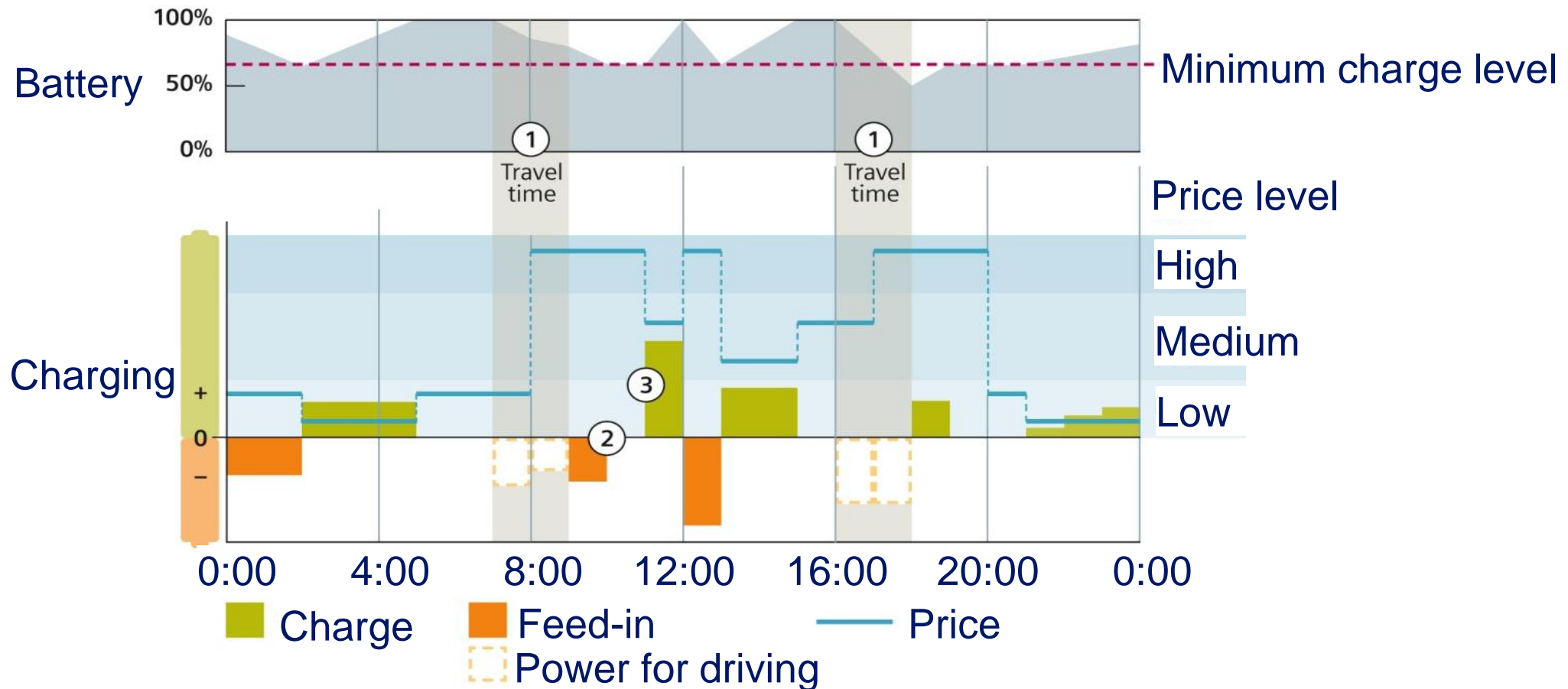


2. Modeling Smart Grid for Berlin 2037: Methodology: General Approach

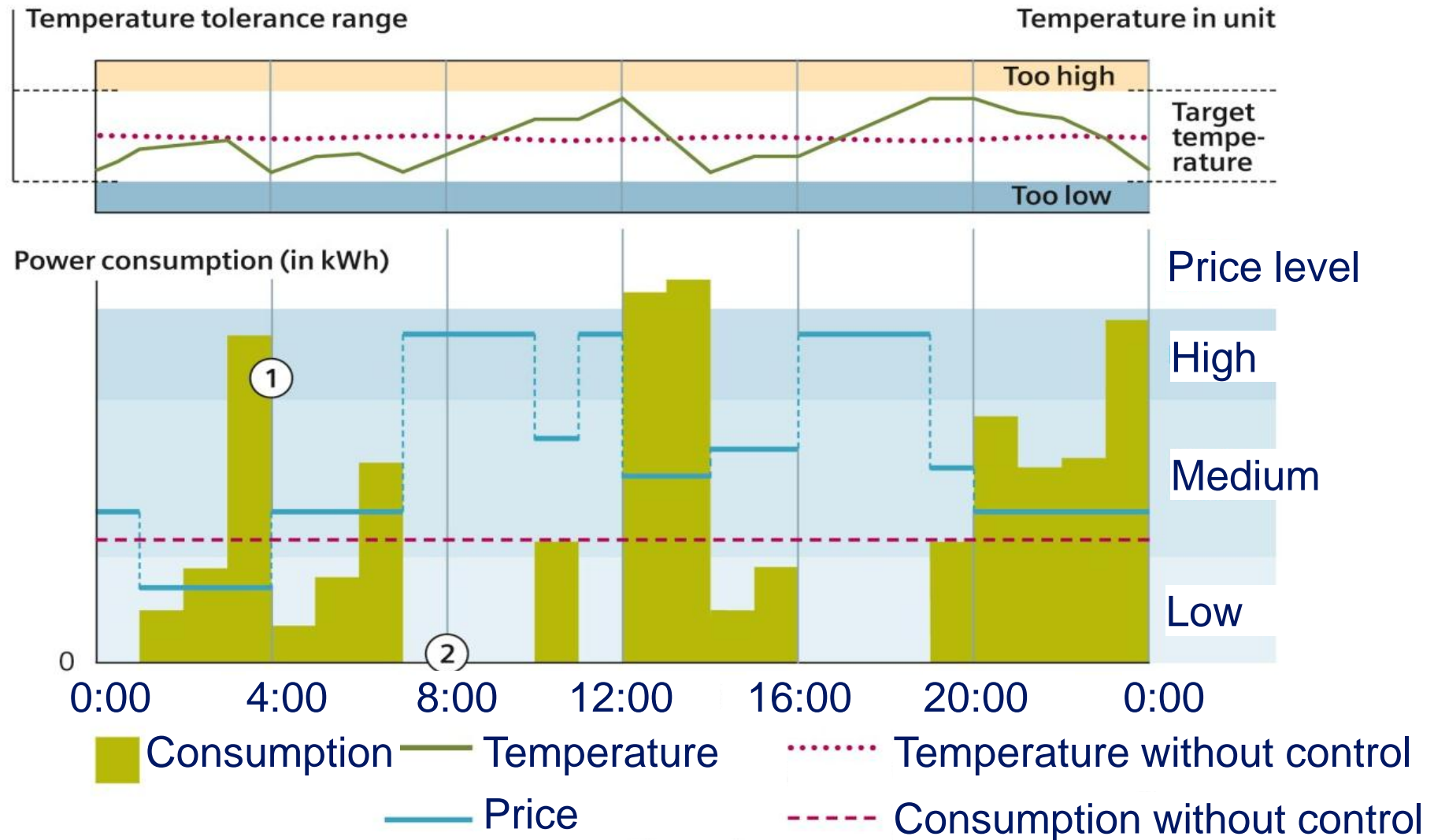


2. Modeling Smart Grid for Berlin 2037: Controlled Charging of Electric Vehicles

- Electric vehicle supplied predominantly by wind and solar power



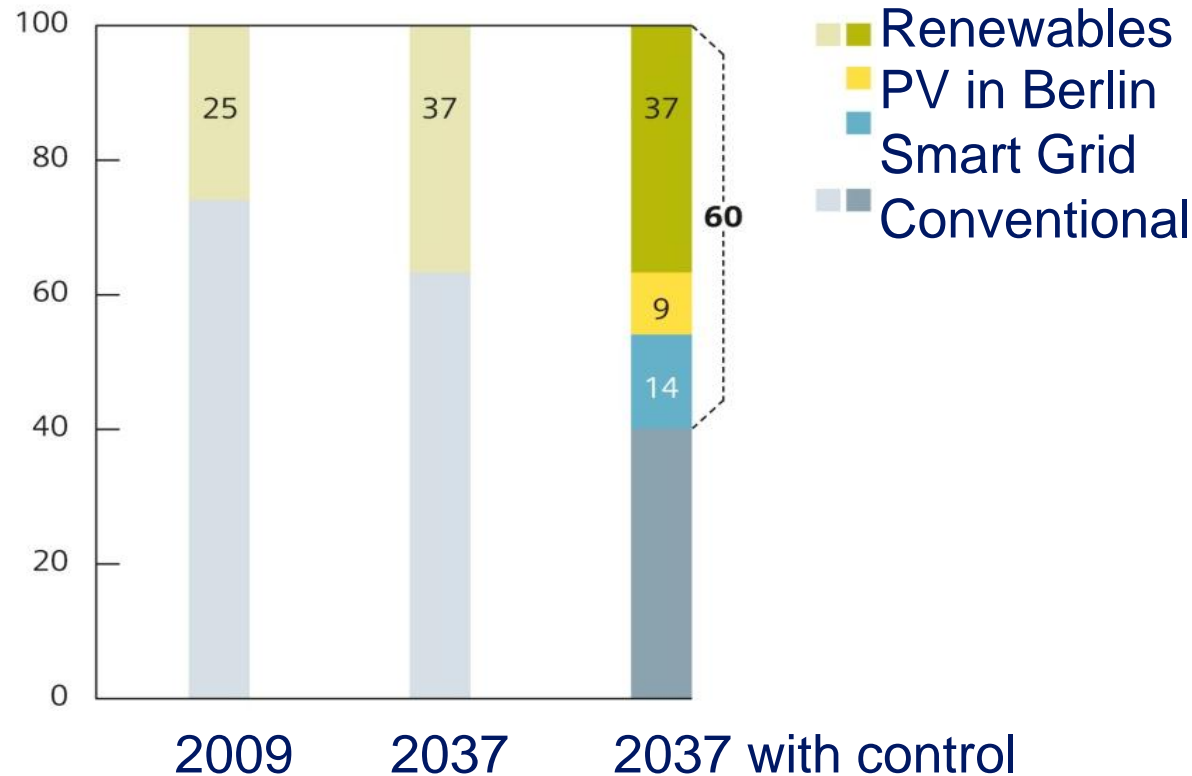
2. Modeling Smart Grid for Berlin 2037: Controlled Operation of Refrigerators



2. Modeling Smart Grid for Berlin 2037:

Impact

- Increase of CO2-neutral energy in Berlin from 25% to 60%
- Expansion of renewables in Eastern Germany from 25% to 37%
- Expansion of PV inside Berlin from 1.6% to 9%
- Operation of smart grid increases share of renewable energy by 14%
- CO2-emissions caused by electrical demand decrease by 20%



3. Modeling Smart Grid for Emerging Cities: 3rd IEEE PES ISGT Europe 2012 as Resource

- IEEE PES (Power and Energy Society) ISGT (Innovative Smart Grid Technologies) Europe 2012 from 14 to 17 October 2012
- More than 700 participants from over 50 countries
- Europe's most significant international smart grid conference
- www.ieee-isgt-2012.eu



