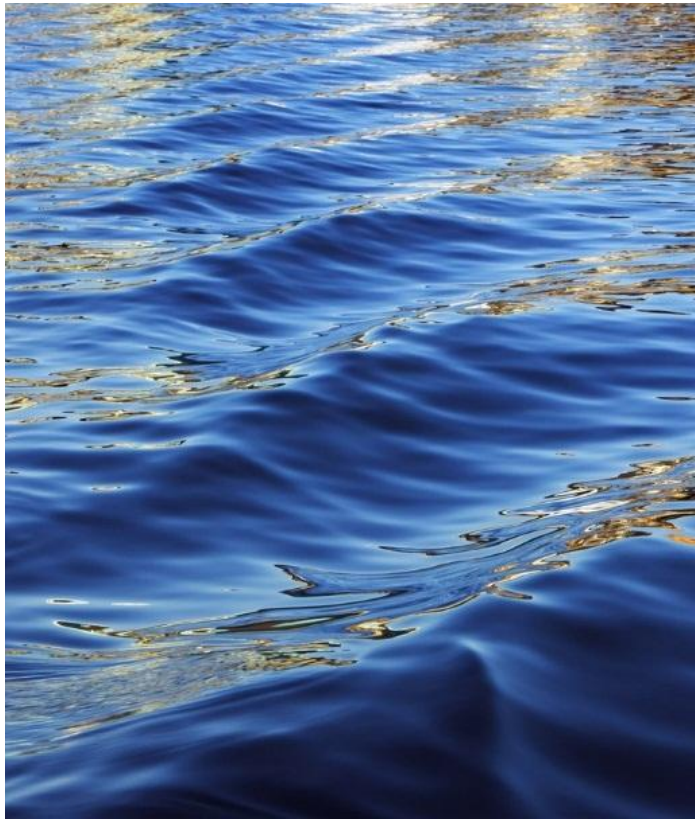
The Circular Economy (CE) and Solid Waste Management

