

The Future of the Industrial Park

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What do we mean by an Industrial Park ?



OR

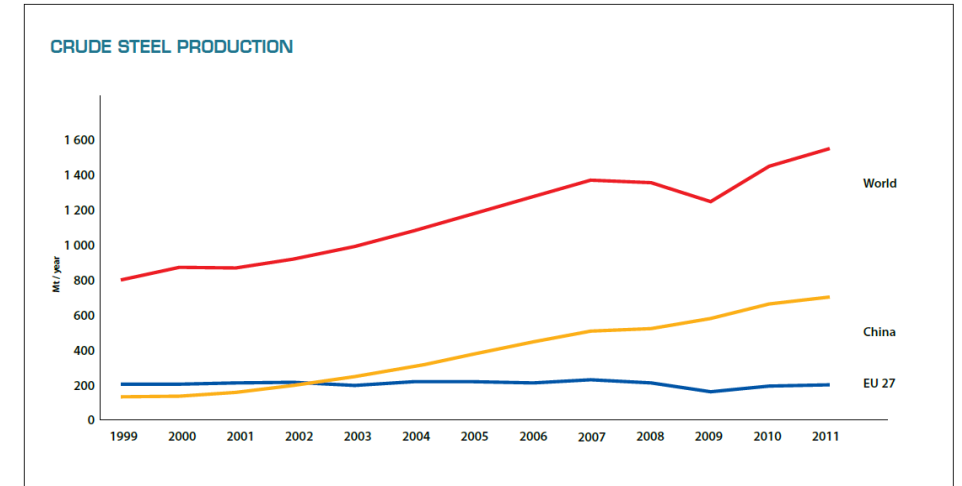


The Changing Energy Intensive Park

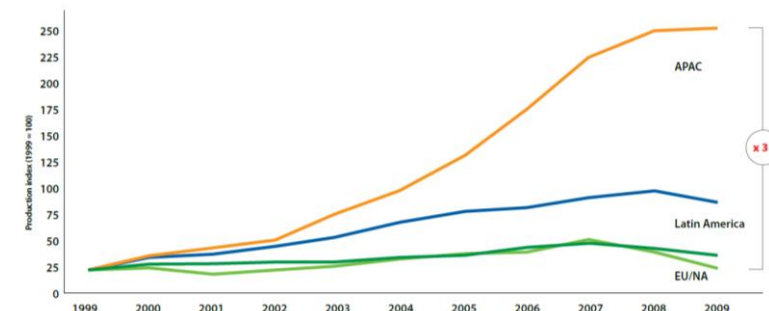
- **Single Company/Sector focus – Steel; Chemicals; Paper; Cement etc.**
- **Sites restructured with industry**
 - **Ownership changes**
 - **Pressure for focus on core business, shareholder value etc.**
 - **Outsourcing of park services & operations**
- **Growth in new regions – limited reinvestment**

The Current Challenges for EU Parks

- **Location v growth markets**
 - Investments
 - New Parks
- **Feedstock & Energy**
 - Costs & Availability/Security
 - Environmental targets
- **Driving Innovation**
- **Attracting Investment**



WORLD PRODUCTION OF CHEMICALS BY REGION



* Asia includes Japan, China, Korea, Malaysia, Philippines, Singapore, Taiwan, Thailand, Pakistan, Bangladesh, and Australia

Source: Cefic Chemdata International

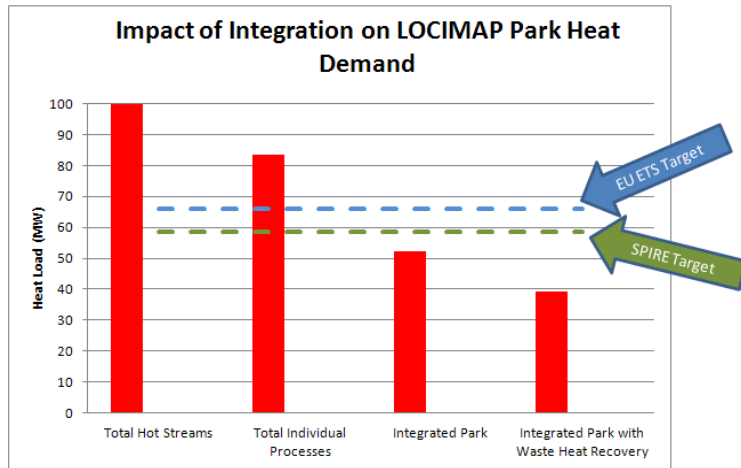
Why a Future ?

