"A Big Conversation" Suggests

Big Questions and *Big Answers*

4 Questions

1. **Why Are We Here?**
2. **Where Are We?**

   Situational Assessment
3. **Where Do We Want to Go?**

   Vision
4. **How Do We Get There?**

   Strategy

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Big Question #1:

"Why Are We Here"?

Helping Plastics Realize its Promise to be a Vital Part of the Circular Economy

MBA POLYMERS
BECAUSE SUSTAINABILITY MATTERS

Material Solutions
Delivering resource efficiency solutions

evōk INNOVATIONS

Dr. Mike Biddle

Founder and Board Member, MBA Polymers

CEO, Material Solutions

Managing Director, Evok Innovations

1. Why Am I Here?

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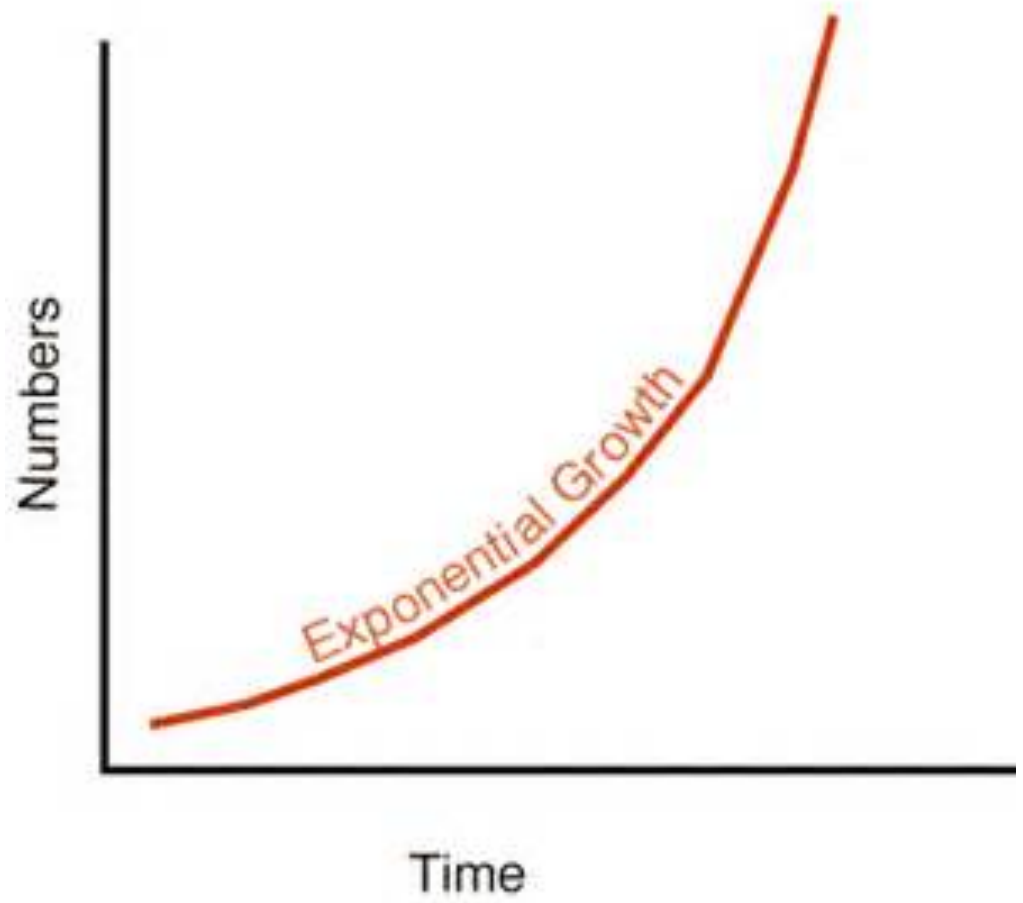
$$x(t) = x_0 \cdot e^{kt} = x_0 \cdot e^{t/\tau} = x_0 \cdot 2^{t/T} = x_0 \cdot \left(1 + \frac{r}{100}\right)^{t/p},$$



It’s getting a wee bit crowded

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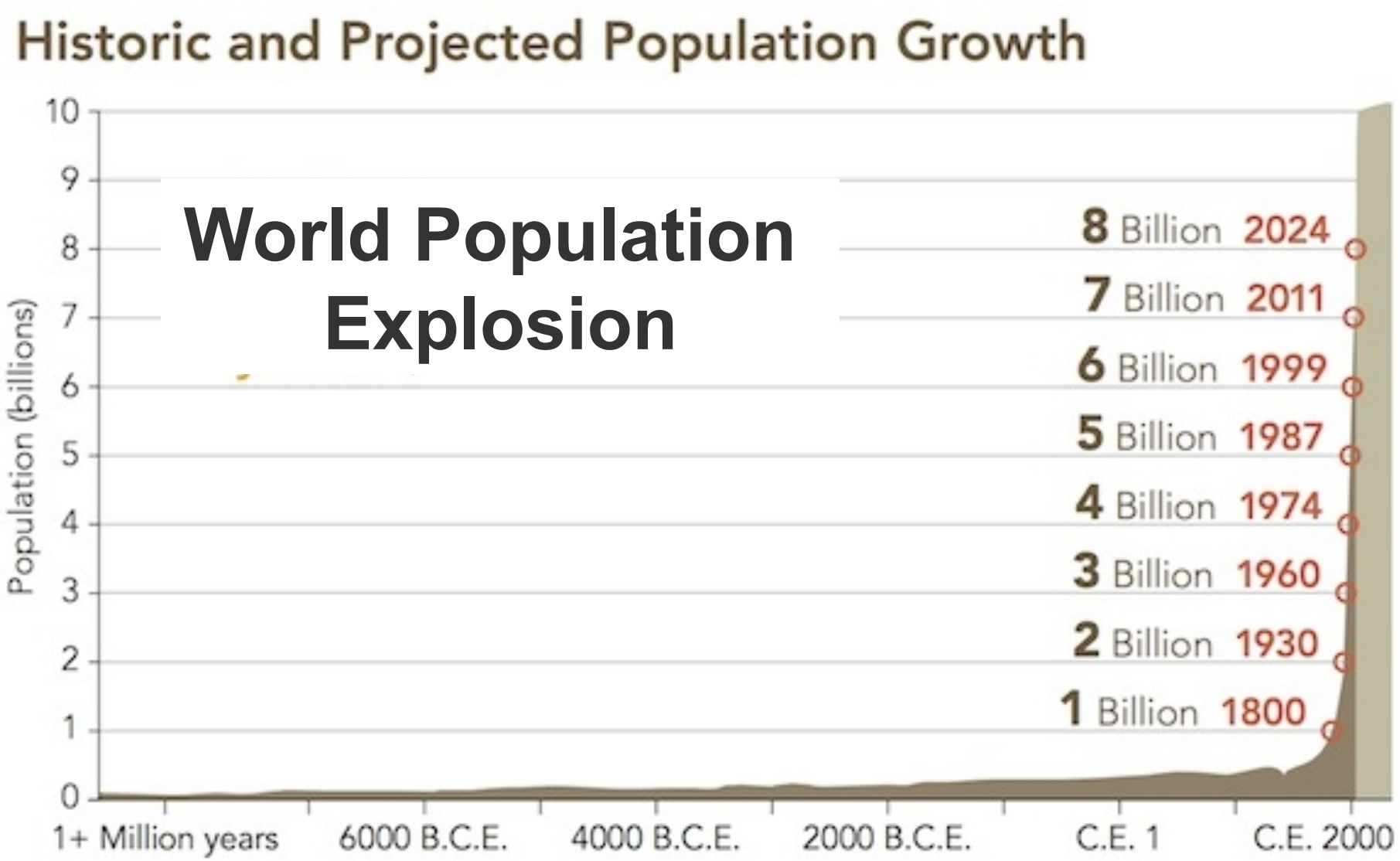