Presentation to Florida SWANA & RFT Joint Summit

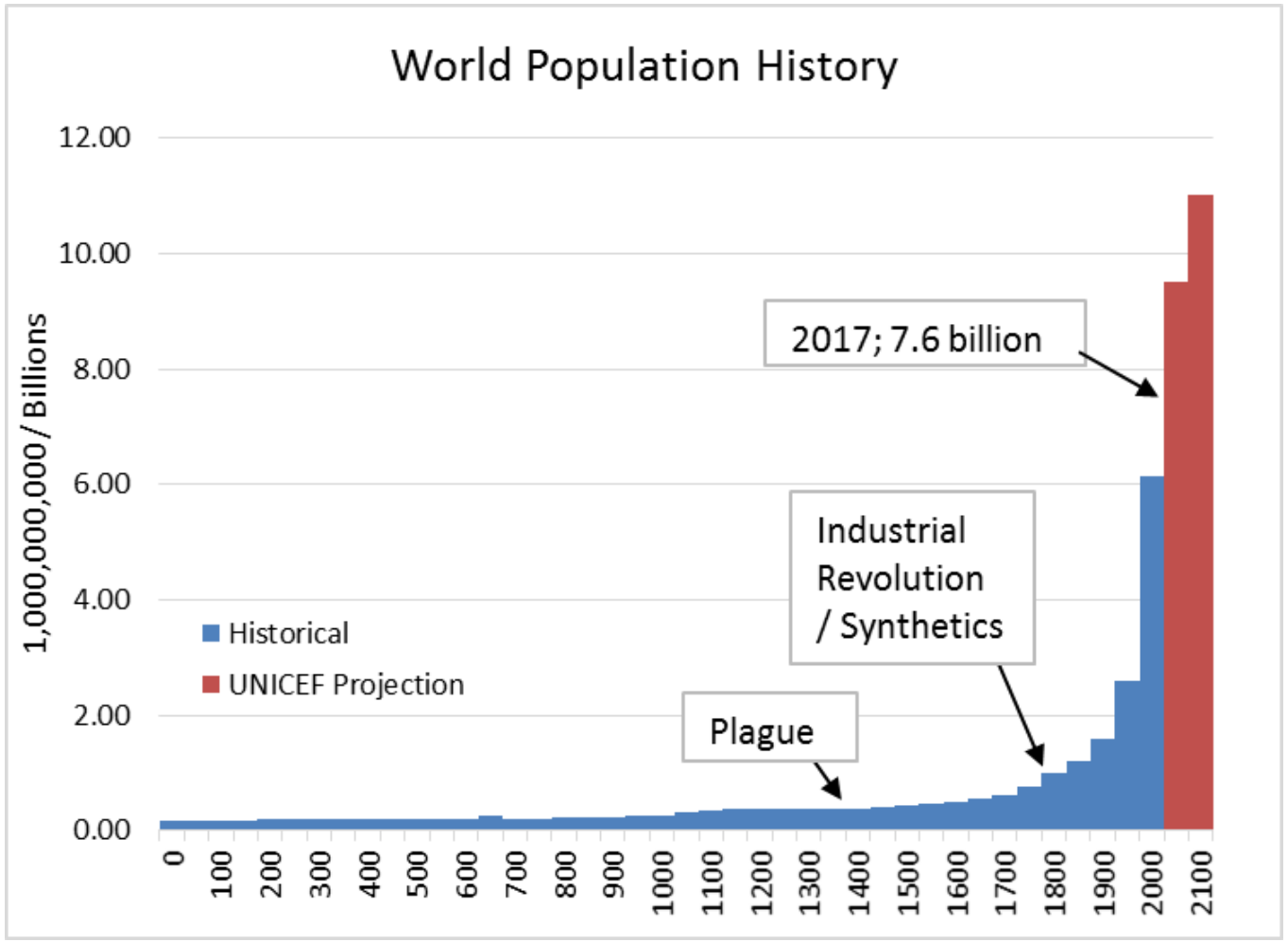
January 29, 2018

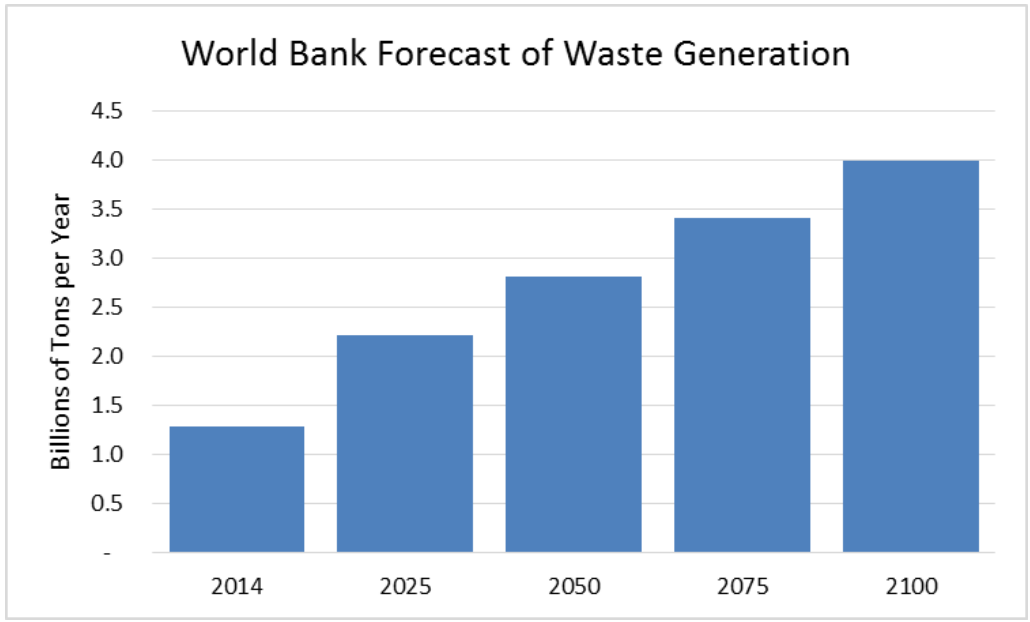
Public Resources Management Group, Inc.
Utility, Rate, Financial and Management Consultants



- Earthrise taken by Bill Anders Dec 24 1968 during Apollo 8
- Considered one of the most influential environmental photographs ever taken
- Nixon / Congress est. EPA in 1970, citing it is "literally now or never" referring to protecting environment
- Resources have limits, we live in a closed system and we are all connected

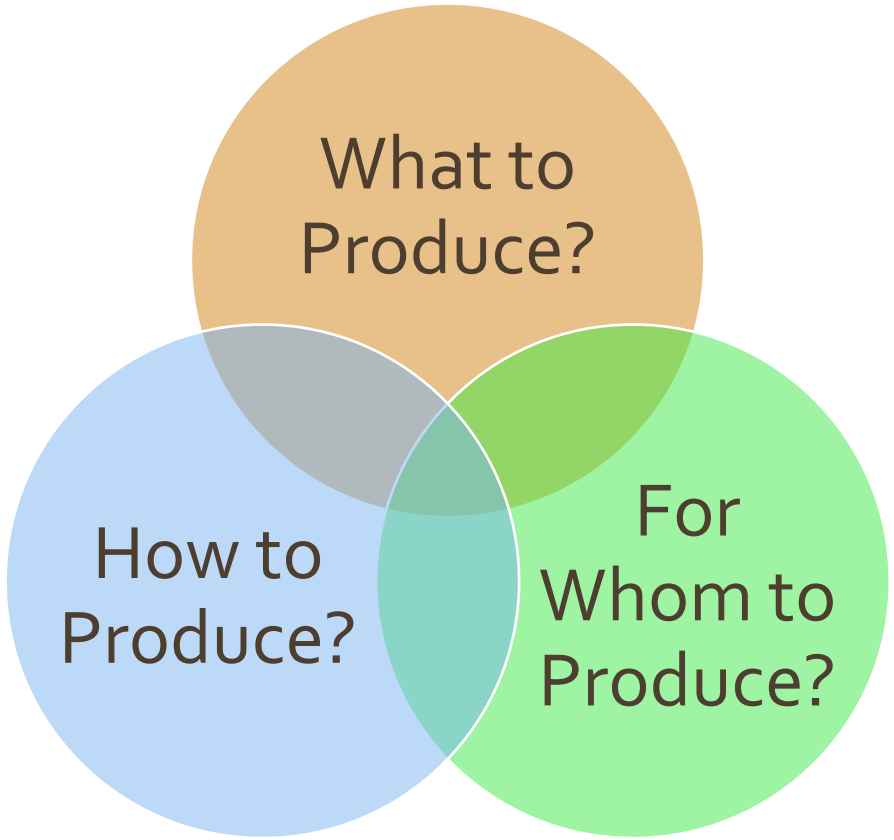
Sustainability in Question?





- US = 5% of the worlds population but Utilizes about 25% of the Resources and Generates about 20% of Waste
- Is this sustainable / equitable?

What Do Economic Systems Do?