Europe's energy-intensive industries have an aggregated turnover of more than 1000 billion Euros per year and provide direct employment to over 3 million people.

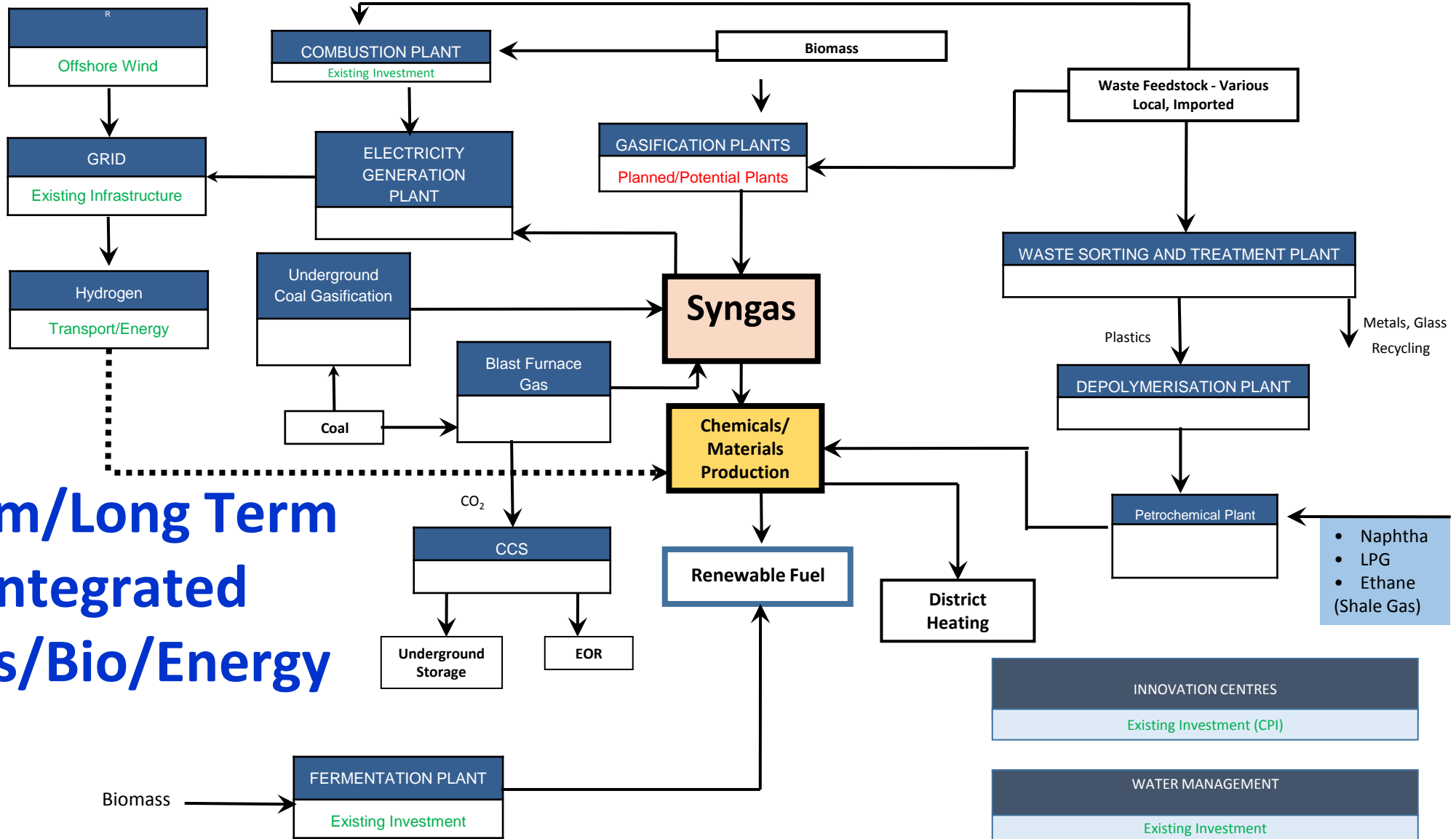
- **Established Infrastructure & Service provision**
- **Established energy & product integration**
- **Access to EU market**
- **Skills & Supply Chain**

Why a Future (Cont.)