Especially for other inhabitants

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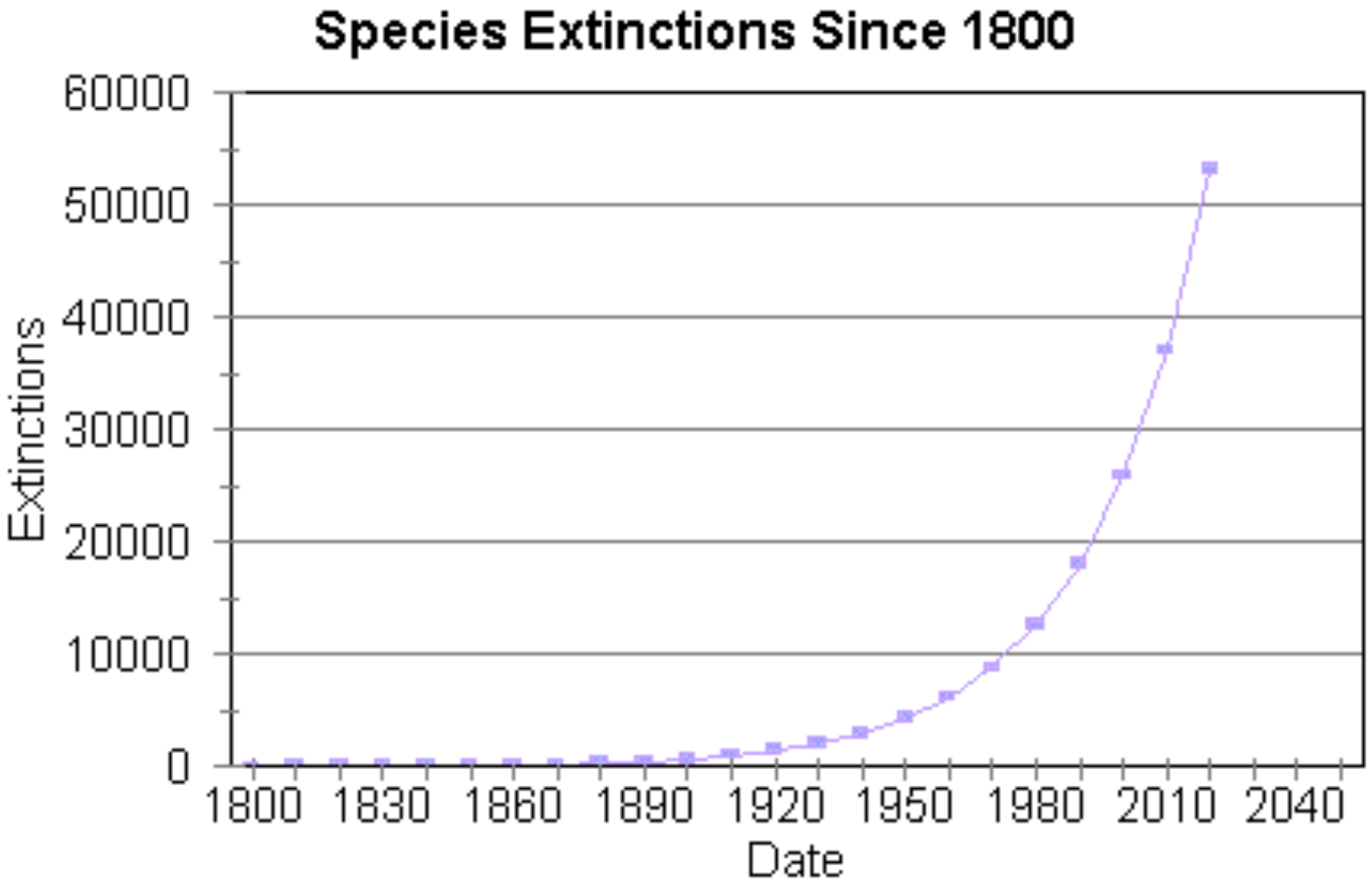

Might these be related in some way?

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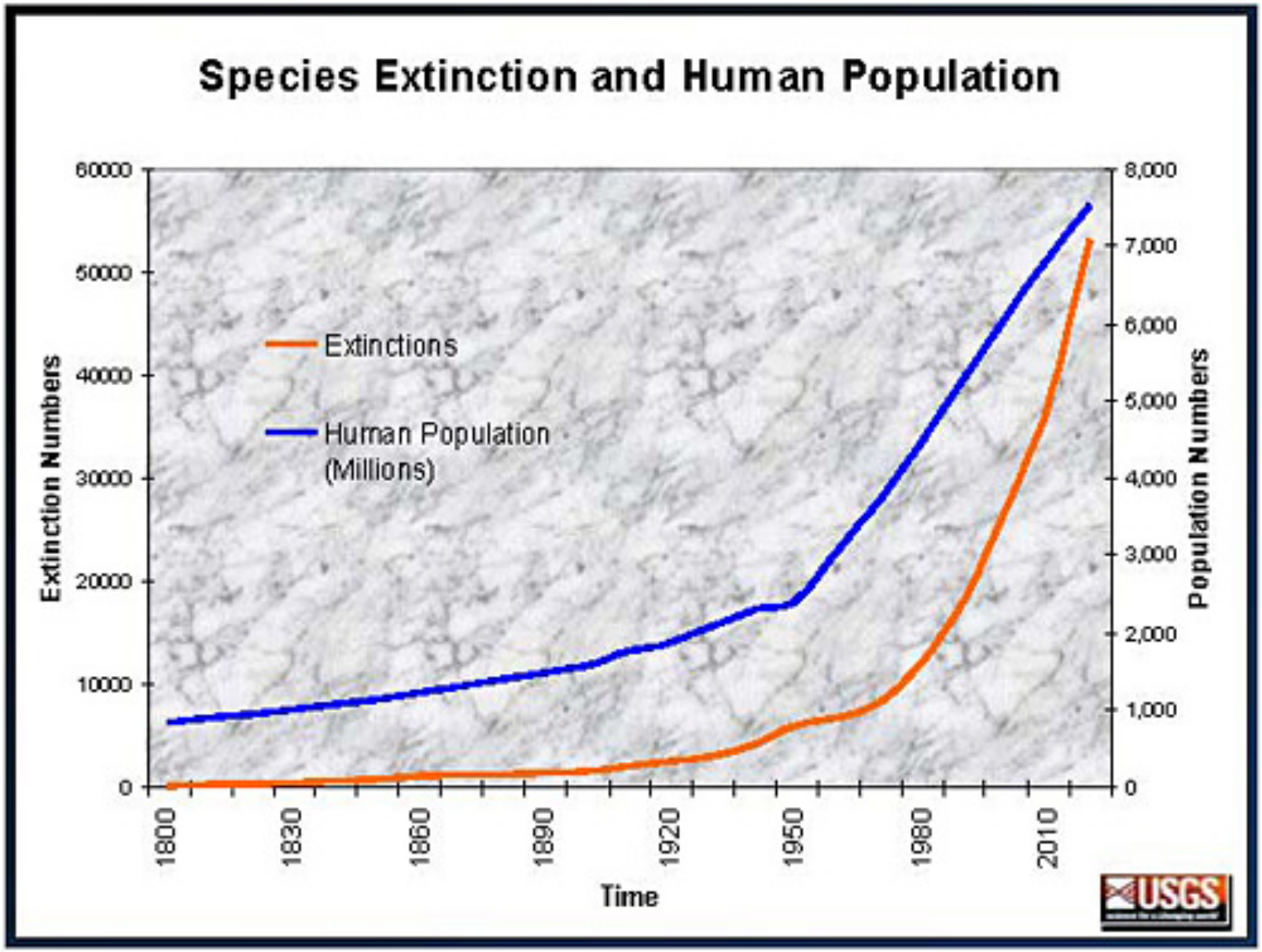


HABITAT LOSS & CLIMATE CHANGE POINT TO 6TH GREAT EXTINCTION...
– STUDY
WE'RE GONNA NEED A SMALLER BOAT.
AUTH
G.30.14 NEWSWORKS.ORG UNIVERSAL UCLICK

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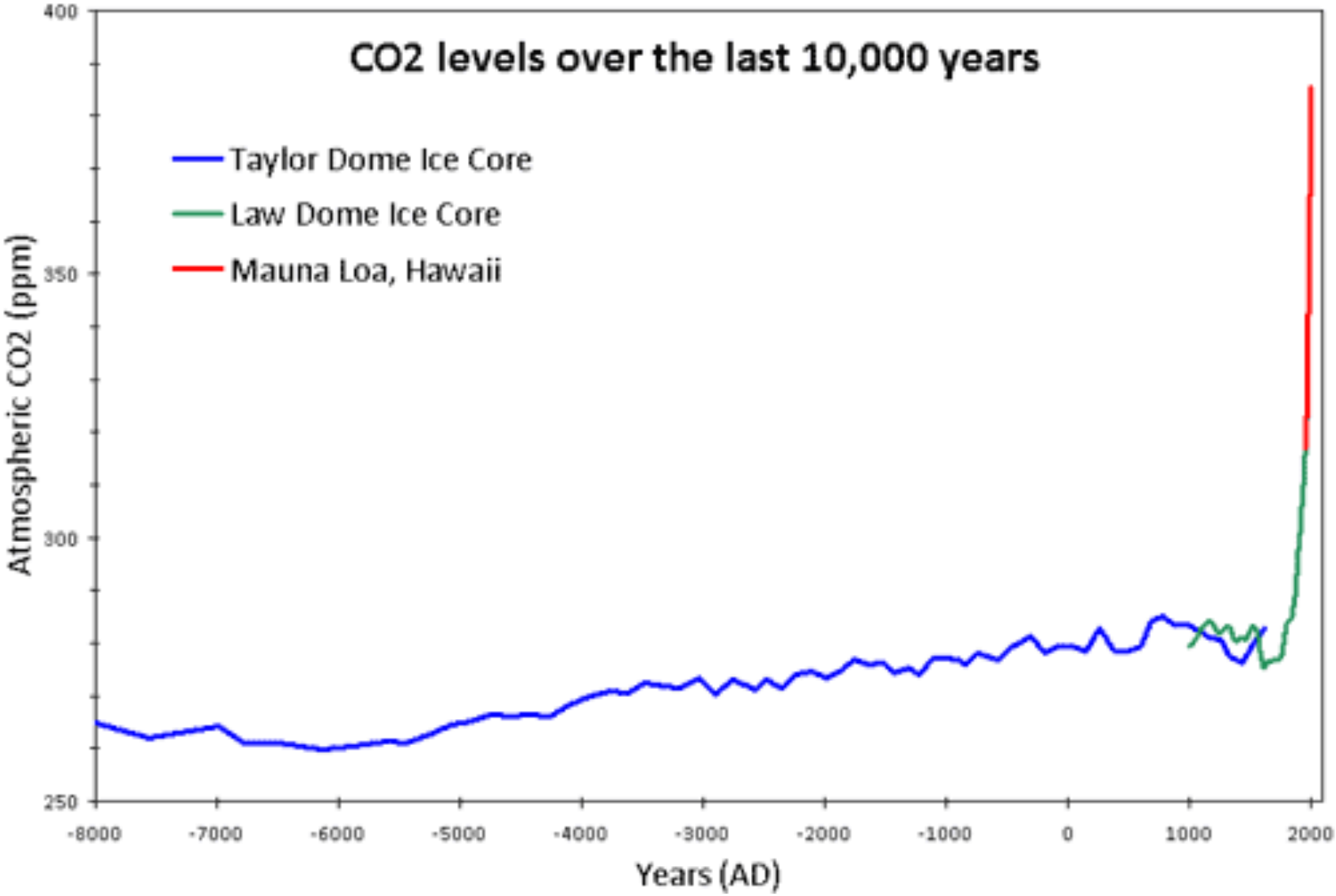
But at least we have a blanket,