Types of Economic Systems

- Traditional System
- Market System
- Command System
- Mixed System

Market Economy Theory

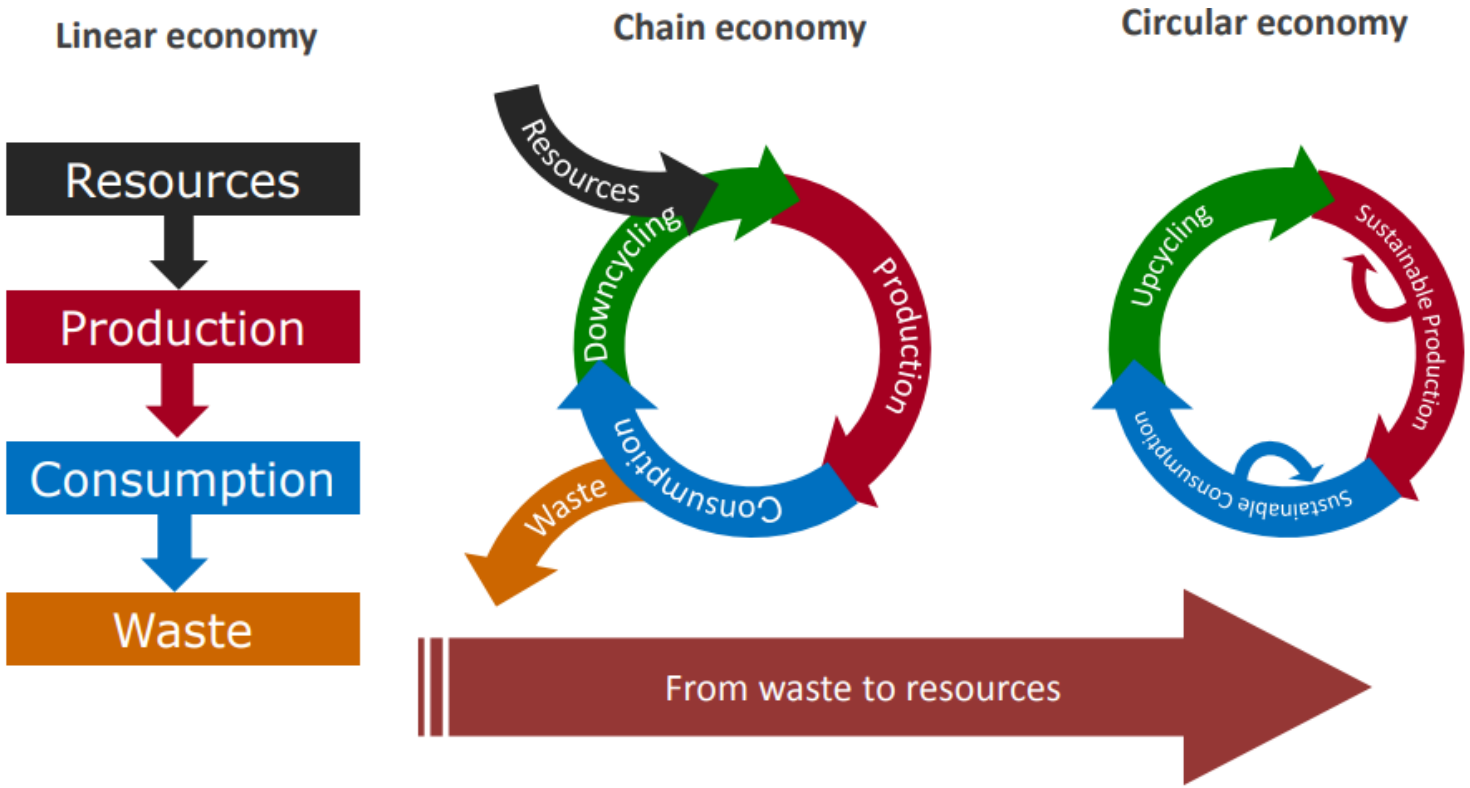
- Prices based on supply and demand
- Efficient Allocation of Resources
- Perfect Markets Rarely Exist
  - E.g., Uncompensated Impacts to Others
  - Referred to as "Externality"
  - Need for Regulation

Our Current System of Consumption & Externalities

- Take ➔ Make ➔ Discard
  - Is Resource Intensive
- Pollution is an Example of a Negative Cost Externality of This System
- 2013 Report for Oregon DEQ by Dr. Jeffrey Morris Estimated that Cost at $0.61 per bottle for lightweight PET bottles.
  - He Argues That The Market is Therefore Inefficient Because it doesn't Price in the Cost of Pollution to Others Around Us.
  - http://www.oregon.gov/deq/FilterDocs/mmexternalities.pdf

Concept & Comparison of the Circular Economy

- Main focus of the Circular Economy is to Optimize the Value of Raw Materials and Minimize the Wasting of Materials
- Can be used as a means to promote Zero Waste concepts



Source: http://ec.europa.eu/environment/legal/pdf/platform/3rd_meeting/francoise_bonnet_2.2.pdf