- Industrial Symbiosis
 - Energy Integration Technologies
 - Materials Integration
 - Process Integration
 - New process technologies – e.g. bio based, renewables

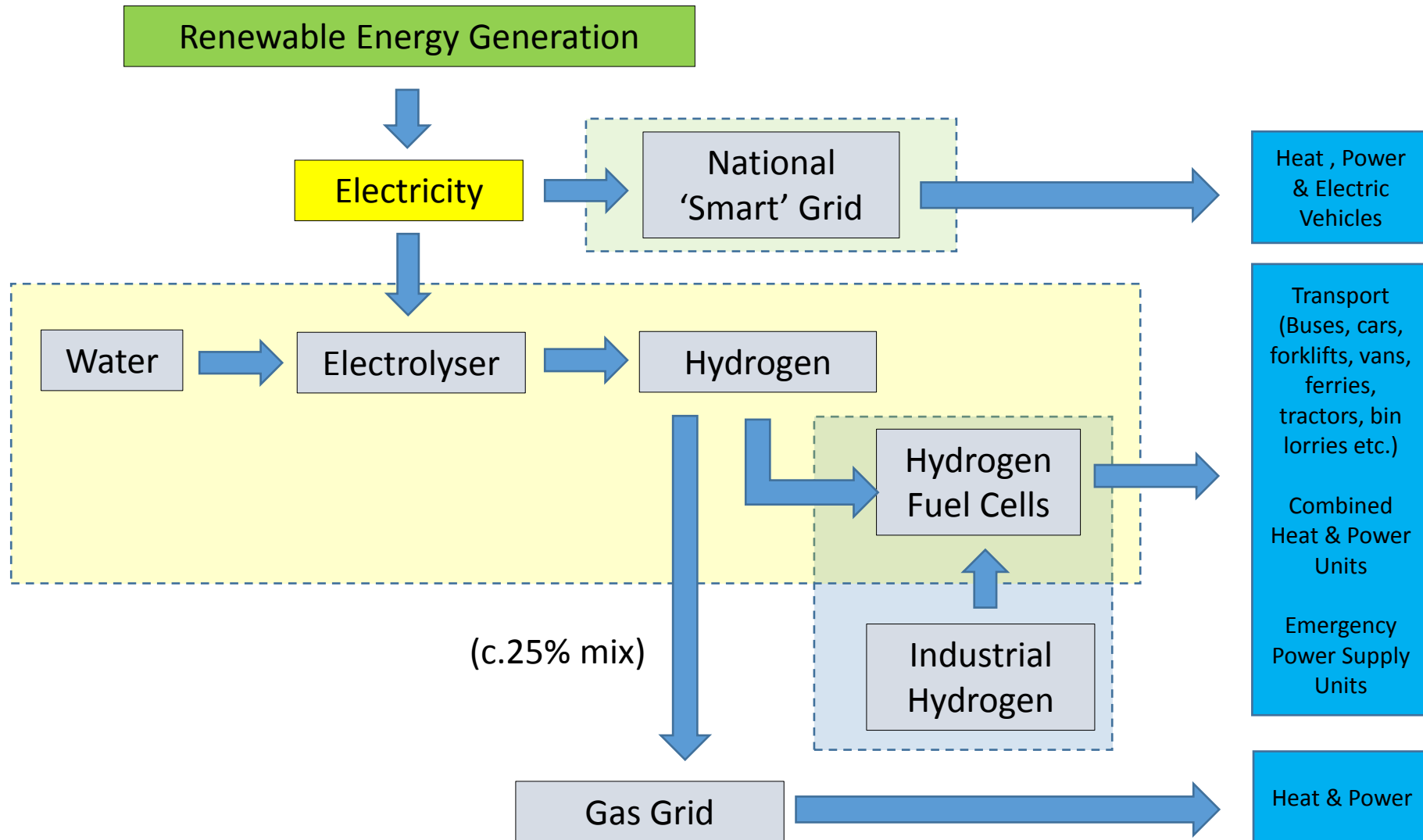


Technology	TRL	Comment
Energy generation (power, heat and cooling)		
Biomass gasification	6-9	Semi-commercial demonstration sites
Biomass torrefaction	6	
Pyrolysis	6	
Concentrated solar power & thermal	5-6	Rapid development
Plasma gasification of waste	9	Units in operation in Japan. Constructions in USA.
Oxy-fuel CFB	6	
Second generation bioethanol	6	Demonstration plants in operation.
Algae for fuel & chemicals	4-9	Very case specific
Trigeneration, (CHRP, CCHP)	9	For simultaneous generation of power, heat and cold.
Air cycle refrigeration	9	
Sorption refrigeration	9	
Hydrothermal carbonization	7	
Hydrotreated vegetable oil (HVO)	6-7	
Anaerobic water treatment	6-9	Very case specific
Biogas	9	Depending on substrate