Albeit rather invisible – especially to certain US Politicians



Invisible, but rather warm

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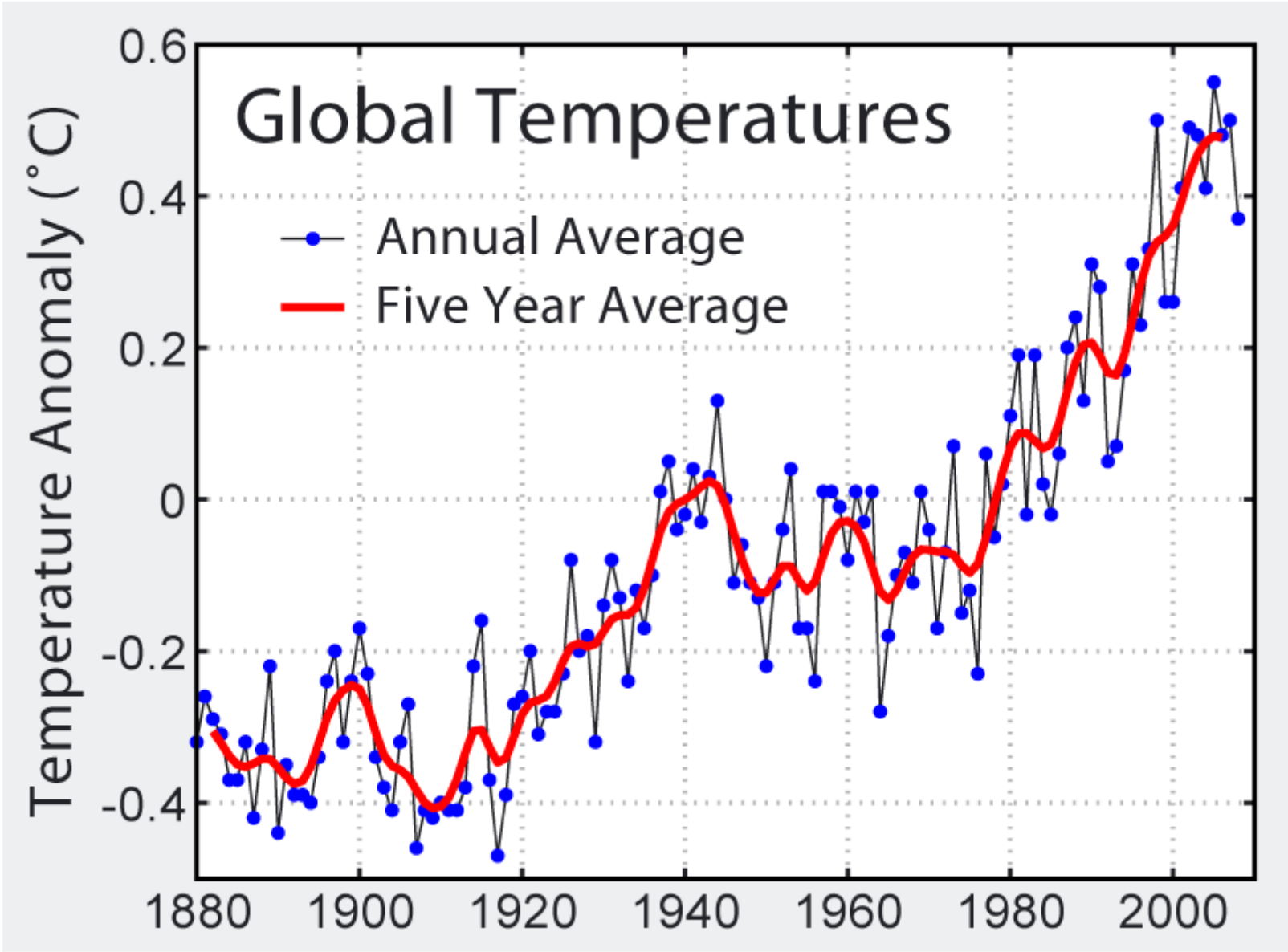

And fish are getting even warmer

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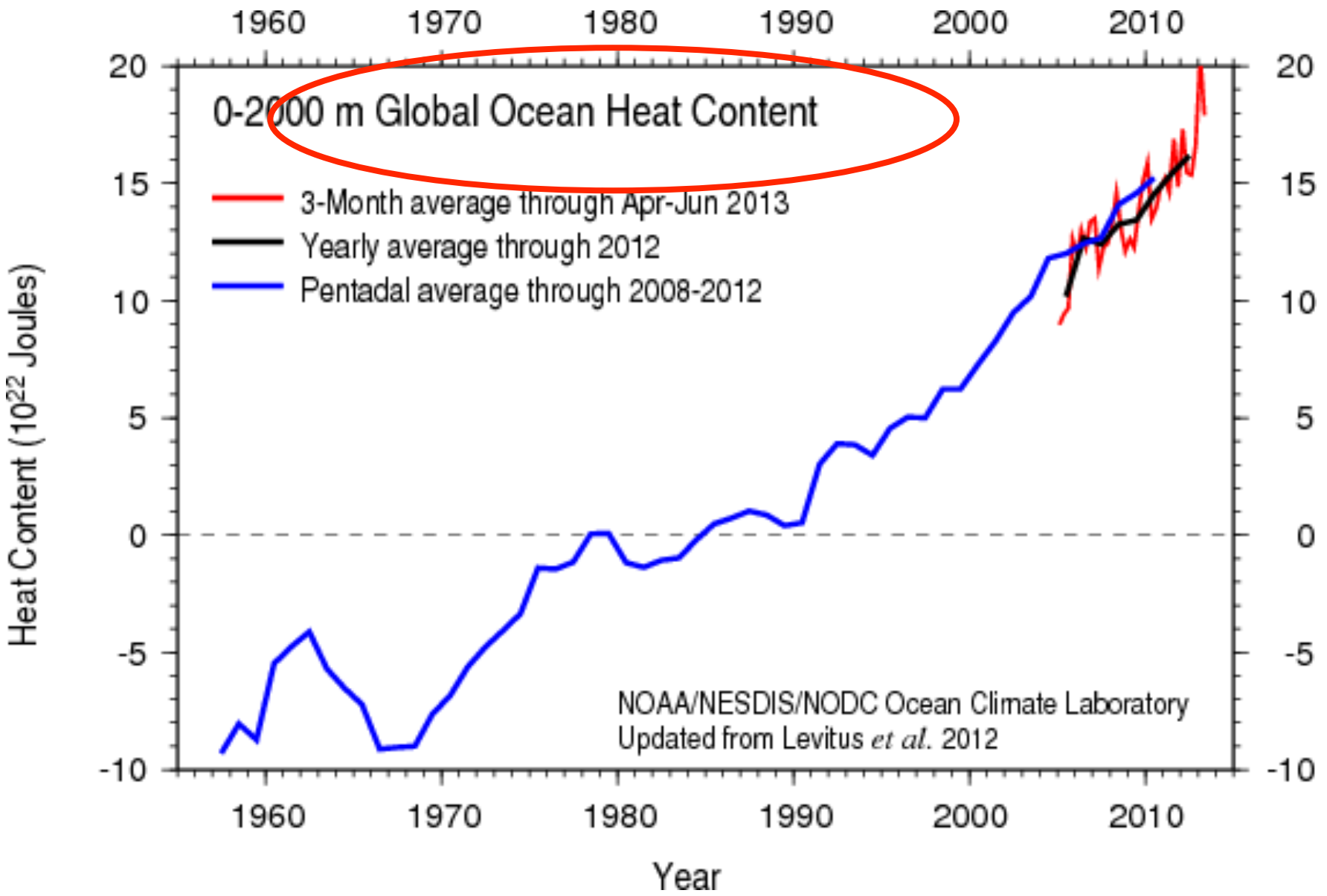


2. Where Are We?

Climate

In Deep

Panel on Climate Change (IPCC)1 2014 findings that to ensure a better-than-even chance of remaining below a 2°C temperature rise, global **annual emissions will need to be reduced 42%–57% by 2050** (relative to 2010), and **73%–107% by 2100**. This will entail, more than any other factor, the profound transformation of energy systems through steeply reducing carbon intensity in all sectors of the economy. We call this transition "deep decarbonization" and our products, **Deep Decarbonization Pathways** (DDPs).