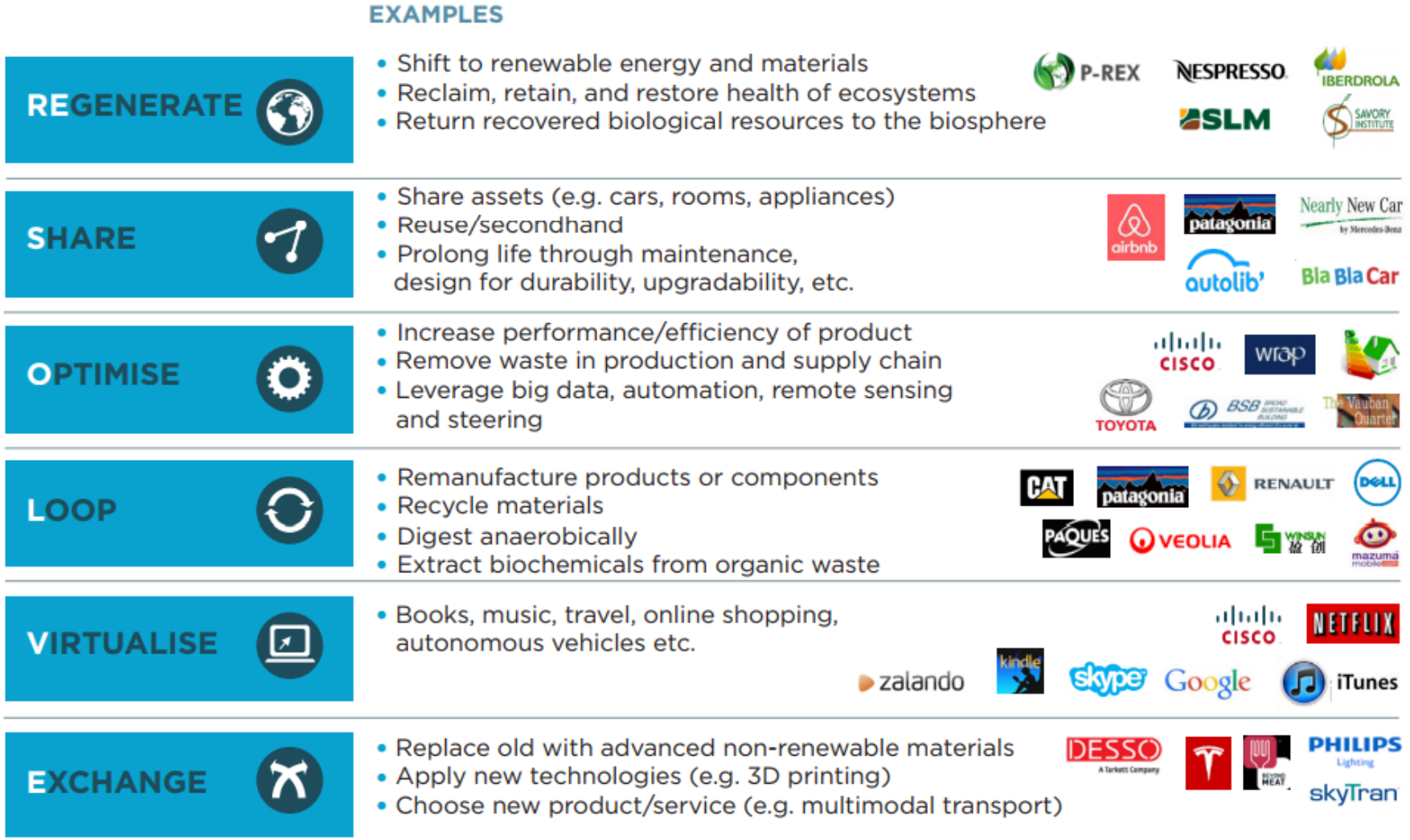
Circular Economy

- Ellen Macarthur Foundation Funded 2015 Report prepared by McKinsey "Growth Within: A Circular Economy Vision for A Competitive Europe"
  - https://www.ellenmacarthurfoundation.org/assets/downloads/publications/EllenMacArthurFoundation_Growth-Within_July15.pdf
- Found that European Economy Is Wasteful in Spite of the Fact that Europe Must Import the Majority of Its Raw Materials (e.g., 60% of all fossil fuels and metals)
  - Europe Landfills or Incinerates 60% of materials, while 40% recycled
  - Europe lost 95 percent of the material and energy value, while material recycling and waste based energy recovery captured only 5 percent of the original raw material value.
  - Even recycling success stories like steel, PET, and paper lose 30–75 percent of the material value in the first use cycle. On average, Europe uses materials only once.
- Study Examined 3 human needs that together account for 60% of European household spend and 80% of resource use — mobility, food, and housing.

Circular Economy

- Ellen MacArthur Foundation 2015 Report (continued)
- ReSOLVE Framework Explained

FIGURE 10 **THE RESOLVE FRAMEWORK**



Source: Company interviews; Web search. S. Heck and M. Rogers, *Resource revolution: How to capture the biggest business opportunity in a century,* 2014.

Circular Economy

- Ellen MacArthur Foundation 2015 Report (continued)
- ReSOLVE Framework
- Opportunities to Lower Total Cost of Ownership
  - Based on Technologies in Next 5-10 Years

