Panel One: Promise and Perils of Technology Disruption

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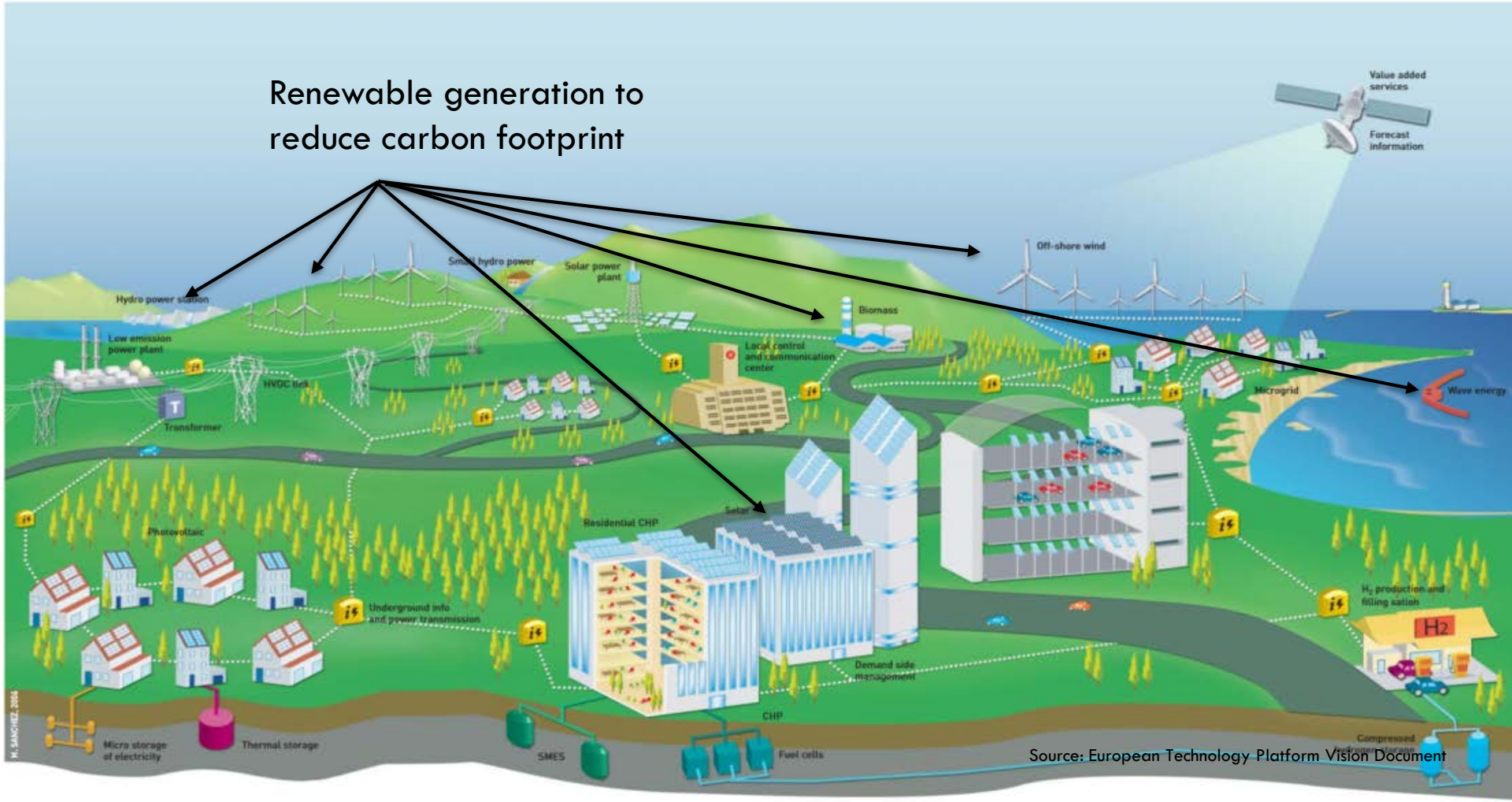
WATERLOO | ENGINEERING