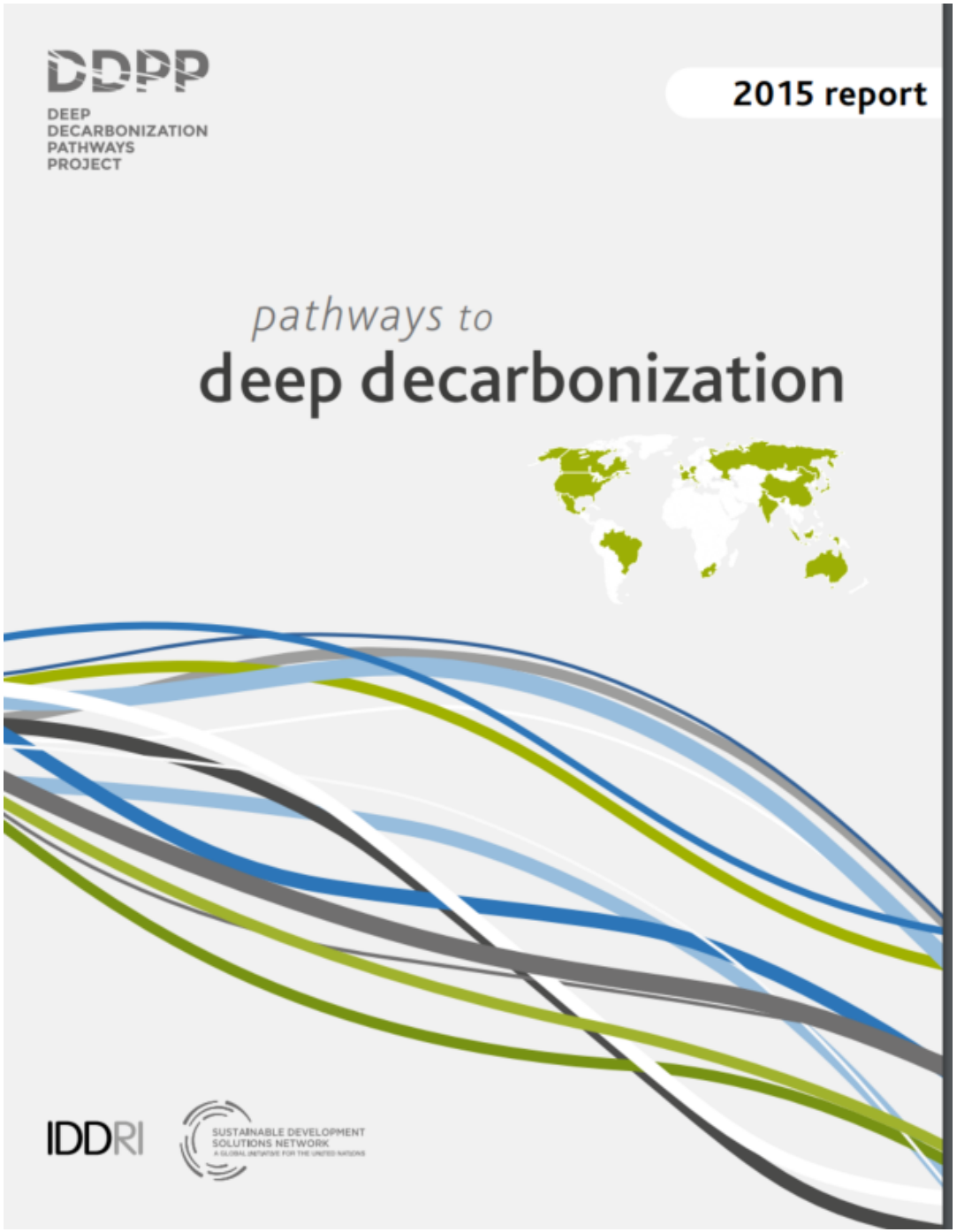
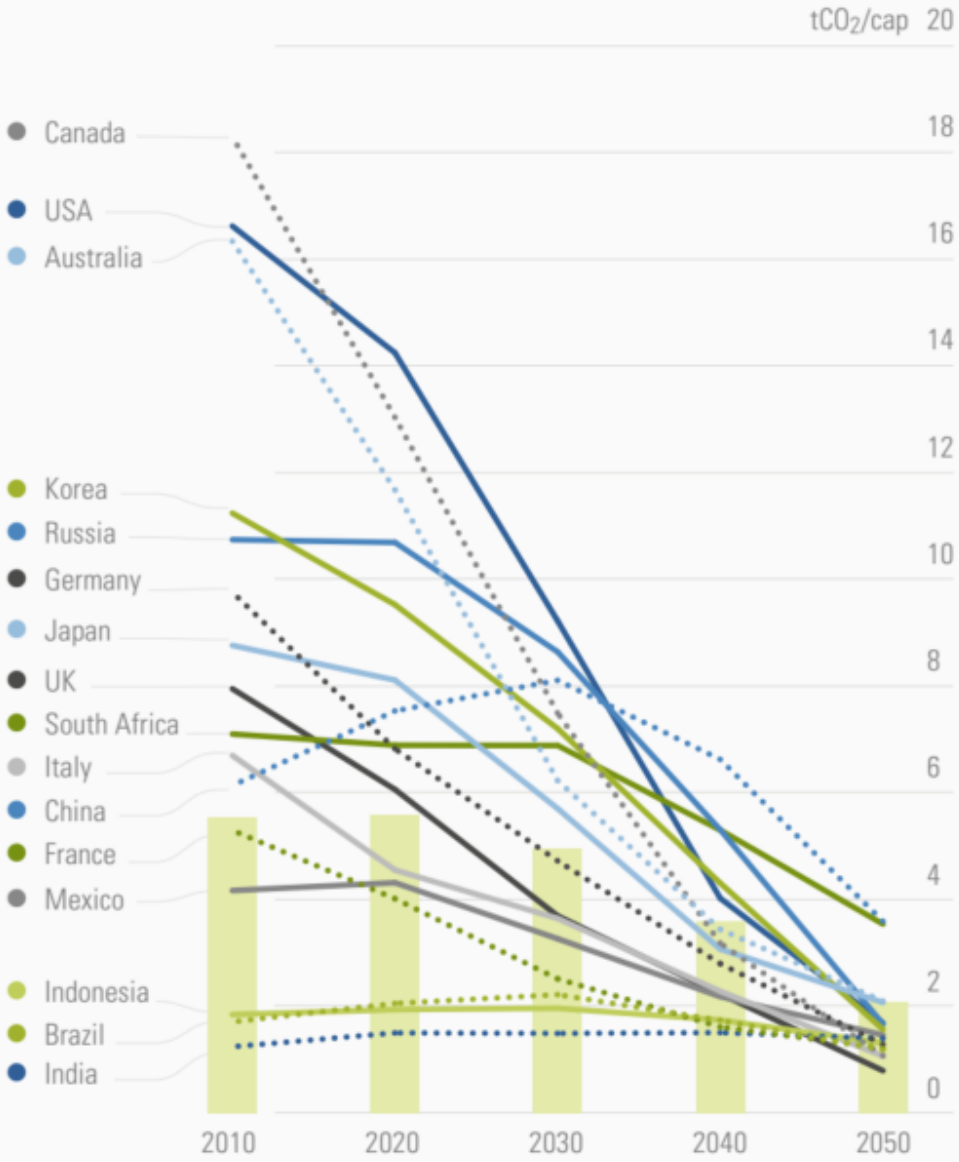


Figure 4. (L) Energy-related CO2 emissions per capita for DDPP countries, (R) Energy-related CO2 emissions per unit of GDP for DDPP countries 2010 to 2050, indexed to 2010.



a. Emissions per capita

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Likely getting even hotter

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"Despite the global community's best intentions to keep global warming below a 2°C increase above pre-industrial climate, higher levels of warming are increasingly likely. Scientists agree that countries' **current United Nations Framework Convention on Climate Change emission pledges and commitments would most likely result in 3.5 to 4°C warming**."