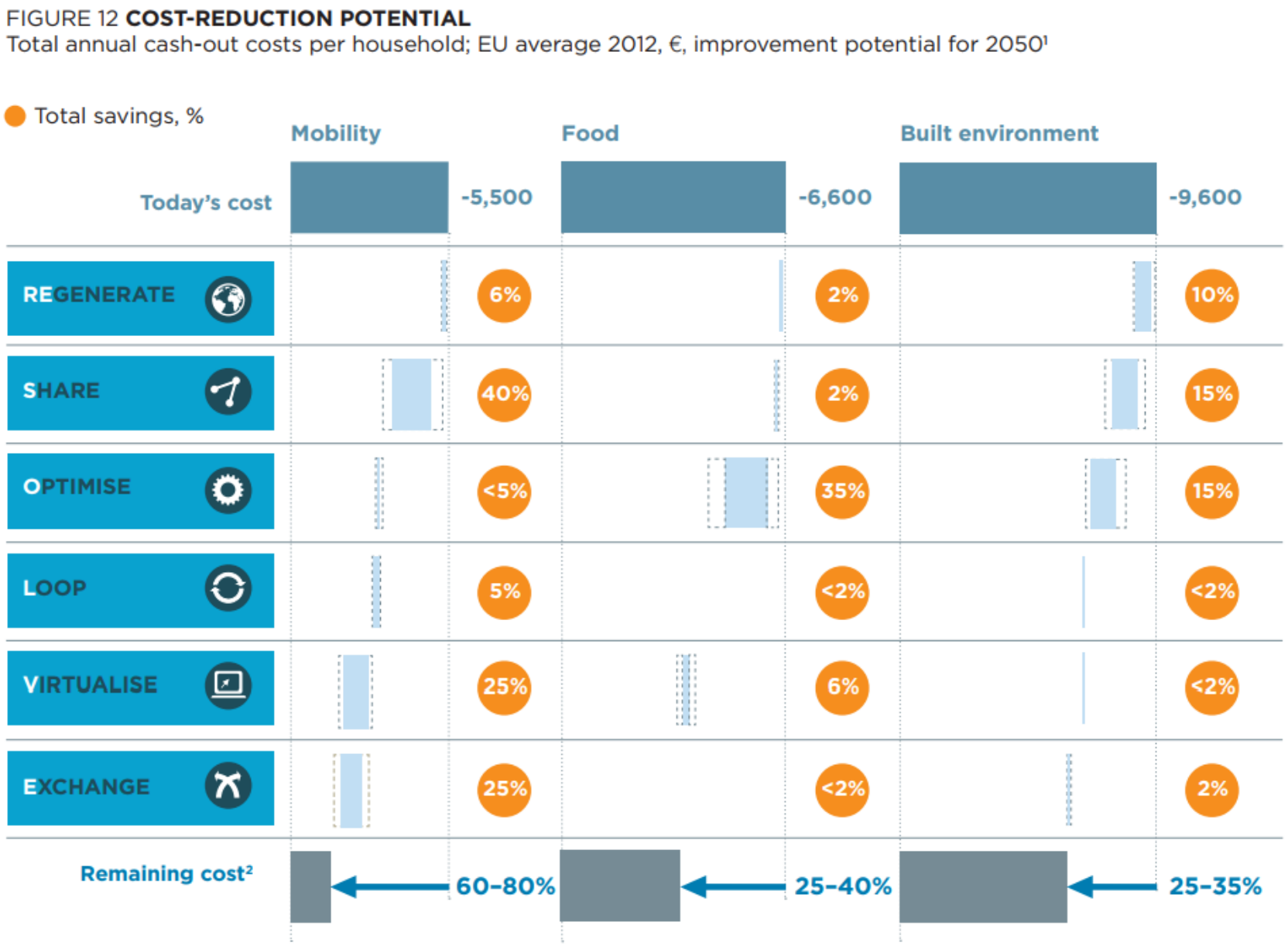


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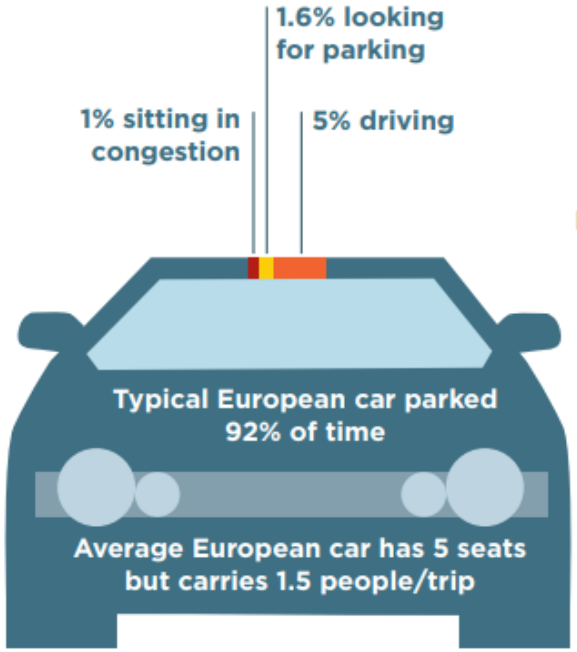
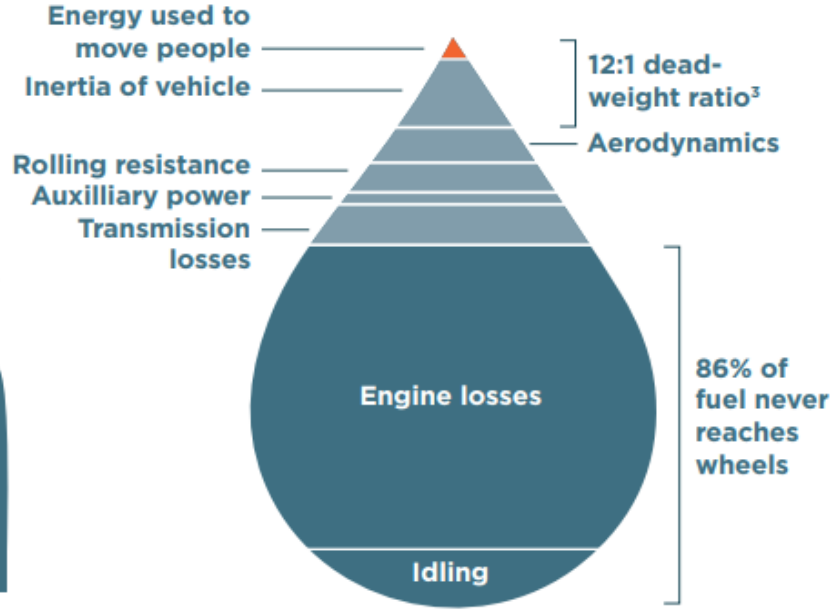
FIGURE 3 **STRUCTURAL WASTE IN THE MOBILITY SYSTEM**

● Productive use

CAR UTILISATION[1]

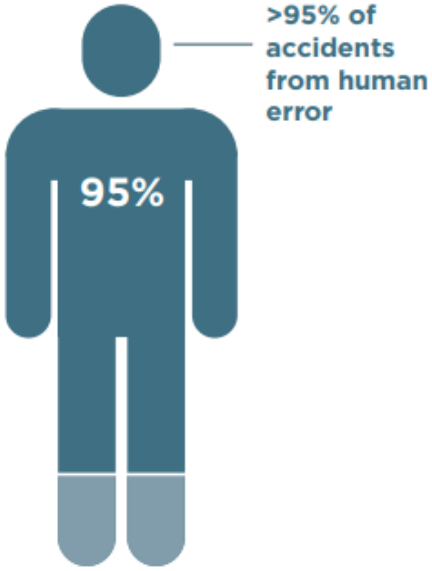


TANK-TO-WHEEL ENERGY FLOW – PETROL



DEATHS AND INJURIES/ YEAR ON ROAD

30,000 deaths in accidents and 4X as many disabling injuries[2]



LAND UTILISATION:

5% Road reaches peak throughput only 5% of time and only 10% covered with cars then

50% 50% of most city land dedicated to streets and roads, parking, service stations, driveways, signals, and traffic signs

1 Based on car parked number for France and productive vs. unproductive driving time in US. 2 For every death on Europe's roads there are an estimated four permanently disabling injuries. 3 Based on average car weight of 1.4 tonnes and average occupation of 1.5 passengers of 75 kg.
Source: EU Commission mobility and transport, accident statistics; www.fueleconomy.gov; EEA car occupancy rates data; S. Heck and M. Rogers, *Resource revolution: How to capture the biggest business opportunity in a century,* 2014; Centre d'études sur les réseaux, les transports, l'urbanisme et les constructions publiques.

