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# Clearing the Path to Commercialization of Fusion Energy

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DOE Workshop on Public-Private Partnerships for Accelerating Commercial  
Fusion

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# White House Fusion Summit Launches Bold Decadal Vision for Fusion Energy

## **Alondra Nelson**

*Head of OSTP & Deputy Assistant to the President*

## **Gina McCarthy**

*National Climate Advisor*

## **Don Beyer**

*Bipartisan House Fusion Caucus Chair*

## **Sally Benson**

*OSTP Deputy Director for Energy*

## **Jennifer Granholm**

*U.S. Secretary of Energy*

## **Brenda Mallory**

*Council on Environmental Quality Chair*

## **Chuck Fleischmann**

*Bipartisan House Fusion Caucus Member*

## **Geraldine Richmond**

*DOE Under Secretary for Science and Innovation*



# Fusion Energy Could Address Urgent Global Climate and Energy Security Issues

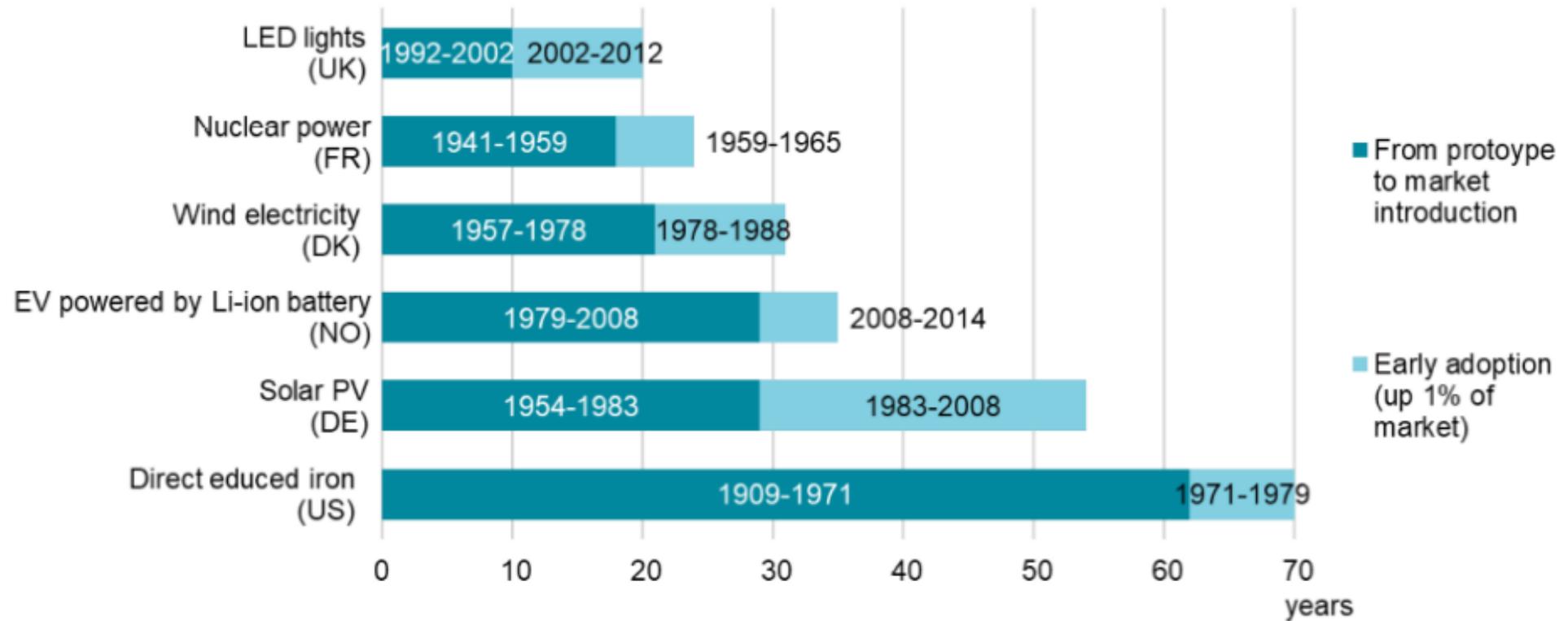
- New carbon-free sources of primary energy are needed to meet global needs
- Urgent need in light of global climate and energy security concerns
- Accelerate technology development **and** clear the path to commercialization
- Pursue concurrent – not sequential strategy for clearing the path to commercialization
- Plan for success in the development of fusion energy – ready to scale when the technology meets safety, cost, and reliability expected for energy technologies