What if we go over?

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2. Where Are We?

Resources

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McKinsey&Company

CARBON TRUST

ARE BUSINESSES SLEEPWALKING INTO A

RESOURCE CRUNCH?

When businesses think that they will need to make significant changes in their business operations to combat resource scarcity

"Meeting global demand for energy, materials, water, and food is an economic imperative"

US military:

"Resource Scarcity could increase wars, conflict"

McKinsey&Company

Are You Ready for the Resource Revolution?

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Financial and Environmental Consequences

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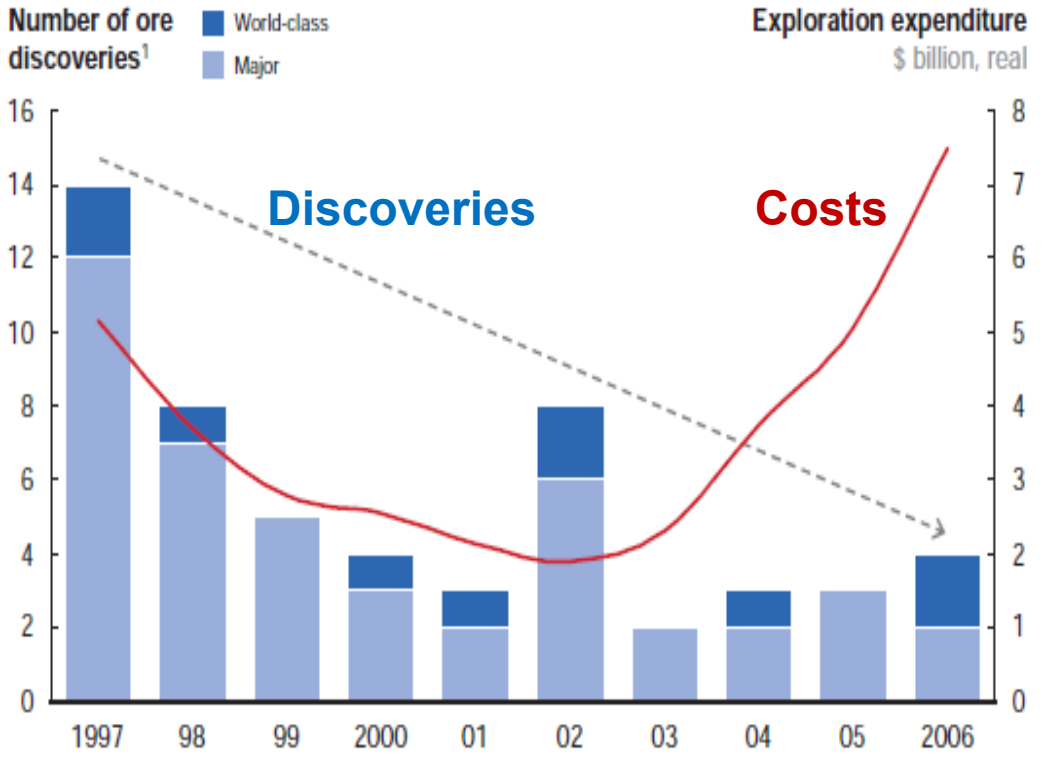
Replenishing reserves of materials is increasingly difficult and expensive



1 All metal and mining materials; latest data available to 2006.

SOURCE: BHP Billiton; USGS; MEG Minerals 2009

Steel Supply Gap Filled by Recycling

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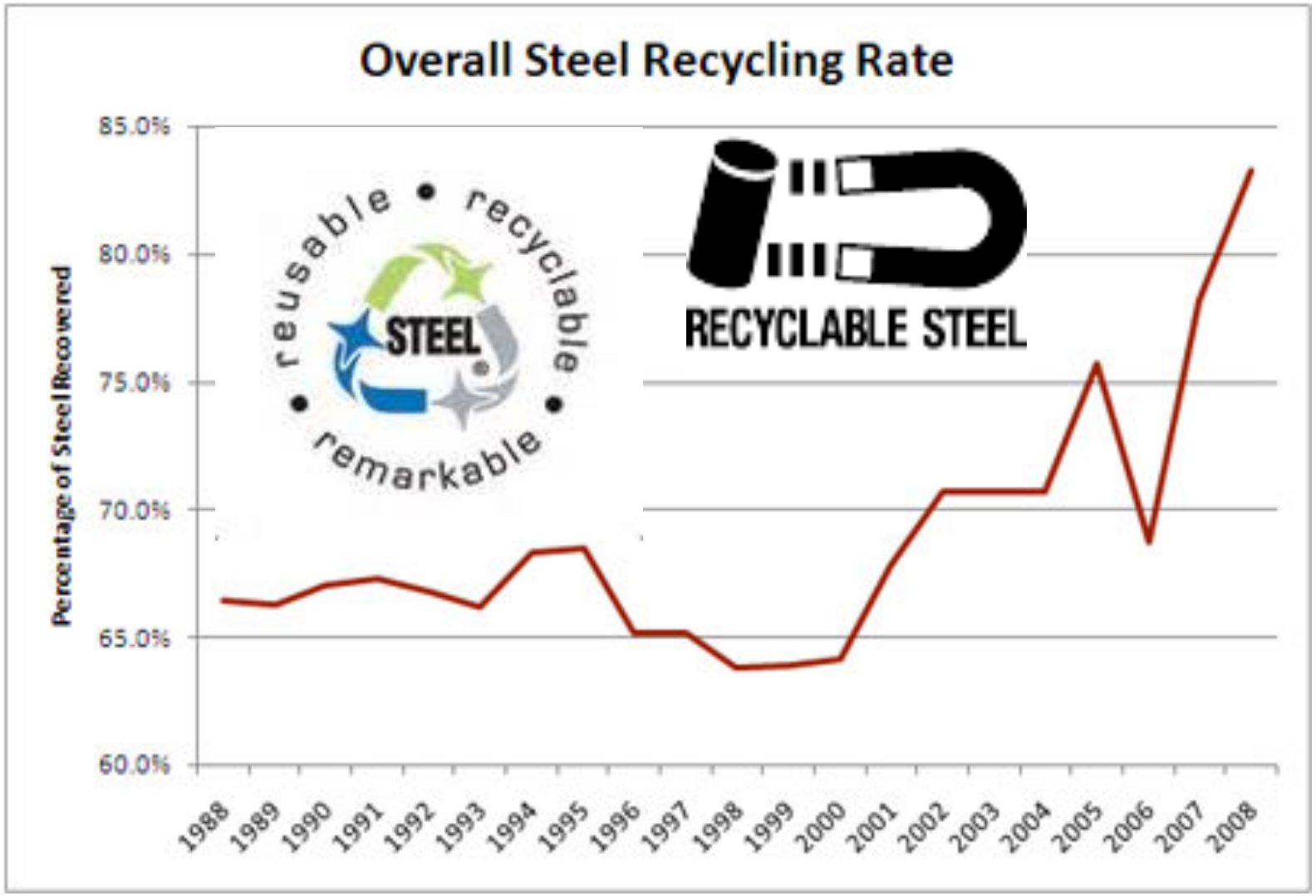