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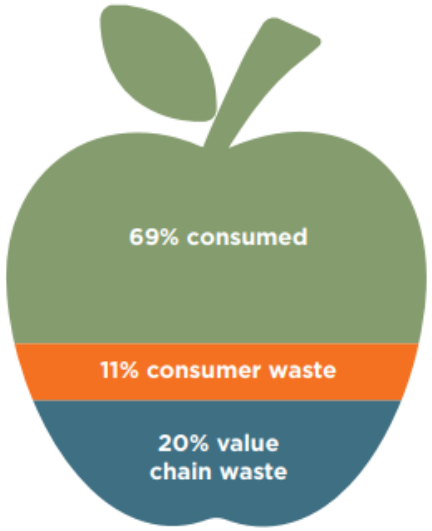
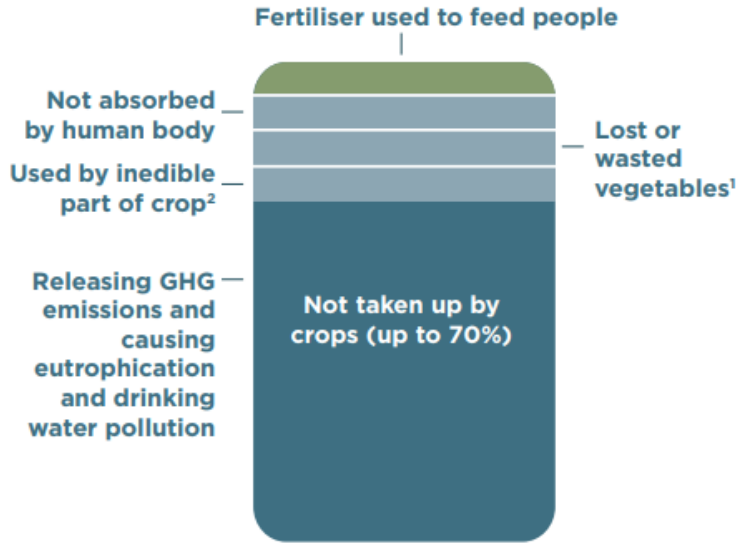
FIGURE 4 **STRUCTURAL WASTE IN THE FOOD SYSTEM**

● Productive use

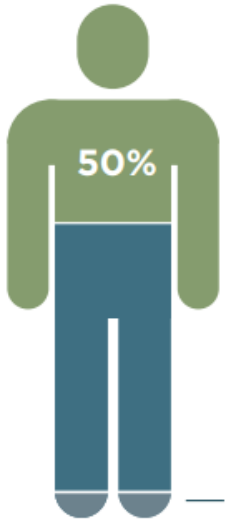
FOOD WASTE
31% of food produced is lost or wasted



FERTILISER UTILISATION
95% of fertilisers do not provide nutrients to human body



MALNUTRITION DEATHS AND DISEASES
Obesity causes 5% of deaths



>50% of European population is overweight (30%) or obese (22%)³

5% of EU population is at risk of undernutrition

LAND DEGRADATION: 30–85% ~30-85% of European agricultural land is affected by soil degradation (range depending on definition and data set used)

1 In Europe ~46% of edible mass of fruit and vegetables is lost or wasted (FAO, Global food losses and food waste, 2011).
2 On average 23% of vegetable crops are not edible (peels, leaves, etc.). 3 BMI >25 (overweight) or >30 (obese).
Source: FAO, *Global food losses and food waste – Extent, Causes and Prevention,* 2011; MGI, *Overcoming obesity: An initial economic analysis,* 2014; WHO website obesity data; EEA, *Towards efficient use of water resources in Europe,* 2012; IFDC; Olle Ljungqvist and Frank de Man, *Under-nutrition – a major health problem in Europe,* 2009; Holly Gibbs and Meghan Salmon, *Mapping the world's degraded lands,* 2015.

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FIGURE 5 **STRUCTURAL WASTE IN THE BUILT ENVIRONMENT**

CONSTRUCTION	UTILISATION	USAGE	END OF LIFE
• **10-15%** of building material wasted during construction	• **60%** of European offices are not used even in working hours	• **20-40%** of energy in existing buildings can be profitably conserved	• **54%** of demolition materials landfilled, while some countries only landfill 6%
• **0-0.5%** productivity increase per year in most European countries 1990-2015, whereas 2% per year achieved in some countries	• **50%** of residential dwellers report living in too much space	• Passive building standards at or near profitability for most new-build segments, but still only constitute a minority of buildings	• Most materials unsuitable for reuse as they contain toxic elements