*Image Credit: NASA's Earth Observatory*



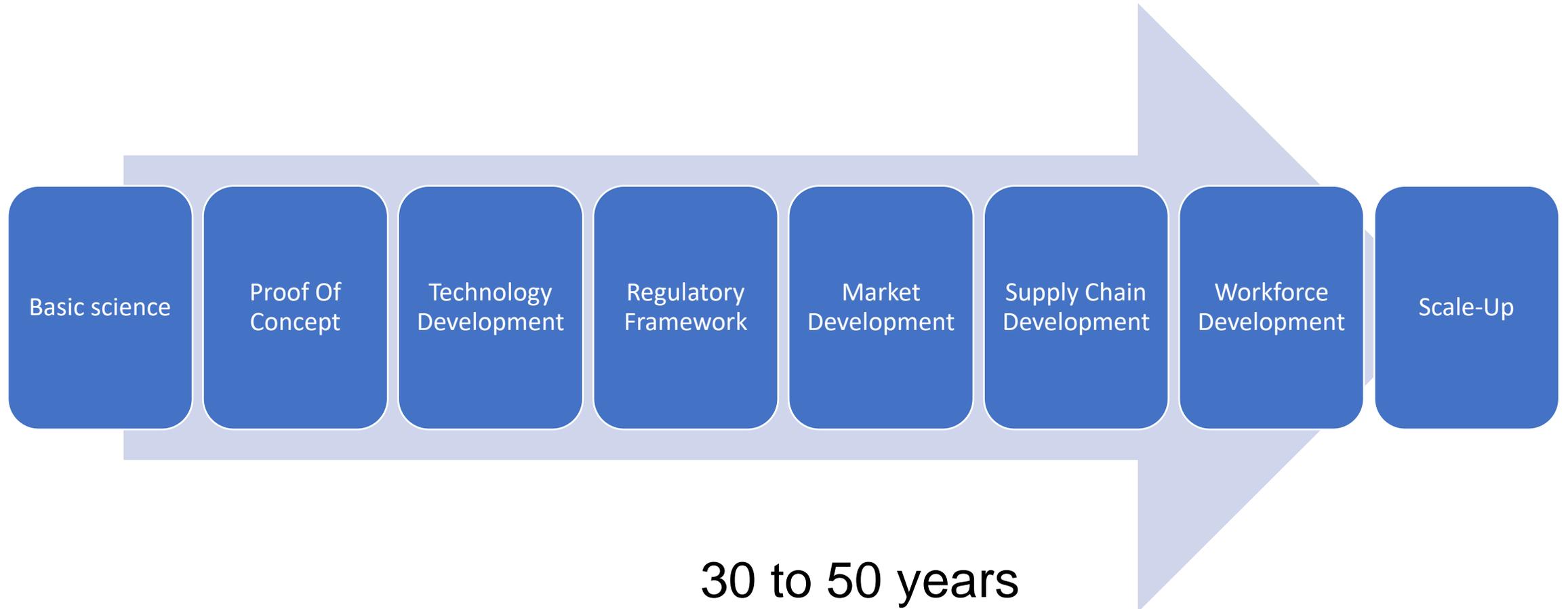
# Commercialization and Scale-Up Times for New Energy Technologies Are Long