Hydrofaction	8	
Energy storage		
Fuel cells	7-9	Depending on technology
Chemical energy storage	5	H ₂ , NH ₃ , CH ₄
Flywheel	7	
Thermal energy storage	7	Including liquefied air and nitrogen
Energy conversion		
Heat to power	4-9	Depending on technology
Expanding heat recovery	4-9	Depending on technology
Kalina cycle	9	Installation in Iceland in 1999
Climeon	5-7	Demonstrator tested.
Stirling engine (also refrigeration)	7	Demonstration plant
Heatcatcher (Organic Rankine Cycle)	7	
Sabatier plant	8	250 kW demonstration plant in Germany 2012
CCS technologies		
Chemical absorption	6-9	
Physical absorption	4-9	
CaO looping	7	
Cryogenic distillation	6-9	
Gas separation	5-9	
Adsorption	5	
Oxyfuel	6-8	
Precombustion	6-9	
Other technologies		
Ion transport membrane air separation	8	
Membrane distillation using waste heat	7-9	



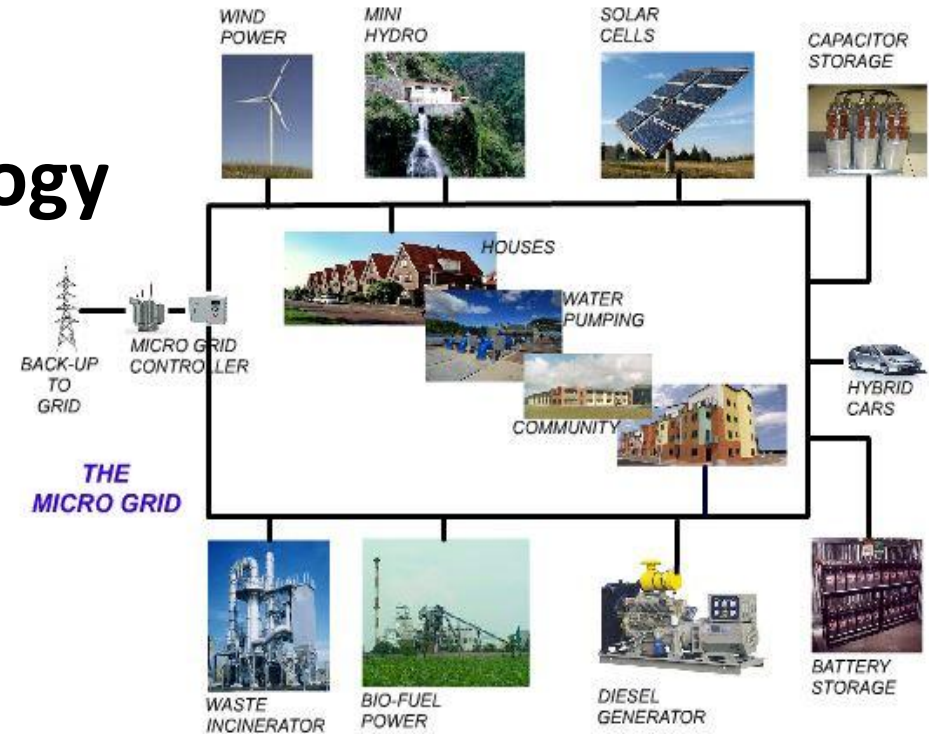
A Medium/Long Term Vision - Integrated Materials/Bio/Energy Park:

