

# The Future of Alternate Proteins

- Some Context -

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# External Forces

Global Population Growth :  
- **“Grow More” on existing land**

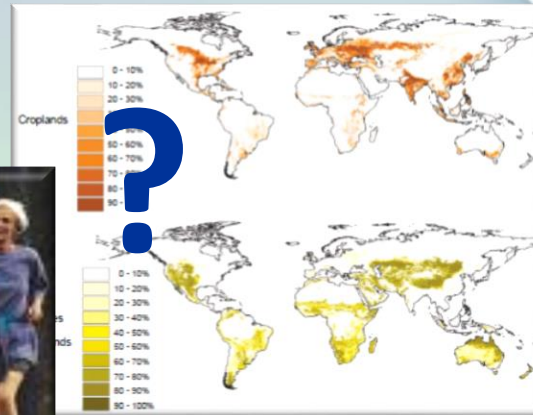


BRIC(today) ≠ BRIC(tomorrow)

- Urbanization, Culture
- **Drives global demand for alternate proteins**



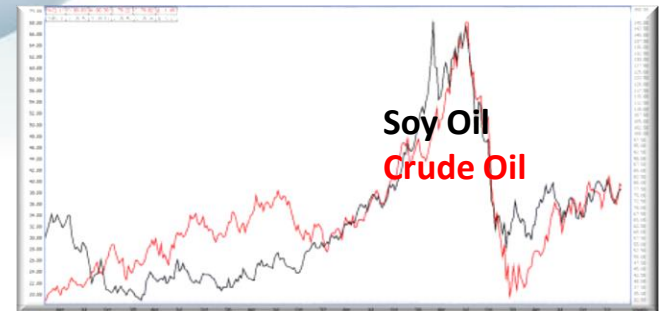
Changing Demographics requires higher Innovations faster.  
**(Product, Package, Delivery)**



Water and Arable Land will be Limited, Sustainability needs continue to increase  
**“Waste less” calories per calorie produced**  
**Impact-Innovation in Meat Space**