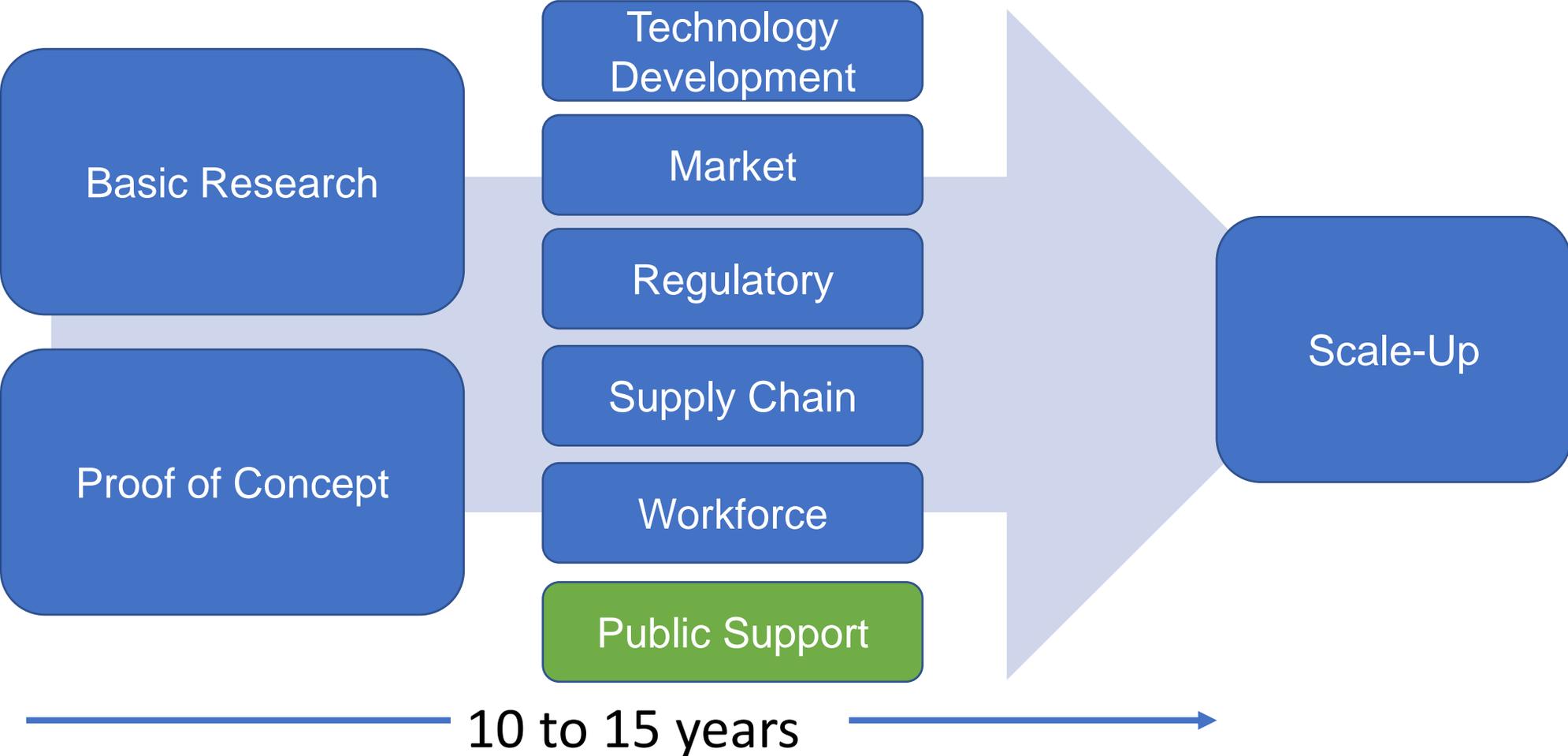
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# Typical Energy Technology Commercialization Pathway Takes Too Long