The Hydrogen Economy

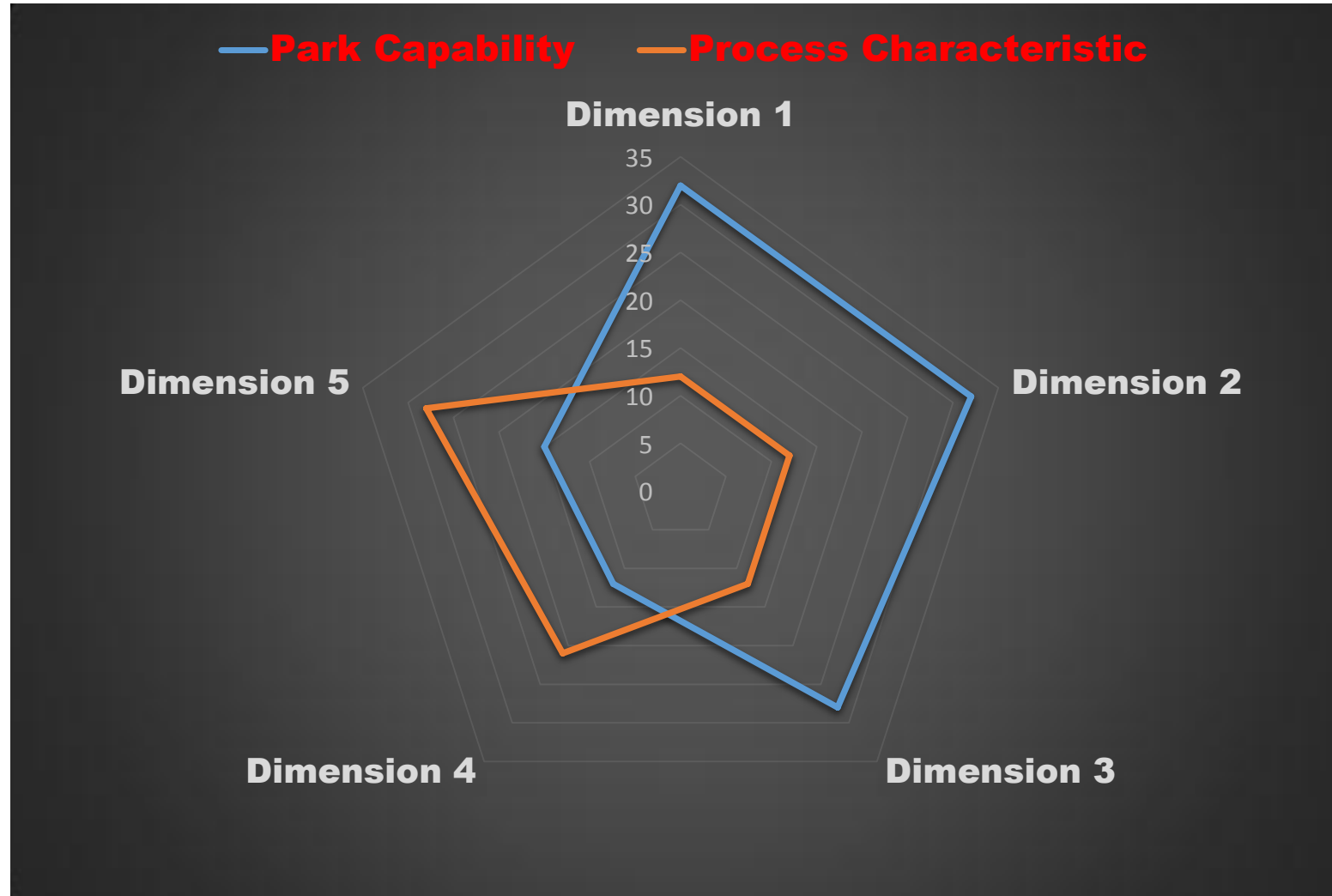


Future Directions

- Information & Control technology
 - The Smart Grid
 - Mobile Computing
 - Data and Information exchange
- Community Integration
 - Heat
 - Power
- Collaboration Structures



Characterising the Opportunity



Thankyou

