

Resource Revolution: Meeting the world's energy, materials, food, and water needs, McKinsey Global Institute, McKinsey Sustainability & Resource Productivity Practice, November 2011

A Resume

Resource productivity opportunities could address nearly 30 % of 2030 resource demand. They could create societal benefits of up to \$3.7 trillion, with 90% of opportunities above the hurdle rate. 70 to 85 % of such opportunities are in developing countries.

15 groups of opportunities represent 75 % of the resource savings.

<u>Abatement Opportunities</u>	<u>\$ billion (2010 dollars)</u>	<u>Best performers</u>
Building Efficiency	696	Japan
Large-scale/smallholder farm yields	266	Germany
Food waste	252	Canada & USA
Municipal water leakage	167	Germany
Urban densification	155	
Iron and steel energy efficiency	145	Korea
Small-holder farm yield	143	
Transport efficiency	138	Portugal & France
Electric and hybrid vehicles	138	Japan
Land degradation	134	Russia
End-use steel efficiency	132	
Oil and coal recovery rate	115	Norway
Irrigation techniques	115	Germany & UK
Road freight shift	108	
Power plant efficiency	106	Canada & Japan (gas-fired only)

Additional investment of \$260 billion to \$370 billion a year would be necessary to reach a 450-ppm climate pathway to reduce from 66 to 35 ***gigatonnes of CO2 emission equivalents by 2030***. . ***Expected Abatements***

Steel and water	1
Cropland	6
Energy	10
Biofuels	1
Renewable Power mix plus CCS	7
Agriculture and forestry	5

Beyond institutional transformation, *action is necessary* on three broad fronts

1. *Strengthen price signals*

Unwind resource subsidies and recognize externalities
Shape expectations on long-term resource prices
Increase the transparency and predictability of financial support

2. *Address (non-price) market failures*

Property rights
Agency issues (to encourage direct buy-in by end-users)
Access to capital
Innovation systems

The next wave of resource technologies

Solar fuels (to use photosynthetic micro-organisms (e.g.algae) to convert waste carbon dioxide and sunlight as primary inputs in the production of ethanol, “drop-in fuels,” such as diesel and jet fuel, or specialty chemicals;
Electrochromatic windows (darkened or lightened electronically) ;
compressorless air conditioners (evaporative cooling); ***Advanced desalination technologies***(forward-osmosis techniques and aquaporins); ***Nanostructured higher-strength steel***; ***Soil-nutrient management***; ***Hydrogen fuel cells***
(Applications in the residential sector allow the use of both the produced heat and power, increasing efficiency to over 80%.)

3. *Build long-term resilience*

Build awareness of scarcity risks and solutions
Strengthen resource access and safety nets
Shift consumer and business mind-sets:

- (a) Demonstrations and role models
- (b) Conviction and understanding about the implications of consumption
- (c) Reinforce change through incentives and formal mechanisms
- (d) Develop new talent and skills to support behavioral change
- (e) Shifting diets from meat to fish through sustainable aquaculture or vastly improved stewardship of ocean fishery stocks (Shifting 20 % of the world’s 2010 calorie consumption from meat to fish would save about 60 to 80 million hectares of cropland.)

Cities offer the most important levers for key resource productivity initiatives (**Buildings, Transport, Power generation, Water, and Waste**)

Private Sector Opportunities

9 disruptive resource-related trends -

1. ***More expensive supply*** – Average cost per oil well doubled from 2000 to 2010).
2. ***Increasing volatility of resource prices and correlation*** between resources and markets - annual volatility across resources is at its highest level of the past 100 years.
3. ***Rising environmental costs potentially impact on yields*** of greater than 10 % in next 20 years.
4. ***Increasing geopolitical concerns*** – over 80 % of available arable land is in countries with infrastructure or political problems.
5. ***Public policy move to reduce subsidies and to price for the true cost of resources*** - current subsidies for agriculture, energy, and water total up to \$1.1 trillion per year.
6. ***Maintaining social license to operate*** is a top-four issue for metals/mining executives.
7. ***Supply-chain efficiency opportunities*** - Creating the ***circular economy*** - Shifting business models from “consumer” to “user” strategies; Rethinking design; Improving effectiveness along the materials stream; Making it happen.
8. ***Technology becoming an increasing source of competitive advantage*** (Learning curves for renewable power sources range from 10 to 20 percent)
9. ***Customer demand for more resource-efficient products*** (Half of shoppers consider green attributes in their purchasing decisions.)

Consumer Packaged Goods (CPG) have some of the highest energy savings opportunities of any industry, by 20 to 50 % on average. Three key strategic implications :

- (a) Creating new partnerships across the value chain
- (b) Pursuing more sophisticated operational risk management
- (c) Strategic sourcing of critical inputs

Mining + Oil and Gas

- (a) China’s growth rate or an accelerated reduction in resource intensity would have a marked negative impact on the mining sector.
- (b) The cost of extraction is likely to continue to rise, driven by labour expenses and the need to access increasingly distant reserves that are frequently of declining quality.
- (c) Growing regulatory pressure

- (d) Many resource-rich countries are today demanding more in exchange for access to their resources

Responses

Capturing resource productivity opportunities; Managing composition of business portfolio; Deciding how to participate in the shale gas opportunity; Improving capital productivity; Pursuing more sophisticated environmental risk; Pursuing more sophisticated regulatory risk management.