Plastics have Grown Faster than most Materials

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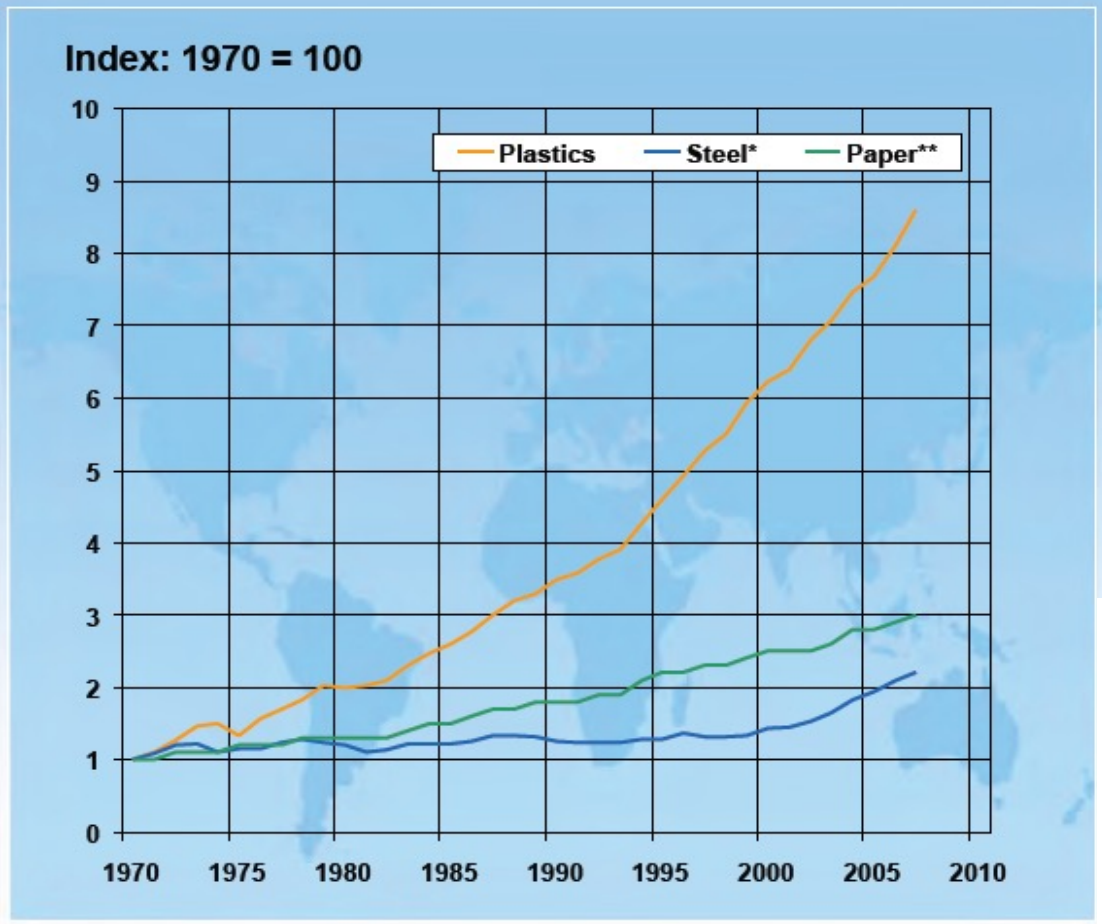
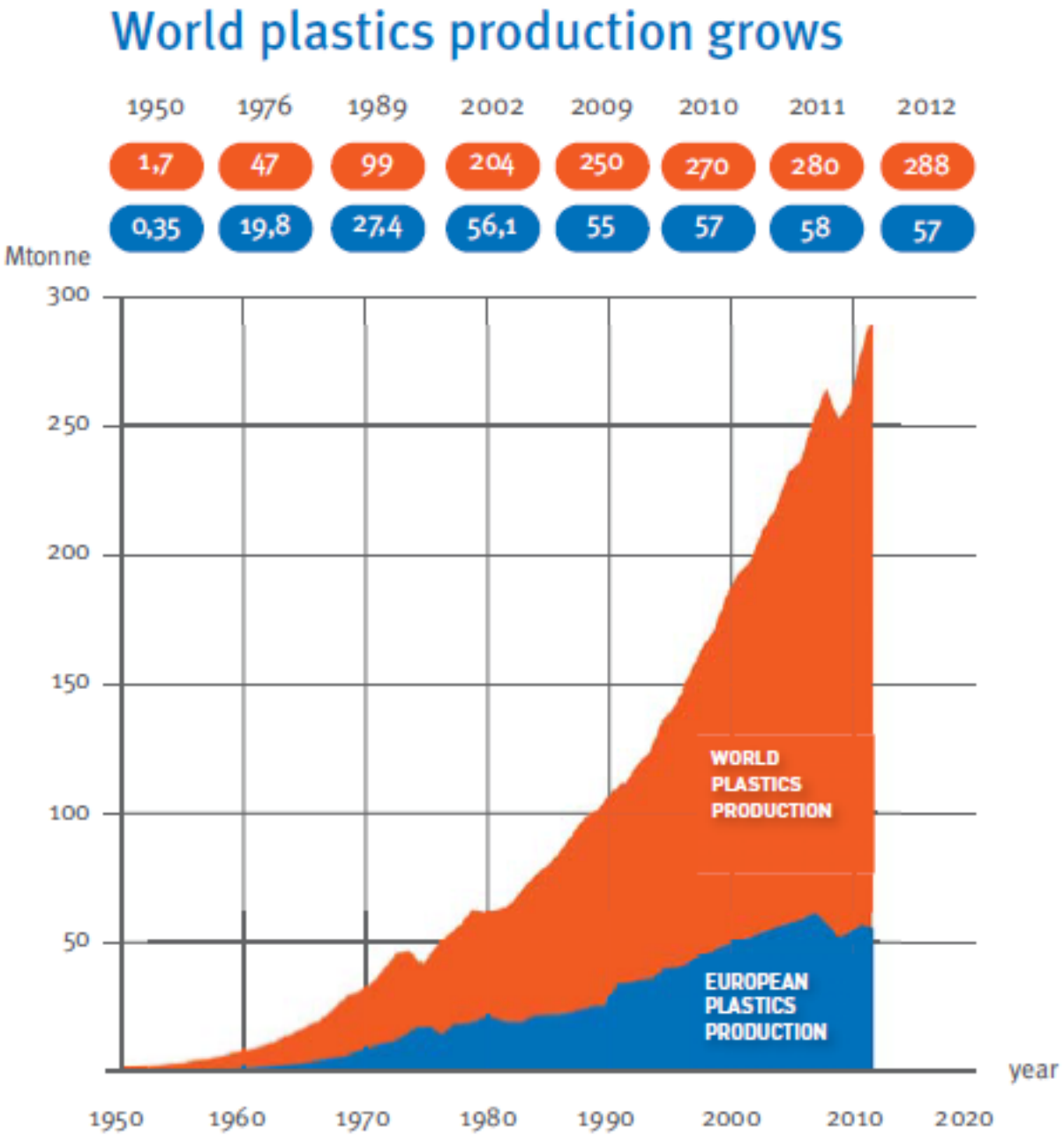


- **Plastics** have outgrown competing materials such as steel and paper
- **Compound Annual Growth Rates (CAGR):**
  Plastics 6%
  Steel 2%
  Paper 3%

Worldwide Yearly Consumption:

- **> 600 Billion Pounds**
- **280 Million Metric Tons**

Source: *Stahl-Zentrum/International Iron and Steel Institute (IISI)
**Verband Deutscher Papierfabriken e.V. (VDP)



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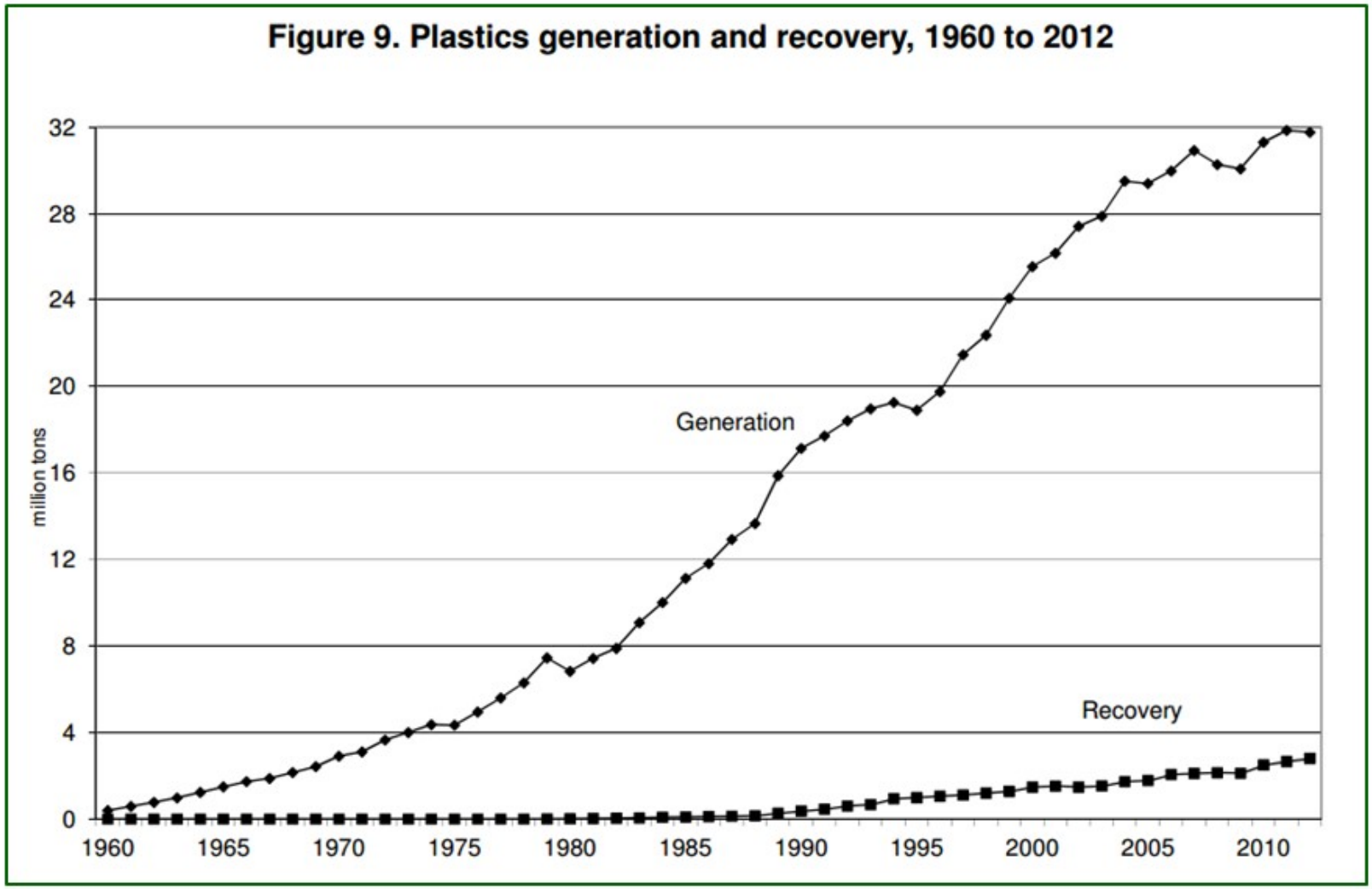
This part of the World Plays an extremely important role in getting it right



SOURCE: US EPA "Municipal Solid Waste in the US: 2012 Data"

Most “Difficult” Plastic Streams are often sent to China for Recycling

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Photos from Scrap Magazine

Despite the large volume of people, trucks, and emaciated stray dogs, the boulevard is entirely barren. It's a dead zone.