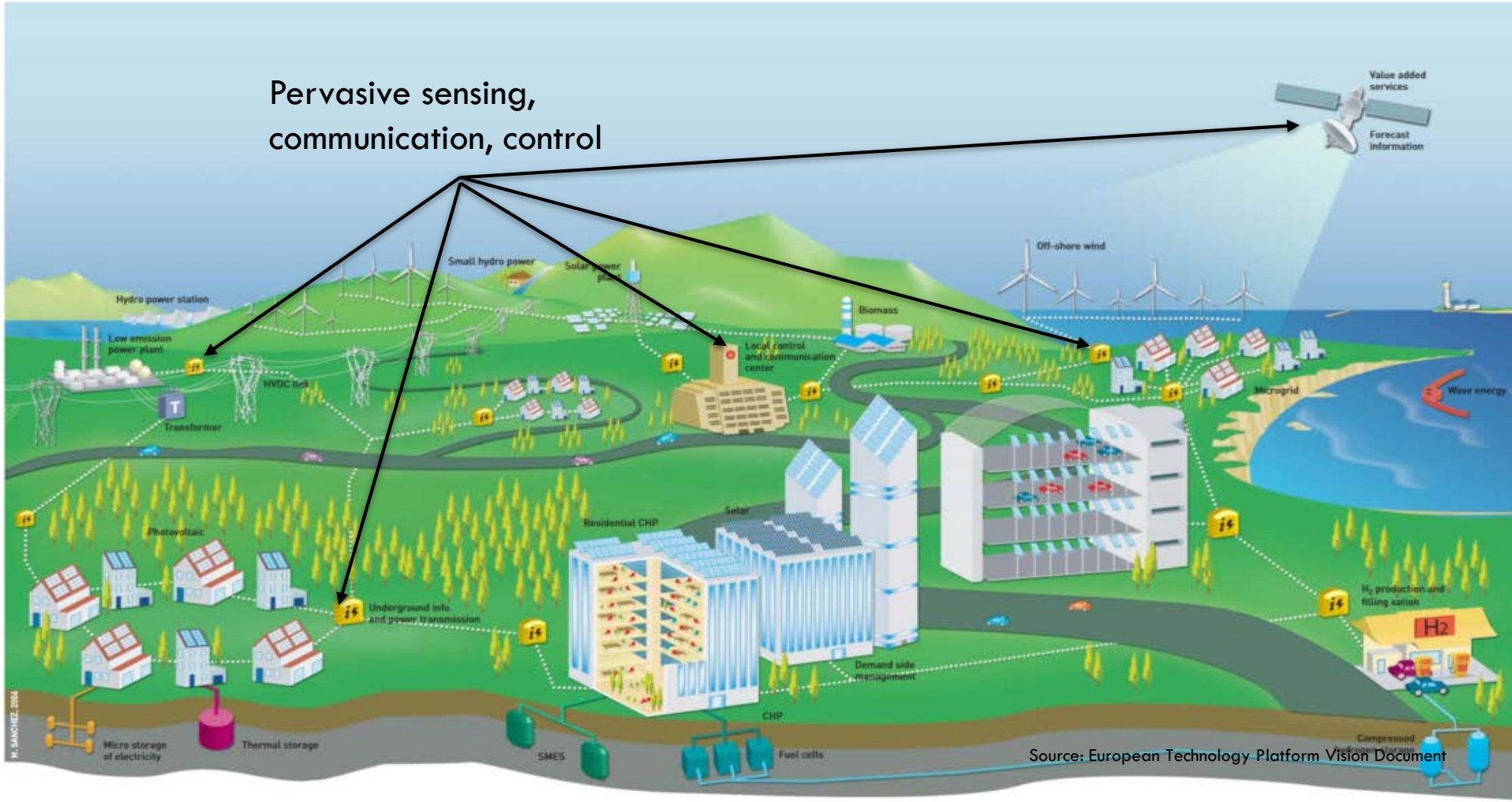
EDUCATING THE ENGINEER OF THE FUTURE

Source: European Technology Platform Vision Document

Renewable generation to reduce carbon footprint

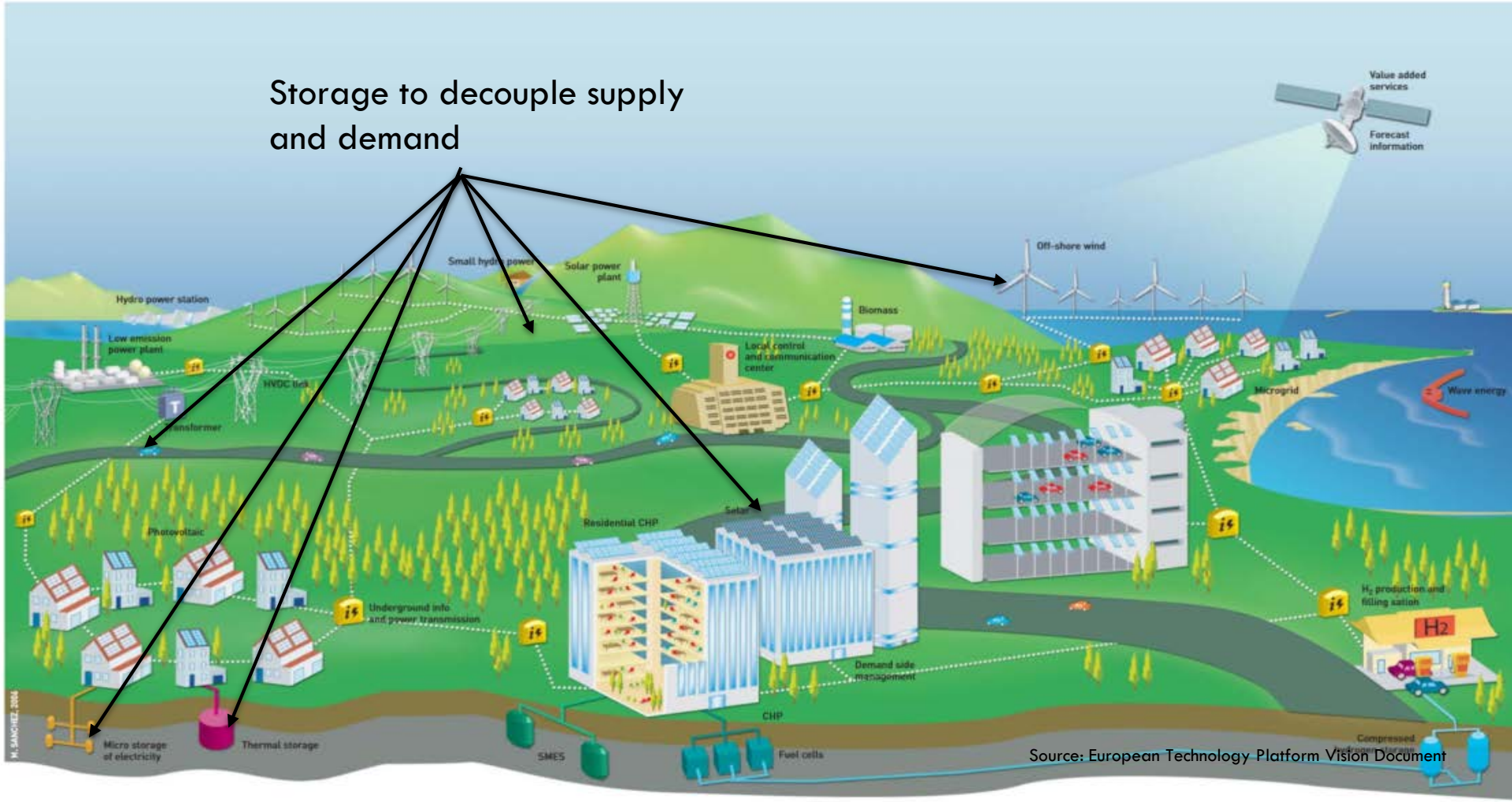


Source: European Technology Platform Vision Document



Source: European Technology Platform Vision Document

Storage to decouple supply and demand



Source: European Technology Platform Vision Document

The future is (almost) here!

- ✓ Costa Rica actually ran on 100 percent renewable energy for more than two months in the past two years. Almost all of the country's infrastructure and utility energy is provided by hydroelectric and geothermal power (Iceland, Norway, Albania and Paraguay are also in the category of almost 100% renewable)
- ✓ Portugal was 100% powered by renewables in March 2018!
- ✓ Google was powered 100% by renewable energy in 2017
- ✓ The cost of energy storage is decreasing fast but still high.

Main remaining technology inflection points

- ✓ Storage
- ✓ IoT for pervasive control and measurements
- ✓ Data analytics

These three “technologies” can be seen as opportunities or threats for the main players in energy systems, i.e., the utilities, the customers (individual and business), the operators and the policy makers. Often an opportunity for a group of players might be a threat for another group.

Examples taken from some of my latest research on energy systems

- ✓ Multi-timescale Electricity **Theft** Detection and Localization in Distribution Systems: *Uses distributed measurements and data to help utilities detect theft:* ***opportunity for the utility***
- ✓ **State Estimation** in Power Distribution Systems Based on Ensemble Kalman Filtering: *Uses distributed measurements and data to help utilities estimate the state of their system:* ***opportunity for the utility***
- ✓ **PV-Storage** System Profitability in **Multiple Jurisdictions**: *Study based on data to help customers understand the profitability of investing in PV-storage:* ***opportunity for the customer***