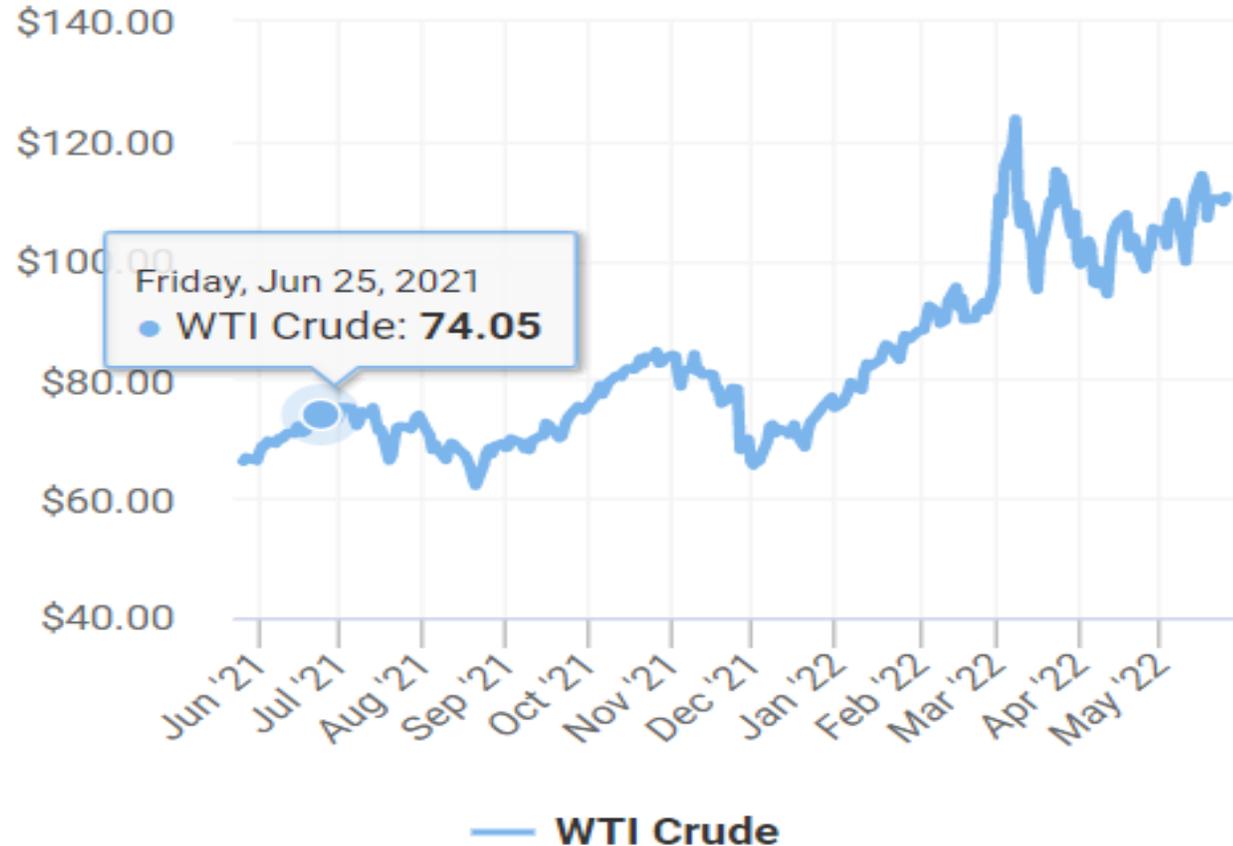
# Accelerate the Time from Proof of Concept to Scale-Up



# Market Development

- Making the case that we need fusion energy
- Developing end-use applications for fusion energy
  - Electricity, H<sub>2</sub>, electrofuels, direct air capture, chemical production, & others
- Policy support for early deployments
- Enabling international markets

Russian Invasion of Ukraine Leads to Painful Oil Price Spikes



# Regulatory Framework

- Fusion-specific NRC licensing construction and operation
- Harmonization with international licensing standards and processes
- Fuel cycle management for start-up and ongoing operations
- Nuclear safeguards and non-proliferation
- Export control regulations
- Low-level waste management and disposal
- Cybersecurity best practices and support