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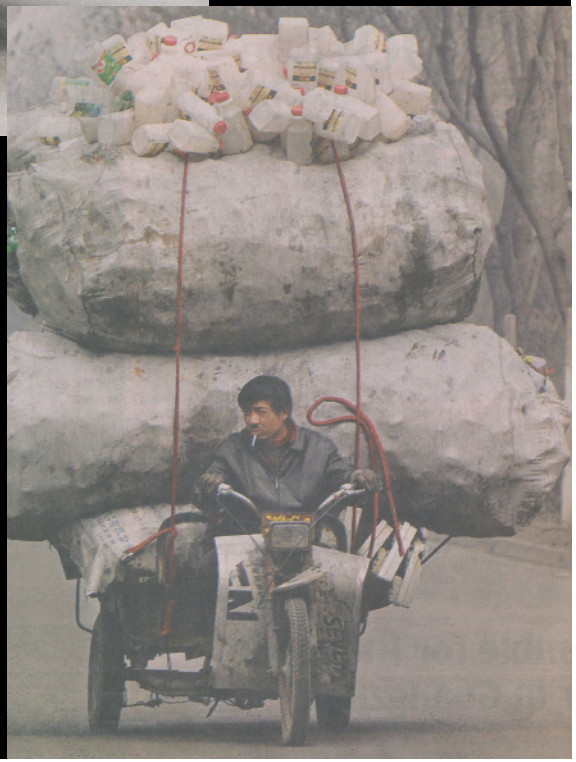

Often the recyclers in developing countries are concentrating the plastics waste near streams

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Photos: Basel Action Network

Often the recyclers in developing countries are concentrating the plastics waste near streams

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Photo from Basel Action Network (BAN), www.ban.org

Photo from www.foxnews.com

Rivers are "self-cleaning"

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"OMG! How Could They Do This?

Photo: "Trashed", the movie

Photo: China Whisper, Peter

NIMBY
Environmental Arbitrage

Photo: The Hindu, Photo: M. Govarthan

2a. Is THIS What We Want for Recycling?

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From Wang Jiuliang Documentary “Plastic China”

2a. Is THIS Really Low Cost Recycling?

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From Wang Jiuliang Documentary “Plastic China”

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Campaign Against The Plastic Plague

Plastic: The Ocean's Deadliest Predator

We Hate Plastics

PLASTIC IS RUBBISH

why we boycott plastic....

Anti-Plastic Bottle Week

BAN THE BOTTLE

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Would ENDING our relationship with Plastic be a GOOD thing?

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Resource efficiency of plastics in the automotive sector
Fender case study: plastics versus traditional materials

Source: Beyond "carbon footprint": The contribution of plastic products to various resource savings – denkstatt GmbH, Vienna, 2012

What about packaging?

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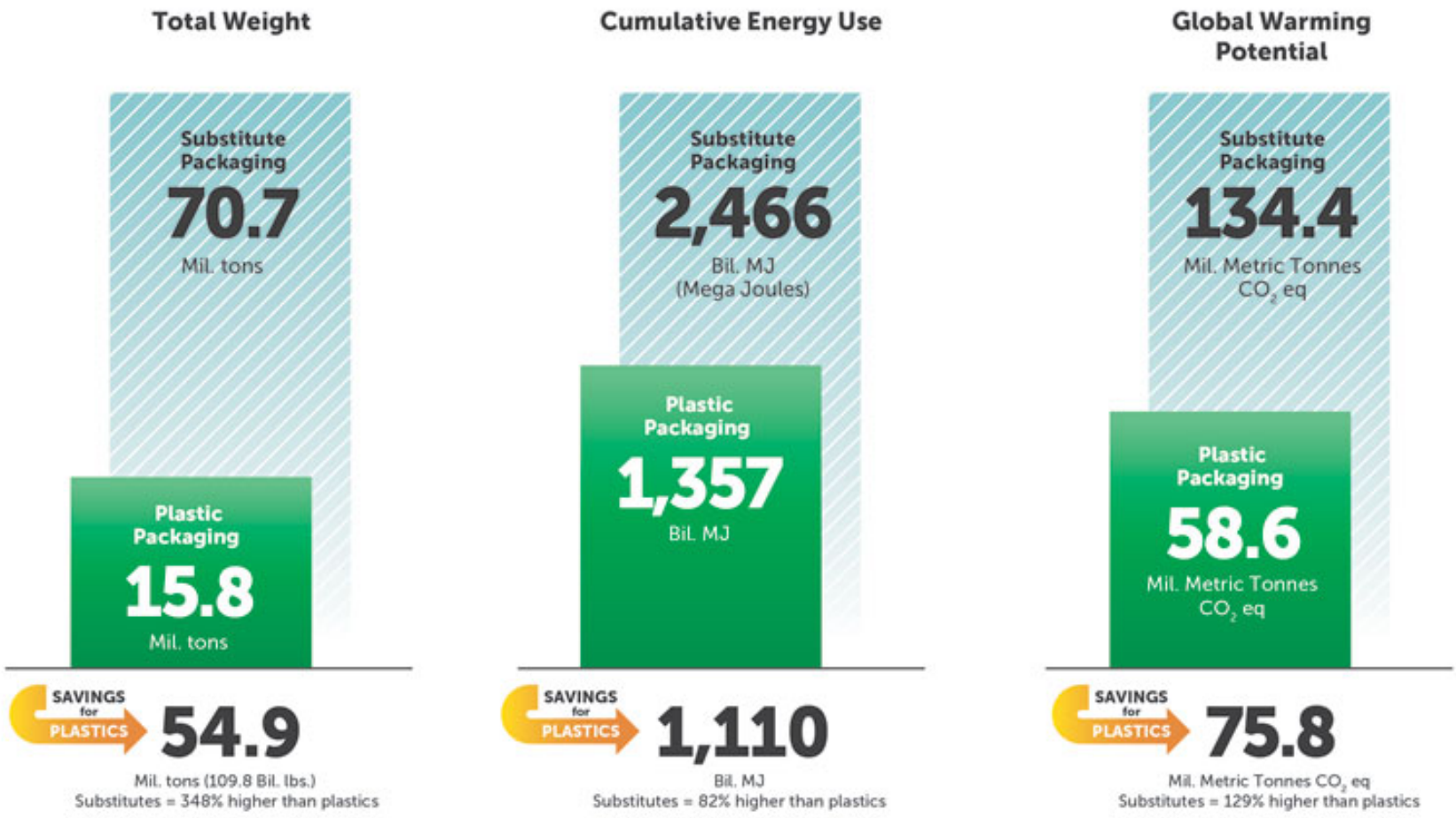
Common Plastics Packaging Helps Reduce Package Weight, Energy Use and GHG Emissions in U.S.



Source: "Impact of Plastics Packaging on Life Cycle Energy Consumption & Greenhouse Gas Emissions in the United States and Canada," Franklin Associates 2014. Study based on 2010 data. This study measures energy use and GHG emissions and is not an ISO 14044 life cycle assessment.

2. Summary: Where Are We?

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Plastics have become ubiquitous in our lives –

for sound economic and environmental reasons

Increasing demand on resources is likely to drive up most resource costs in the long term

Recycling of plastics lags behind other major materials

Plastic waste, particularly in our oceans, has become an emotional catalyst for anti-plastics sentiment

The public has become increasingly unclear about the role of plastics in their lives

3. Where Do We Want to Go with Plastics?

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The Public once again considers Plastics to be:

One of the 'Coolest' Materials on the Planet

We continue to enjoy plastics' ability to deliver products and function in a resource efficient manner

We better manage plastics at end of use

4. How Do We Get There?

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Responsible Waste Management

We Must First Start Looking at Waste Differently

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How Do We Get There?

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Responsible ~~Waste~~ Resource Management

- **Collect and aggregate more**
- **Biodegradable plastics for products not likely to be collected**
- **Recycle more**
- **Energy recovery/WTF for what can't be recycled**

Why is Recycling so important?