**Beyond Taste:**  
Trusted, affordable, healthy

- **Wellness vs. Healthful**
- **Limiters vs. Positives**



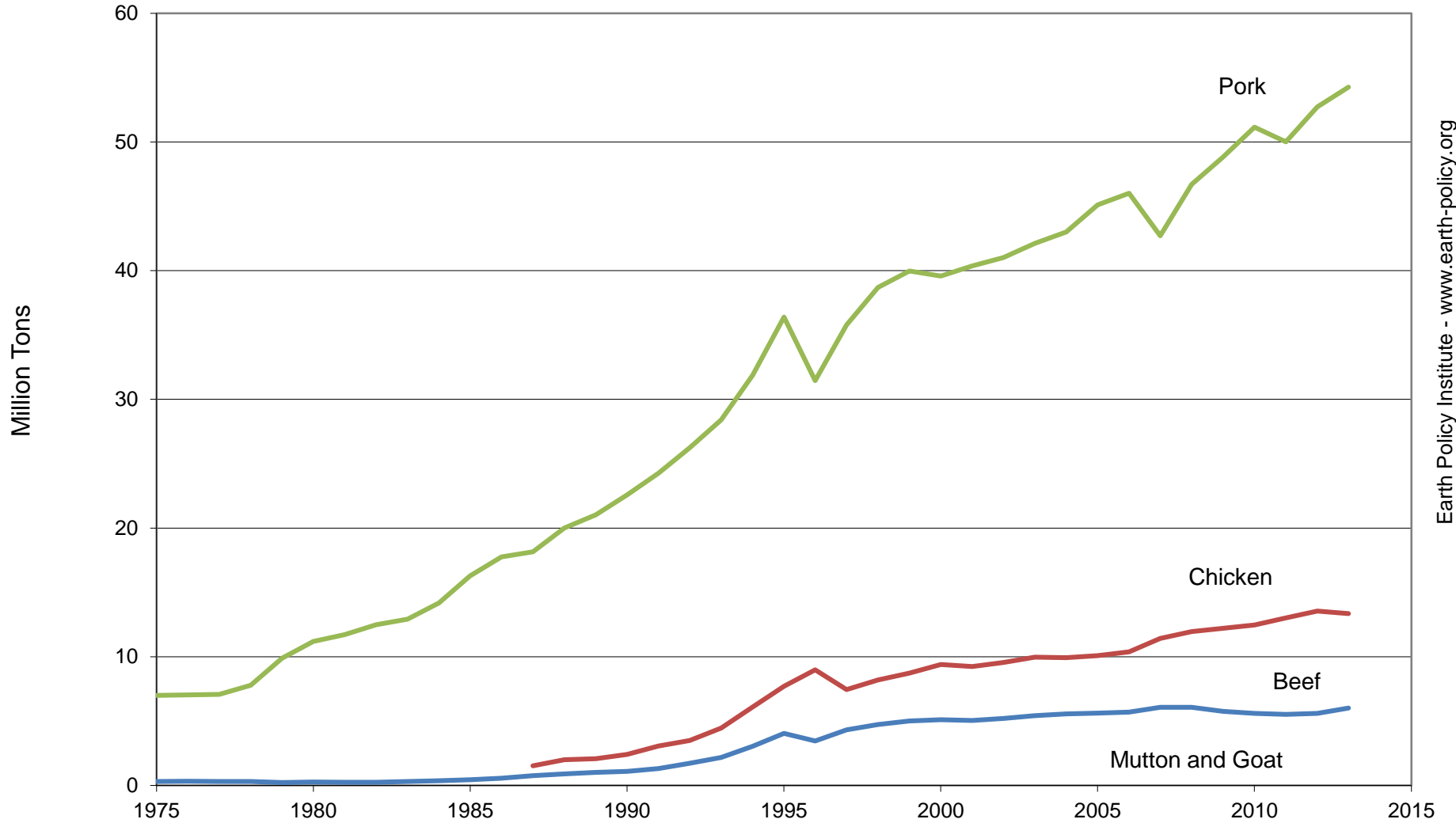
**Commodity Price Volatility:**

- **Mitigation needed through alternate options (land, sea)**

## Facts :

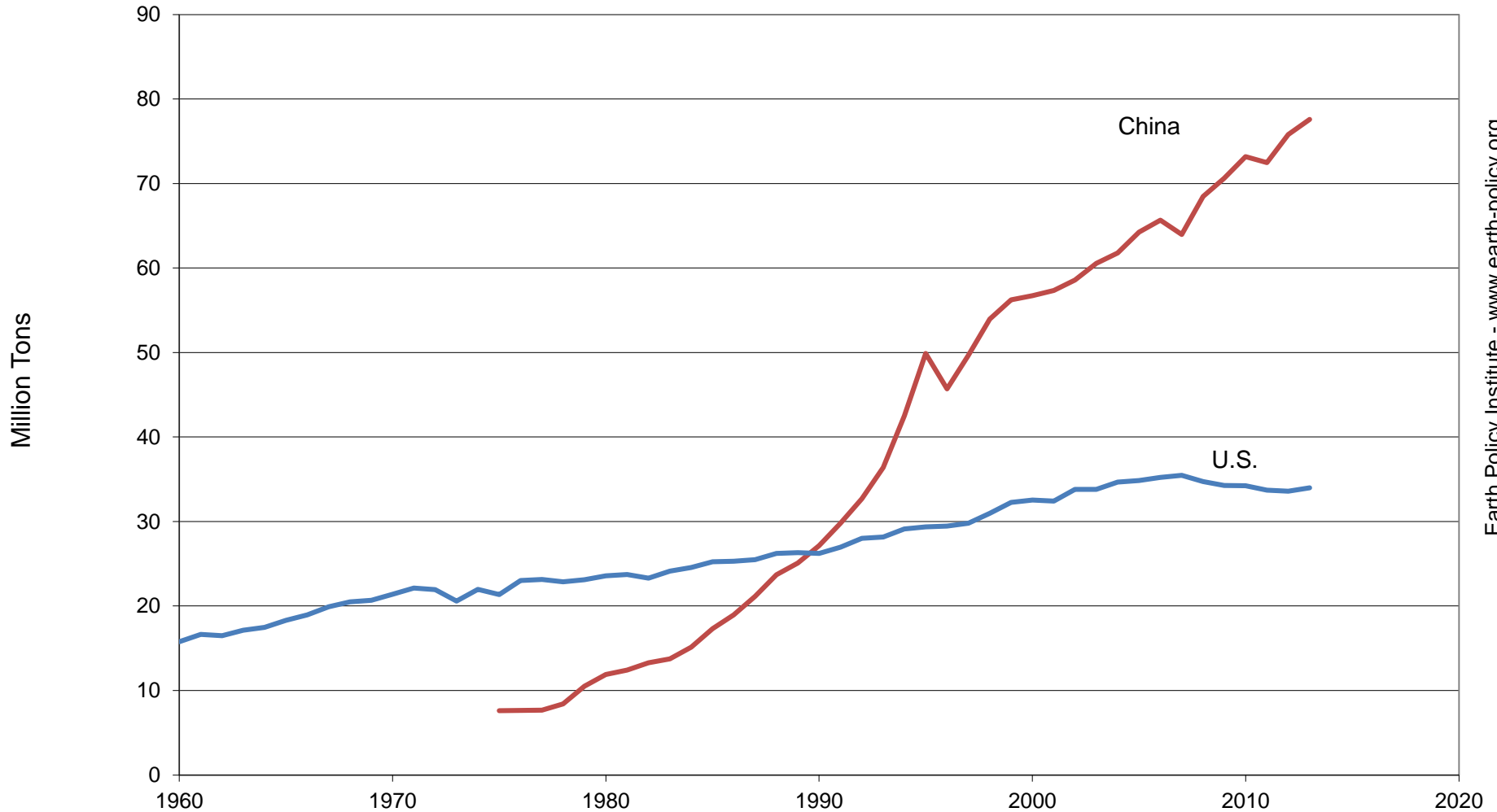
- > 0.5 bio People in South East Asia urbanizing (=changing diet)
  - from chicken to pork to beef to farmed fish (salmon, carp).
- Plus: Global population growth demands more meat
- But: Protein Conversion Factor: 5...12 : 1
- Soy: most effective crop for plant protein production / ha
- Agricultural efficiency increase approaching plateau at 1%
- Algae identified as high potential source for protein alternative