## Challenge – Diversity of Designs and Hazards

### Fusion Technologies

- Magnetic
- Magneto-Inertial
- Inertial

### Fusion Reactions

- D-T
- P-<sup>11</sup>B
- D-<sup>3</sup>HE

Radiological Hazards  
Chemical & Other Hazards

NRC, APPA-E Summit, 2021

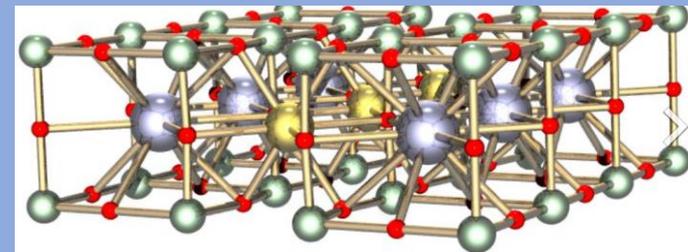


# Securing Supply Chains

- Identifying critical supply chain vulnerabilities and bottlenecks
- Building a U.S. manufacturing base and supply chains
- International partnerships for supply diversification and security

## High Temperature Super-Conducting Magnets Are Made with the Rare-Earth Element Yttrium

- U. S. Imports nearly 100% of our yttrium consumption
- 97% of yttrium imports come from China
- Supply chains need to be diversified, including increase U.S. domestic rare earth mining and processing

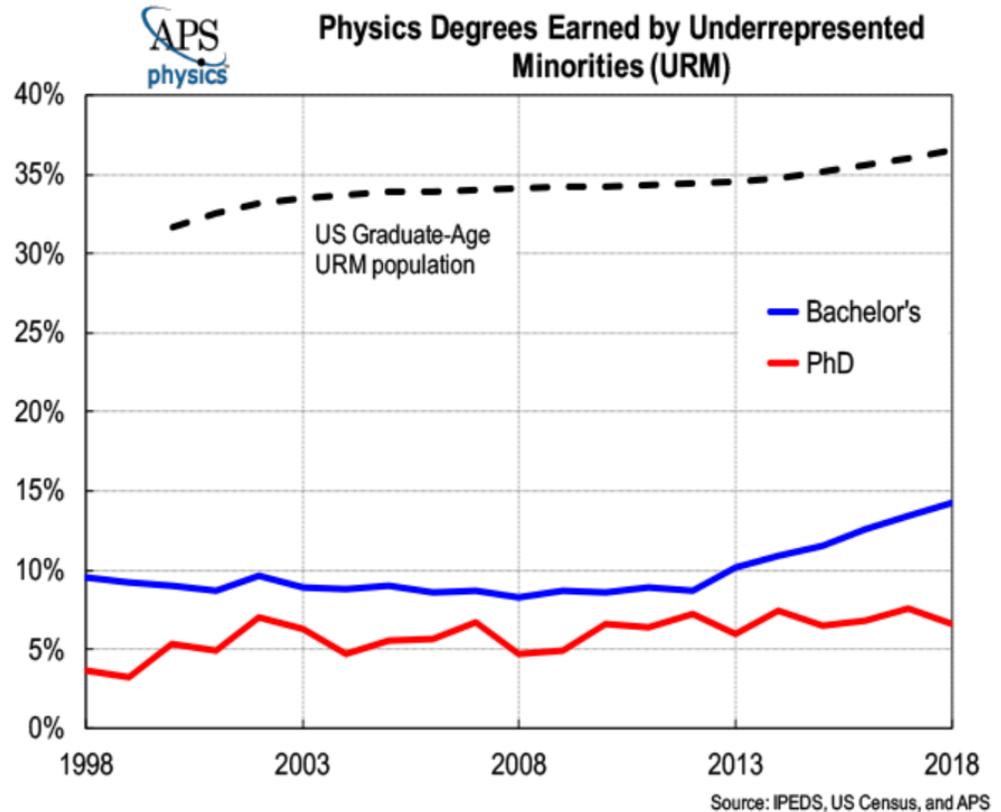


HTS: Yttrium-Barium-Copper-Oxide



# Workforce Development

- Engaging prospective workforce and their families in high school
- Develop pipeline for skilled workers
- Multidisciplinary academic and technical training
  - Physics, engineering, material science, computer science, machine learning
- Increasing diversity in the fusion workforce