3. Modeling Smart Grid for Emerging Cities: Support of 3rd IEEE PES ISGT Europe 2012

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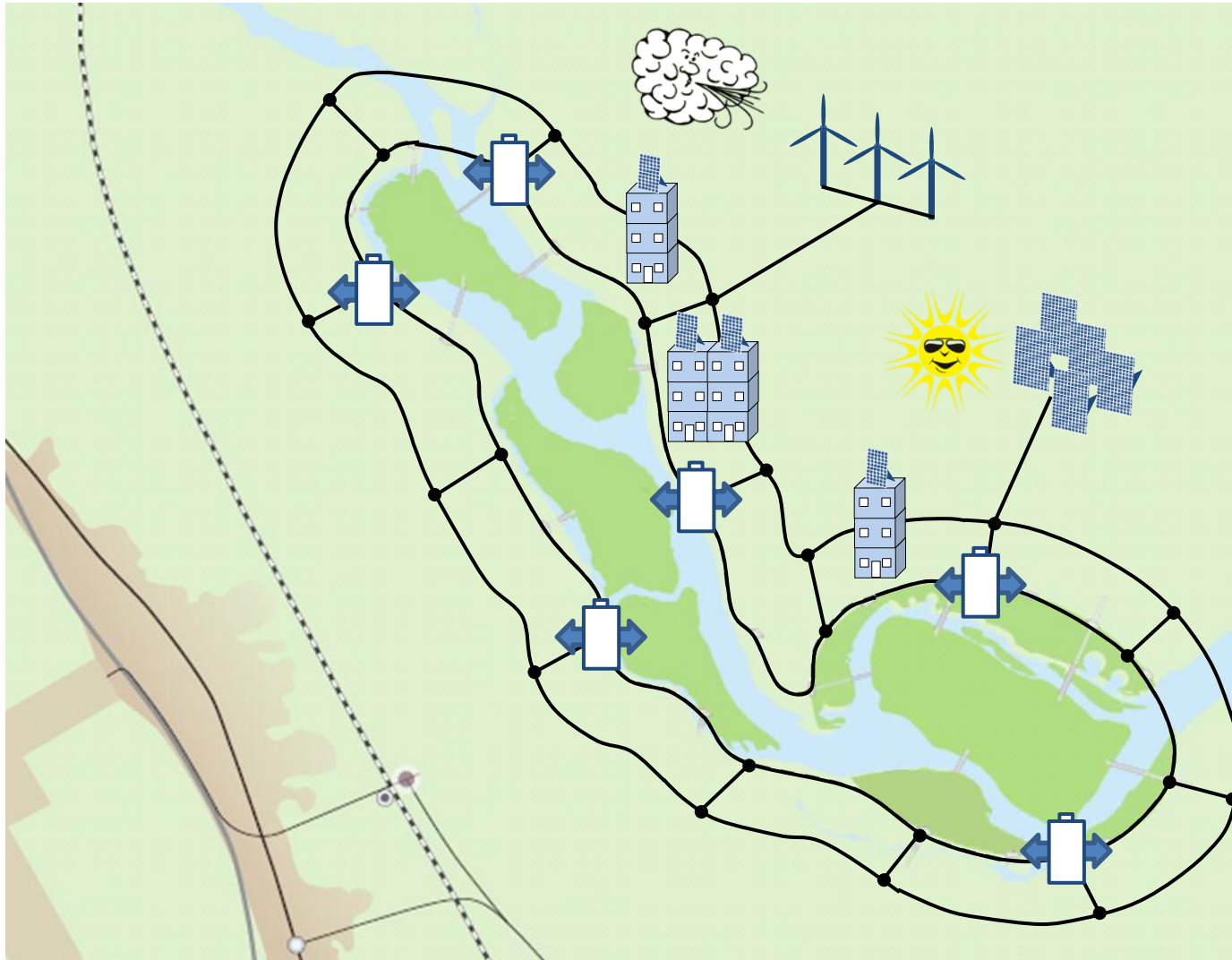


3. Modeling Smart Grid for Emerging Cities: Impressions of 3rd IEEE PES ISGT Europe 2012



*Lessons Learnt from
Conference are Basis for
Smart Cities*

3. Modeling Smart Grid for Emerging Cities: The Concept





Innovative Smart Grid

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4. Wrap-up

Thank you for your support