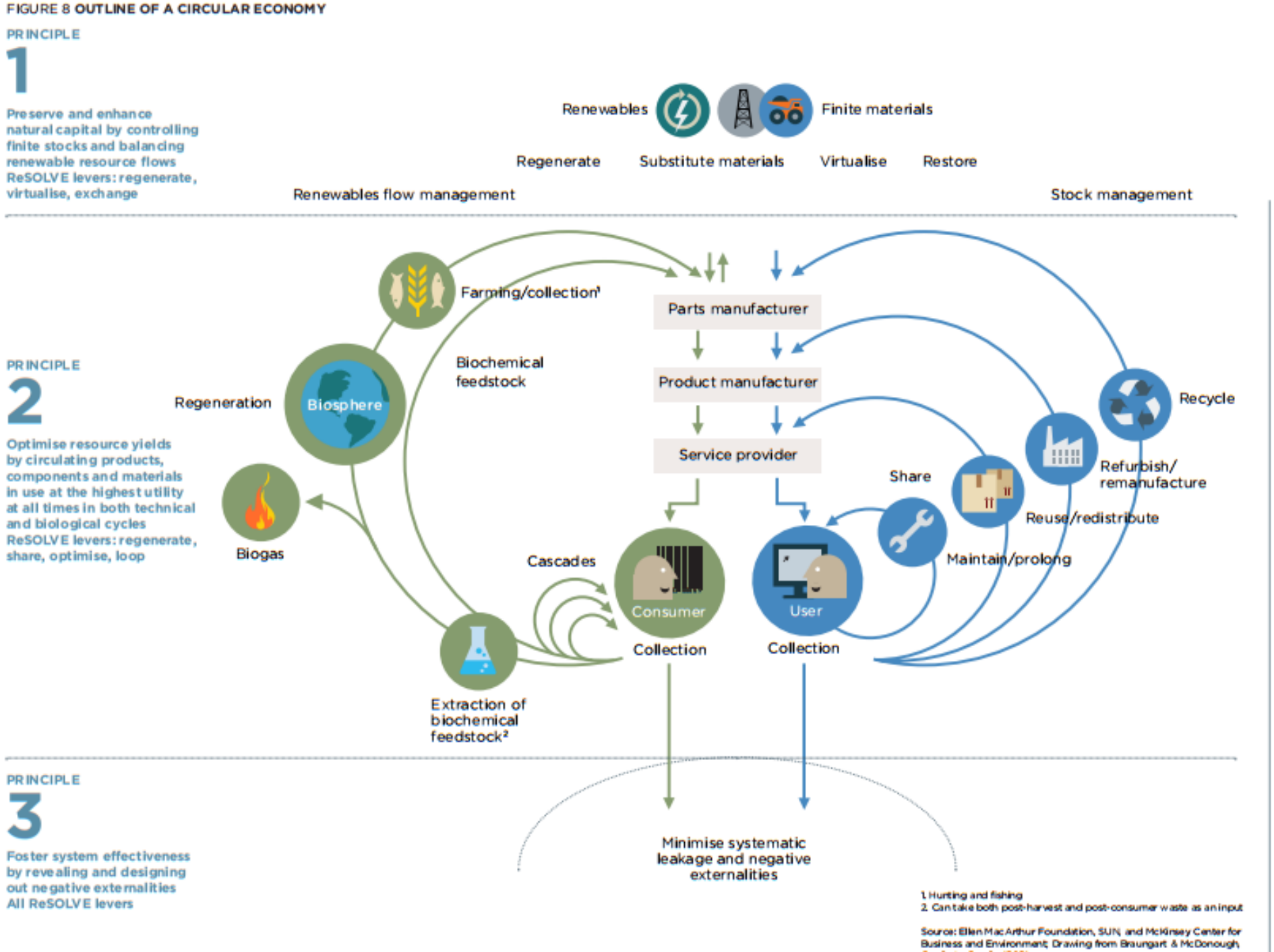
URBAN PLANNING:
- **50% of most city land dedicated to infrastructure**
- **11 million households experience severe housing deprivation**
- **Congestion cost 2% of GDP in many cities**

Source: Norm Miller, *Workplace Trends in Office Space: Implications for Future Office Demand,* University of San Diego, 2014; GSA Office of Governmentwide Policy, *Workspace Utilization and Allocation Benchmark,* 2011; Flexibility.co.uk, Shrinking the office; IEA Statistics © OECD/IEA (http://www.iea.org/stats/index.asp) Energy Statistics and Balances of Non-OECD Countries, Energy Statistics of OECD Countries, and United Nations, Energy Statistics Yearbook; European Commission, *Service contract on management of construction and demolition waste,* 2011.

- Ellen MacArthur Foundation 2015 Report (continued)

- Cradle to Cradle
  - Tech & Bio Cycles

FIGURE 8 **OUTLINE OF A CIRCULAR ECONOMY**



Circular Economy / Change in the Business Model

- What if we didn't own a product but just paid for the service?
  - Performance Based Economy => focus on service
  - Concept similar to buying a seat on a plane
    - "Turn Too" => Product as a Service
    - Philips sells lighting not the bulb or electricity
    - Lease a Jeans (www.mudjeans.eu) Lease a Suit (www.Dutchspirit.com)
- Buildings as Material Banks (BAMB)
  - 15 partners from 7 European countries are working together with one mission – enabling a systemic shift in the building sector by creating circular solutions.
  - BAMB will enable a systemic shift where dynamically and flexibly designed buildings can be incorporated into a circular economy.
  - The project is developing and integrating tools that will enable the shift: Materials Passports and Reversible Building Design – supported by new business models, policy propositions and management and decision-making models
- Or what if we owned and leased back to the public like our cars?
  - TURO App Allows you to Rent a Car or List a Car

CE and the Link to Solid Waste Management (SWM)

- SWM = Sustainable Materials Management (SMM)
- Plays Important Role in Supporting & Transitioning to the CE
- More Municipalities and Companies Adopting Zero Waste Goals
- SMM Role in CE can be to Support Increasing Diversion & Recycling
  - Cleaner Material / Consumer Education
  - Need for Domestic Markets
  - Prioritize Local First
  - Organics / Composting
  - C&D Recovery
  - Beneficial Ash Reuse
- Support Education
- Support Research