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- **80-90% energy savings** compared to virgin
- **2-4 tons of CO_2 savings** per ton of virgin replaced
- Recycling keeps plastics out of **harmful places**
- Recycling can be a **good business**
- **Social License**: It's part of the expected social contract with communities and consumers/citizens if we want to keep using plastics

How Do We Do a Better Job?

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Let's learn from other materials

Let's learn from best practices of existing plastics recyclers

Evolution of Steel Recycling Technology

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Evolution of Steel Recycling Technology

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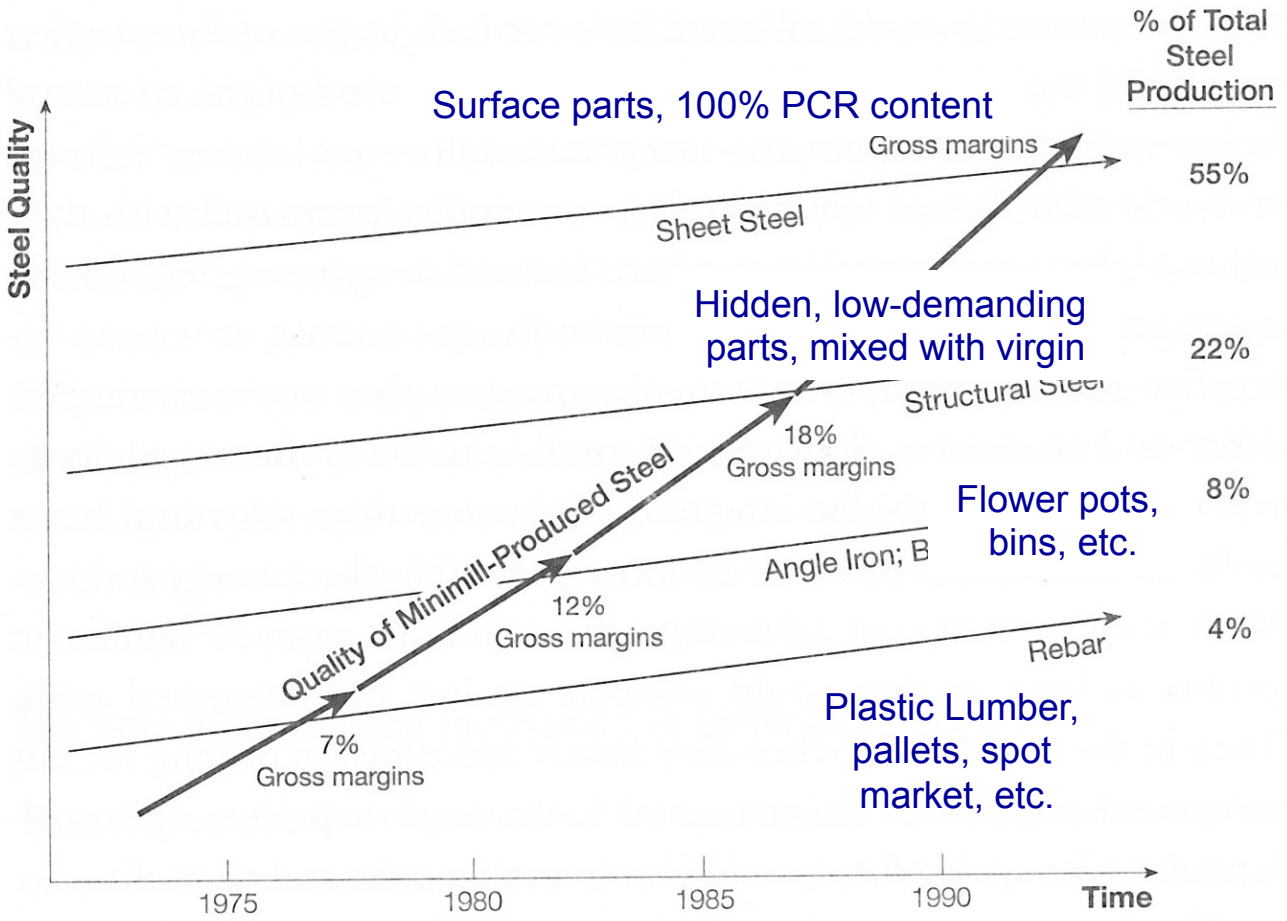
Recycled Plastic is Following Similar Path to that followed by Recycled Steel

From: **"The Innovator's Solution"**, Clayton M. Christensen and Michael E. Raynor, Harvard Business School Press, Boston, MA 2003, pg. 37.



Source: American Iron and Steel Institute; interviews with company executives. Note that the tonnage percentages do not sum to 100 percent because there are other specialty categories of steel.

Evolution of Steel Recycling Technology

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theguardian

What plastic can learn from steel in a circular economy

Virgin metal companies said steel recycling would never get very far.

It did. So can plastic follow in its footsteps?

http://www.theguardian.com/sustainable-business/2015/jan/29/plastic-industry-recycling-learn-from-steel-circular-economy

Sponsored by: PHILIPS

Thursday 29 January 2015 09.24 EST

Mike Biddle is the founder and director of MBA Polymers, and the founder and principal of Material Solutions

Evolution of Household Waste Recycling

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Evolution to Single Stream and MRFs

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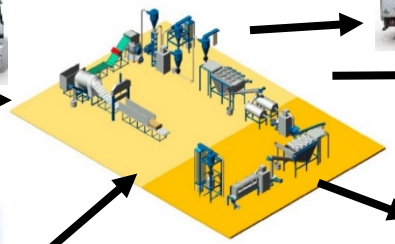
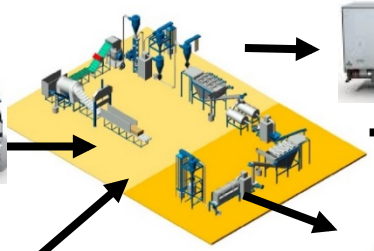
PET - rich



Products

Waste

PE, PP - rich



Products

Waste

mixed plastic residual

- China
- Africa
- SE Asia
- ETC

Waste

The Future will be “less touches”

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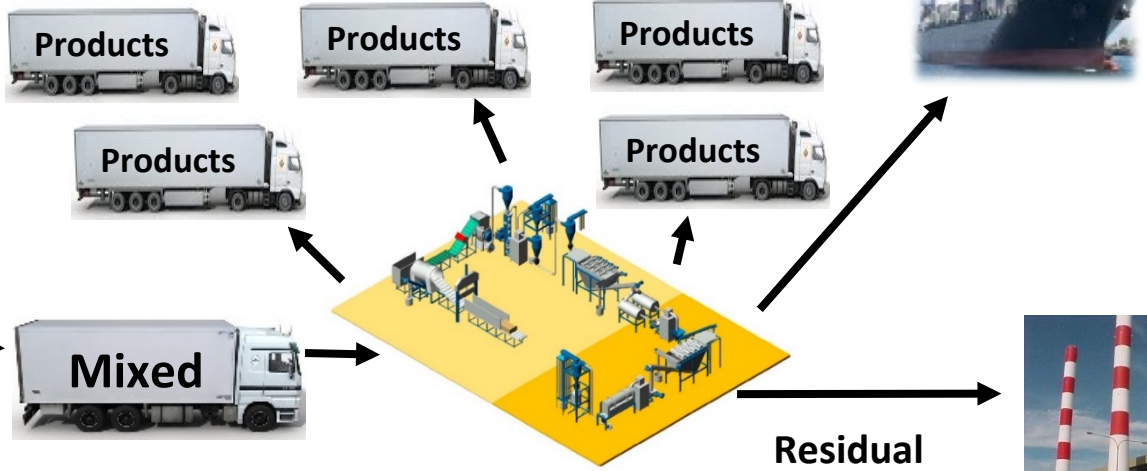
TOUCH IT ONCE AND MOVE ON

The Future will be more <u>Efficient</u> and more financially attractive

Therefore plastics will be more Sustainable



Robust Recycling

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Mixed plastics separations & recycling facilities

Reduces handling and transport costs throughout the supply chain

Lowers CapEx and OpEx costs at MRFs

Larger volumes from each source

Access to a **wider** customer base

Enables the business to **scale**

Robust Recycling

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Economies of Scale

Lower CapEx

Lower OpEx

Access to larger customers/markets

Inbound and outbound transportation more efficient

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Why should we believe this will work?

Additional Resources

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TED
Ideas worth spreading

Plastics Recycling **TED** talk:
http://on.ted.com/j07ad

CNN

CNN: ***The Garbage Man***:
http://ht.cdn.turner.com/cnn/big/business/2014/08/14/spc-make-create-innovate-plastic-man.cnn_512x288_550k.mp4

3 minute **BIG SHFT** video: http://tinyurl.com/cpee3vw

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POPULAR SCIENCE
THE FUTURE NOW

Popular Science: ***"THE GARBAGE MAN"***
http://www.popsci.com/article/science/garbage-man

Recycling Today, Sept. 2014 on what's next for Plastics Recycling:
http://www.recyclingtoday.com/rt0914-michael-biddle-q-a.aspx

recycling today
The Portal to the Recycling Industry