# Meat Consumption in China, 1975-2013



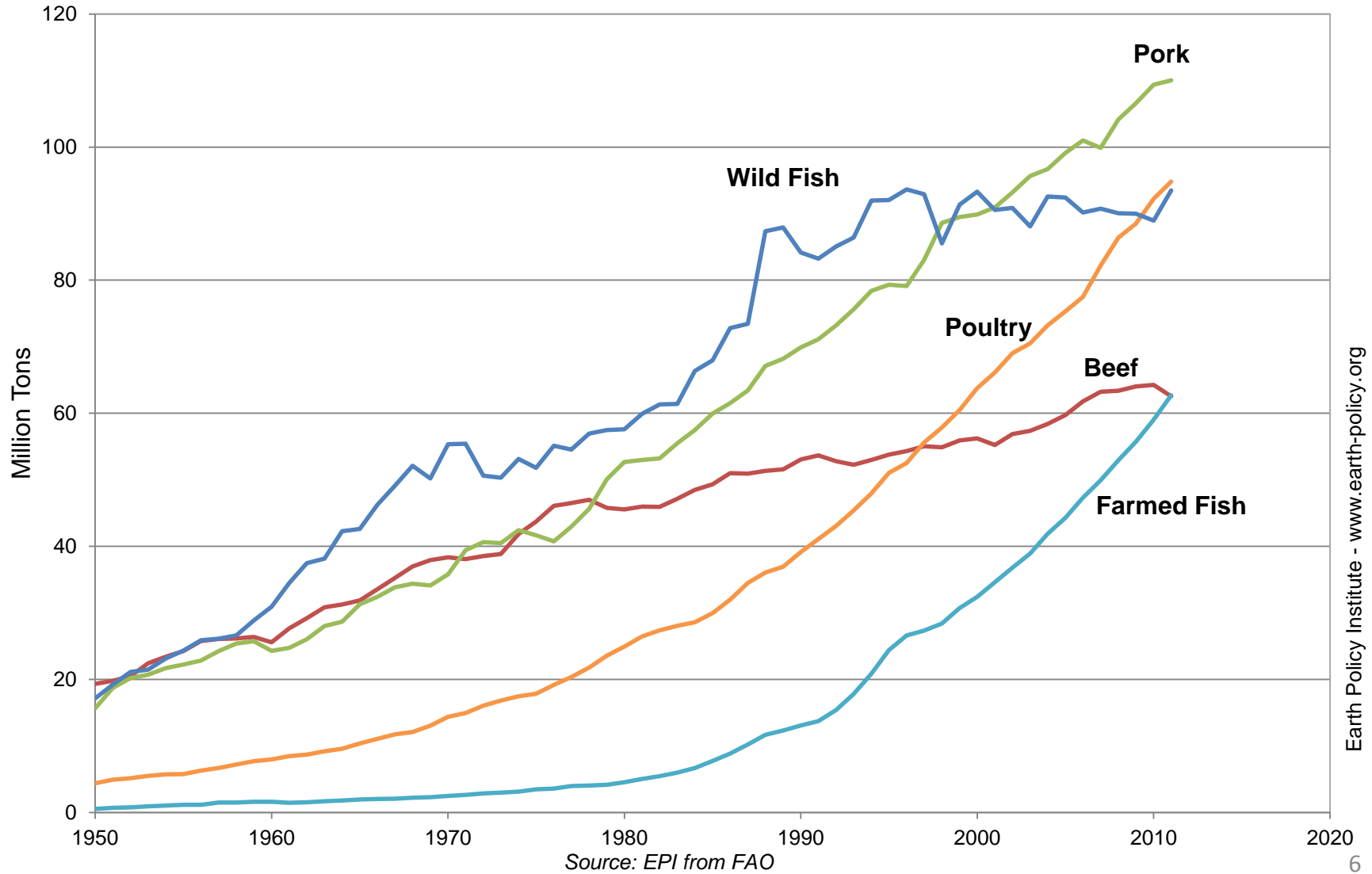
Source: USDA, FAO

# Meat Consumption in China and the United States, 1960-2013

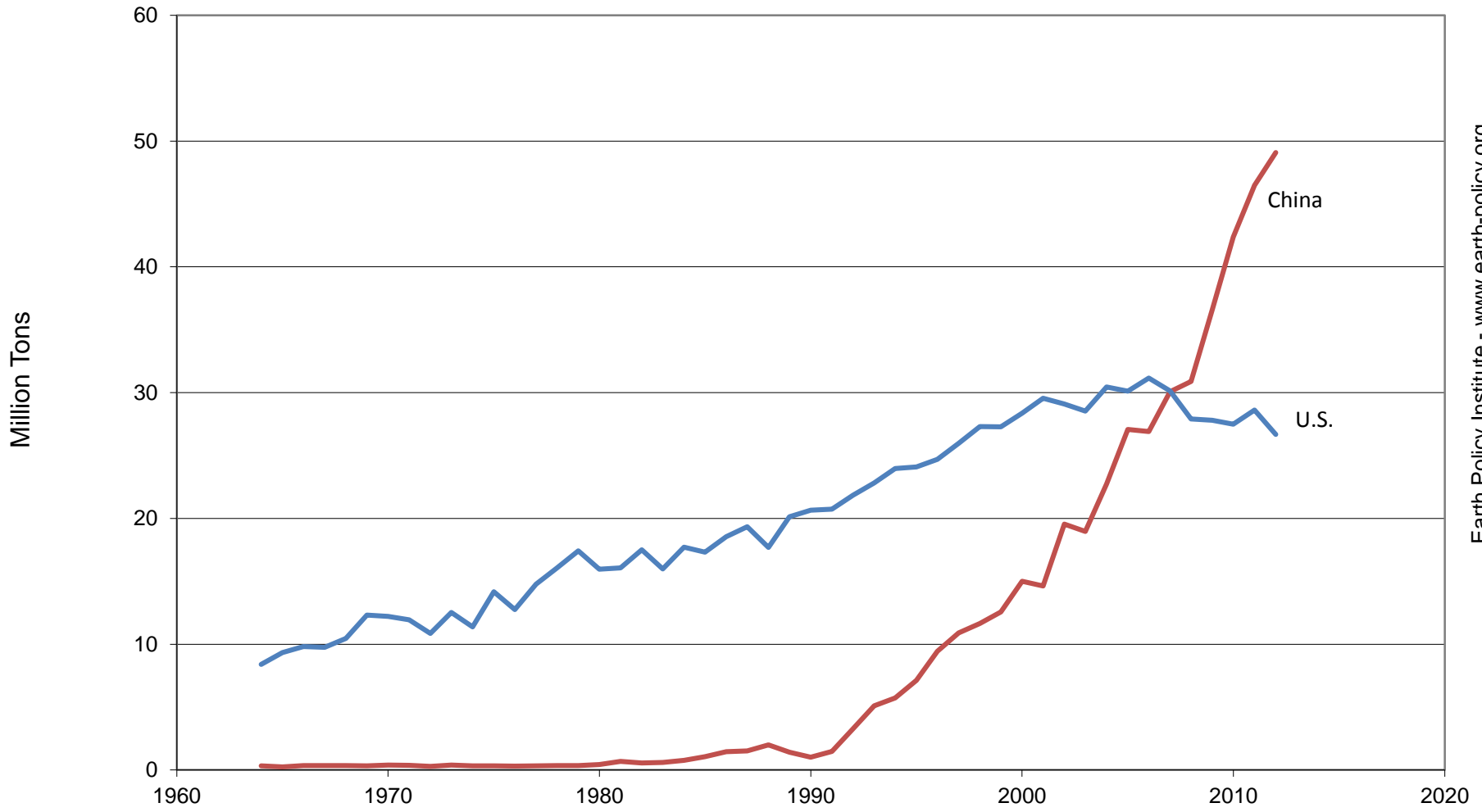


Source: USDA, FAO

# World Animal Protein Production by Type, 1950-2011

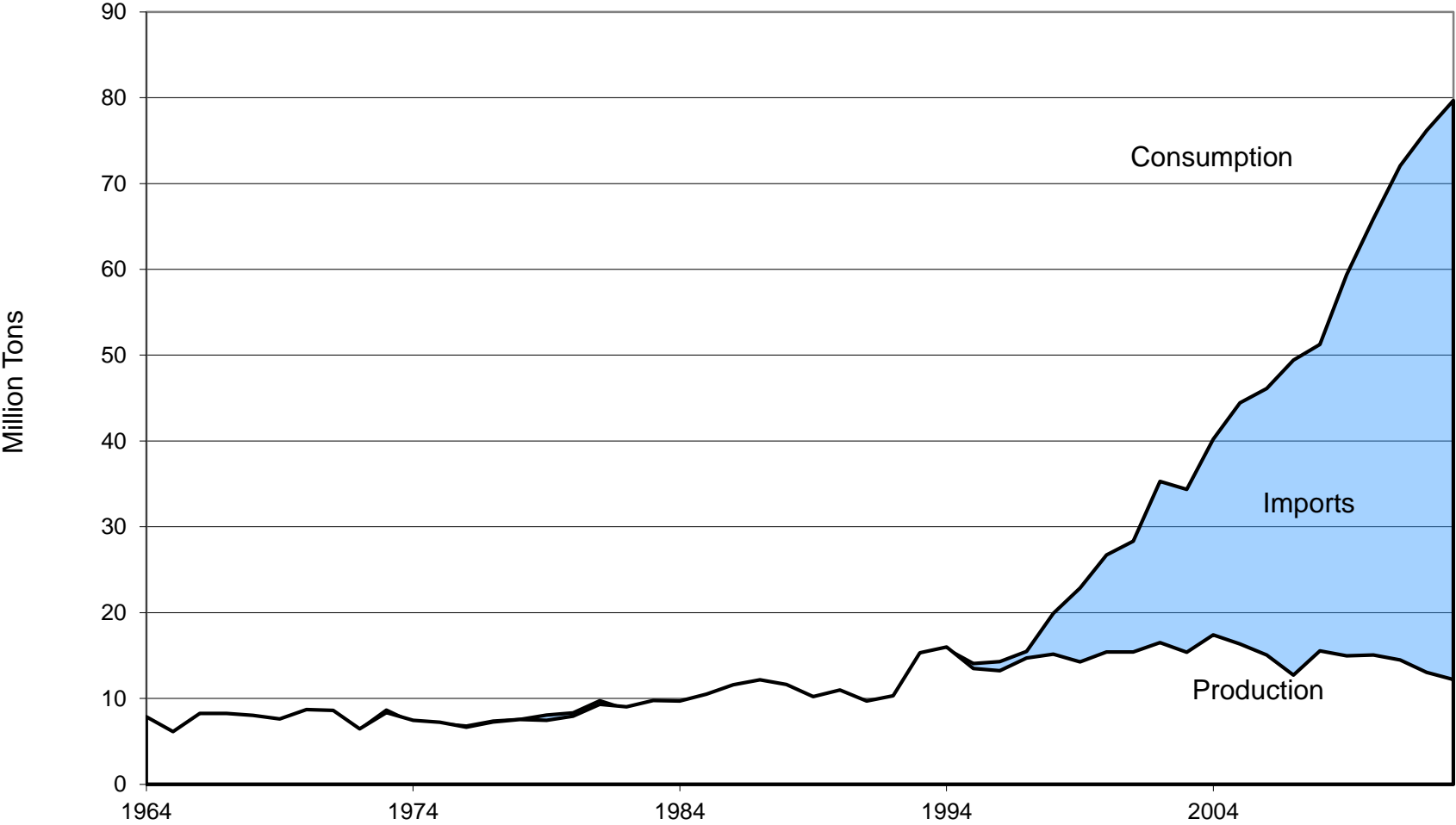


# Soybean Meal Feed Use in China and the United States, 1964-2012



Source: USDA

# Soybean Production, Consumption, and Imports in China, 1964-2013



Source: USDA



# Today's Options

## Alternate Protein Sources

Proteins from Microorganism (Algae, Bacteria, Yeast, Fungi)

past issues : taste, smell, cost, functionality

to solve : cost(some), PDCASS, functionality

outlook : positive

Protein from Plants (Pulses, Grains)

past issues : taste, cost, functionality

to solve : alternates to peas needed (beans, lupins)

outlook : positive

Others

Cell Cultures : scaleability, consumer adoption, health concerns after heating?

Insect based : regionality, animal vs. human.

## Robust Technologies for Food Production Available for Key Applications

Dry Extrusion (conventional TVP)

'Wet' Extrusion (enables larger sizes – i.e. chicken strips, steaks, etc.)

Homogenization/Emulsion/Shear Technologies

# Requirements for Alternate Proteins for Food

## Safe

- GRAS
- Non Allergenic

## Sensory (Ingredient, Food)

- Taste
- Smell
- Appearance

## Affordability

- Cost in Use
- Cost per PDCAAS

## Functionality

- Texturizability,
- Binding of Oil, Water, Gel-Forming, etc.
- Inert vs. not inert

## Nutritional Quality

PDCAAS  
Digestibility  
AA-spectrum

# Ultimately ...Consumer's TRUST will drive purchase decision ...

- Simple
- Authentic
- Transparent
- Believable to be
  - good for 'me'
  - good for the planet