# Building Public Support From the Bottom Up

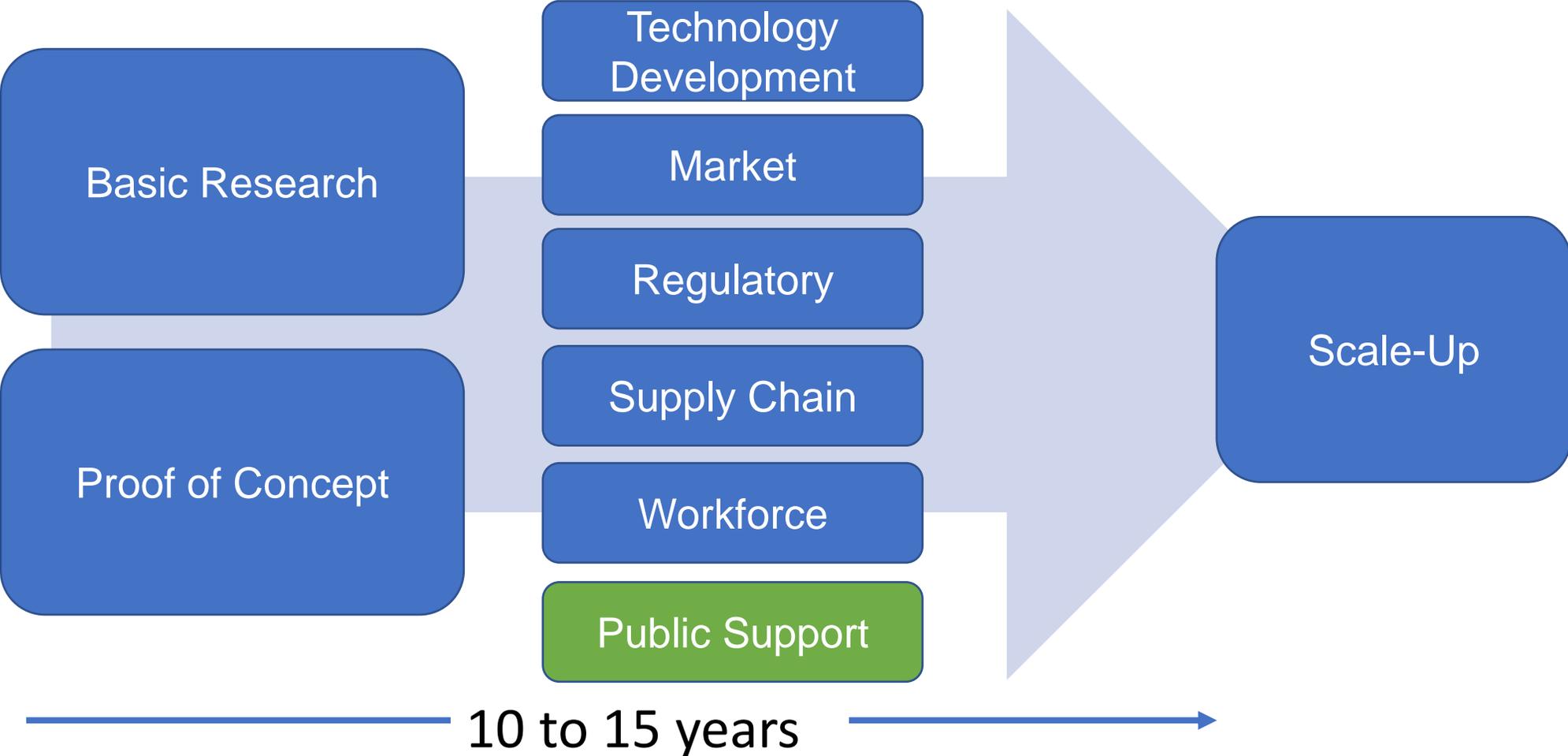
- Basic energy education and education about fusion energy
- Engaging and listening about risks and benefits of fusion in communities
- Integrate environmental justice at the beginning, to ensure fusion energy benefits all communities and does not repeat harmful mistakes of the past.
- Engaging with communities regarding potential siting and benefits of new projects
- Increasing diversity in the fusion community



*Construction of CFS SPARC Prototype in Massachusetts*



# Accelerate the Time from Proof of Concept to Scale-Up





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