- ✓ Practical Strategies for **Storage Operation** in Energy Systems: Design and Evaluation: *How to operate storage efficiently based on data and pricing schemes:* ***opportunity for the customer***

Examples taken from some of my latest research on energy systems

- ✓ On the Interaction between **Personal Comfort Systems** and Centralized HVAC Systems in Office Buildings: *How to help buildings reduce their energy bill while preserving individual comfort*: ***opportunity for the customer***
- ✓ Modelling Weather Effects for Impact Analysis of **Pricing Policies**: Methodology and Case Study: *Data driven study evaluating impact of recent change in pricing policies:* ***opportunity for the operator***
- ✓ Energy Storage and **Regulation**: An Analysis: *How to operate storage in ancillary services:* ***opportunity for new players***

My point of view

- ✓ Technologies create many opportunities but the incumbents are often too slow to take full advantage of these opportunities.
- ✓ New business models will be needed and regulations should not create unnecessary roadblocks.
- ✓ Great lessons can be learned from what happened in Germany, recognizing that the problems are different in Canada (jurisdiction-specific solutions)
- ✓ IoT for control is a great opportunity for utilities that need to invest in it while being fully aware of the issues of security and dependability

My point of view

- ✓ IoT for data collection is also a great opportunity but:
  - As in other fields, utilities are not sure how to use the data and very hesitant to share it with other players.
  - Customers will need help to take advantage of their own data.
  - There is also a need to think in terms of usability of data before starting collecting it.
- ✓ Customers will need plug and play solutions requiring data collection and AI.

In conclusion: the threat will be for players that do not plan and cannot adapt