# Presentation 3

## The Resource Efficiency Era: Doing so much more with Less

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*Addressing the challenges of the future through innovation*

# Our Understanding of Technology

1. Anything that is **in the world when you are born** is a natural part of the way the world works
2. Anything that is invented **between when you are fifteen and forty** is new, exciting and you can probably get a career out of it
3. Anything invented **after you are forty** is against the natural order of things

Douglas Adams

# The Challenge of Predicting Technology and its Effects

- Bell's talking telegraph only creates interest in scientific circles; as a toy it is beautiful; but its commercial value will be limited (Elisha Gray, 1876)
- The horse is here to stay, the automobile is a novelty (Michigan Bank manager to Henry Ford, 1908)
- Who the hell wants to hear actors talk? (Jack Warner, 1930)
- There is a world market for about five computers (Thomas Watson, IBM, 1943)
- Guitar music is on the way out (Decca Records rejecting Beatles, 1962)
- If anything will remain unchanged, it is the role of women (David Riesman, 1967)
- Before the year 2000 is over, the first child will have been born on the moon (Werner von Braun, 1972)
- The Internet is full. Go away. (T-shirt, 1995)
- No-one will buy anything over the Web (Newsweek, 1995)
- Spam will be gone within two years (Bill Gates, 2004)

# Predicting Technology and its Effects – *Technological Trends and National Policy* (1937)

- Needs focussed, identified thirteen key technologies within a 15-20 year time horizon
- Identified predicted uses, market timing and impact, and social implications
- Television, facsimile transmission, air conditioning, mechanical cotton picker, synthetic rubber – essentially correct on all counts
- Cotton/wool substitute and photo-electric eye – optimistic timing, different form and uses
- Steep flight aircraft, prefabricated housing, automobile trailers, tray agriculture, gasoline from coal - essentially wrong on all counts

# Our Challenge
## (2014)

- Global population growth – 2.5B in 1943, 7.2B today, 8.3-10.9 B by 2050
- 2.5B people in China, India and other developing counties will enter the ‘middle class’ by 2030
- Increased demand on already constrained resources of food, water, energy and minerals
- Non-sustainability of many current industrial practices, and the growing levels of pollution and environmental degradation
- Climate change

# Our Opportunity
## (2014)

- The need to achieve a **Factor Ten** increase in the efficiency of resource use will be a major driver of economic activity in the next 20 years.
- **Factor Ten** is the radical idea that humanity must reduce resource turnover by 90 percent on a global scale within the next 30 to 50 years.
- To achieve dematerialisation, within the next generation human energy use must decrease by a factor of 10 while resource productivity and efficiency must increase by a factor of 10.
- This will lead to transformation of resource dependency and advantage, the creation of a new technological landscape and shifts in the global factors of production.

# Sources of Factor Ten Productivity Growth

- Substitution – lighter stronger, cheaper, lower
- Waste reduction
- Circularity – closed-loop use of resources
- Optimisation – predictive and real-time analytics to reduce resource requirements and increase asset use
- Virtualisation – resources as a service

Heck and Rogers, *Resource Revolution,* Harcourt, 2014

# Case Study – Transport

## Current massive inefficiencies in car-based transport

- Usage - 95% of time unused
- Fuel consumption – 86% of fuel never reaches the wheels
- Average occupancy – 1.6 people
- Motorways operating at peak capacity are less than 10% covered by cars
- Peak capacity is achieved only 4-5% of the day

## Opportunities

- Car sharing
- Smart roads
- New fuels - electric
- Efficient batteries
- 3-D printed manufacture

# Case Study – Smart Agriculture

- Networks of low-cost sensors, actuators and wireless networks for data collection and process monitoring of crops and livestock
- Robots with enhanced senses, dexterity, and intelligence used to automate tasks, such as harvesting fruit and controlling weeds and pests
- Vehicles that can navigate and operate with reduced or no human control to herd livestock and harvest crops
- The simulation of real-time agricultural processes using data and algorithms
- Inexpensive and capable mobile computing devices with high-speed internet connectivity to the farmer in the field
- Intelligent software that can perform farm planning tasks, and support decision-making and optimize large-scale production processes.

# Case Study – and Smart Food

- Smart packaging to enhance life and detect breakdown
- Interactive labelling to advise on nutrition, energy load, etc
- Food tracking and management systems to minimise wastage
- Decentralised and localised food production (vertical gardens)