Thank You

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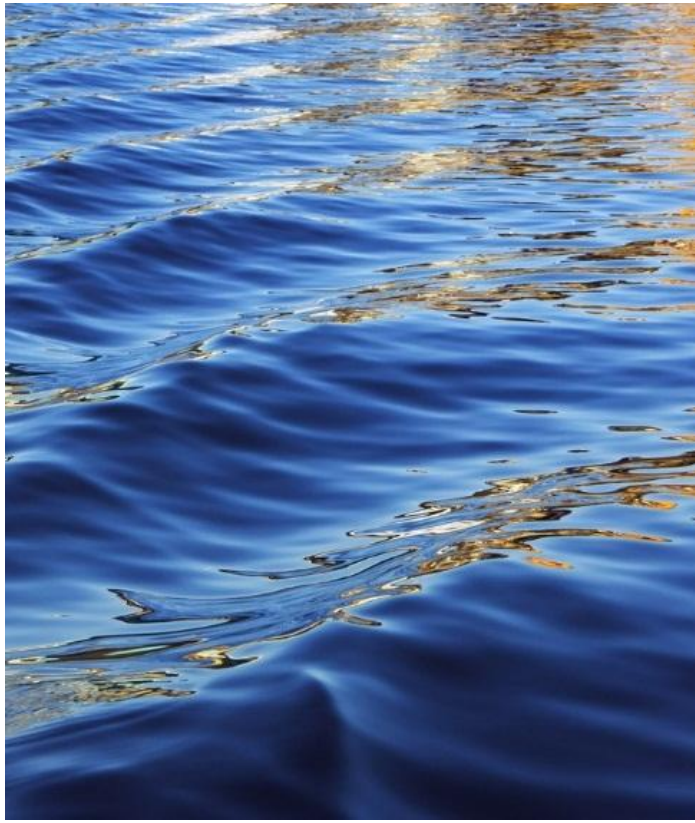

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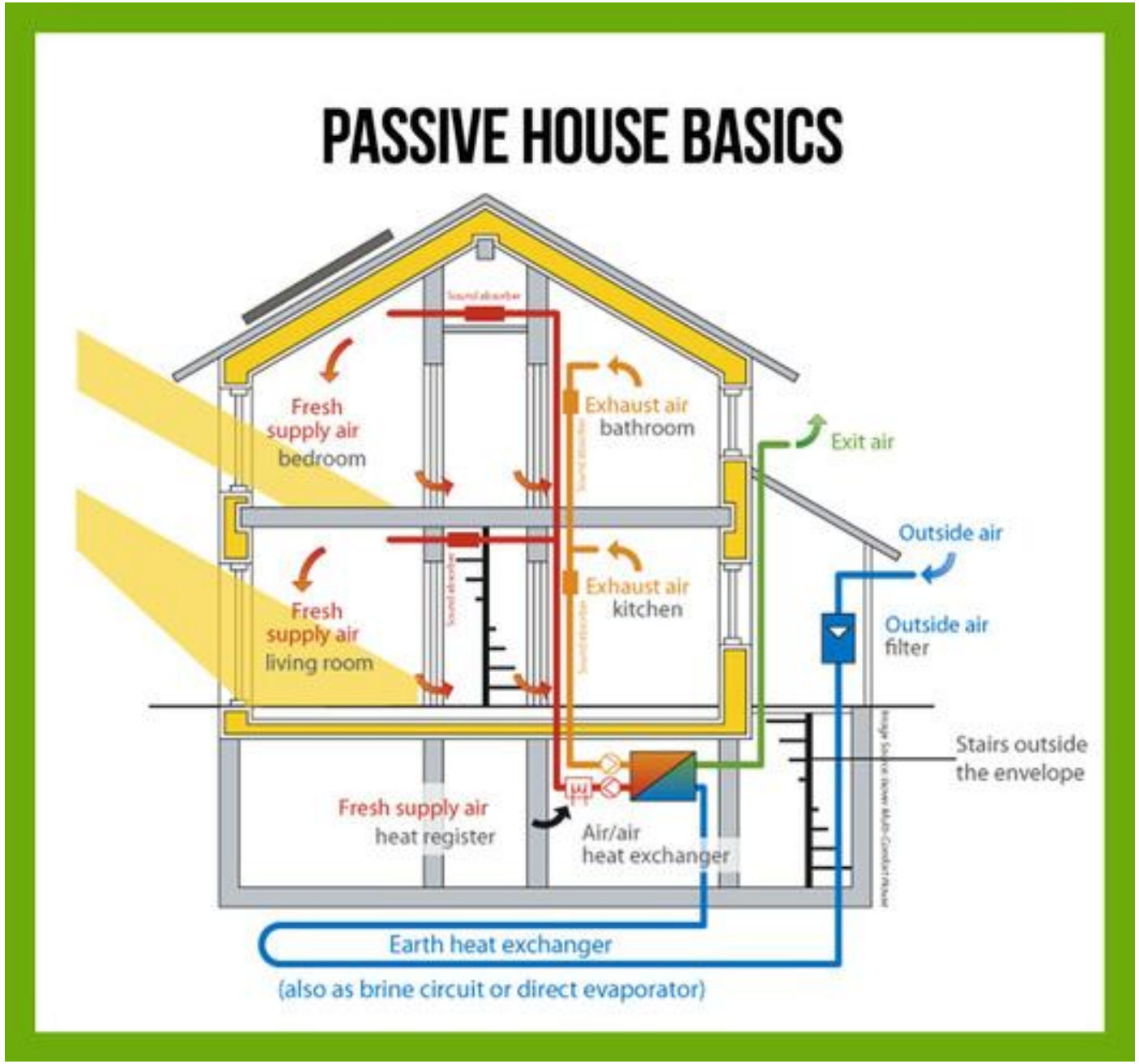
PASSIVE HOUSE BASICS
Fresh supply air bedroom
Exhaust air bathroom
Exit air
Outside air
Fresh supply air living room
Exhaust air kitchen
Outside air filter
Stairs outside the envelope
Fresh supply air heat register
Air/air heat exchanger
Earth heat exchanger
(also as brine circuit or direct evaporator)

Circular Economy / Change in the Business Model

- Price in full cost, including externalities
- Requires Public and Political Support to Change Policy to Support Transition
- Public Policy Has a Big Impact
  - CHINA adopted CE Goals in 2002; Developed in a Number of PILOT Areas