




Scaling Up 2022

Further and faster: A sustainable economy beyond oil, gas and coal

Canada's 7th annual industrial bioeconomy business



November 7-9, 2022

Ottawa, Canada

www.scalingupconf.com

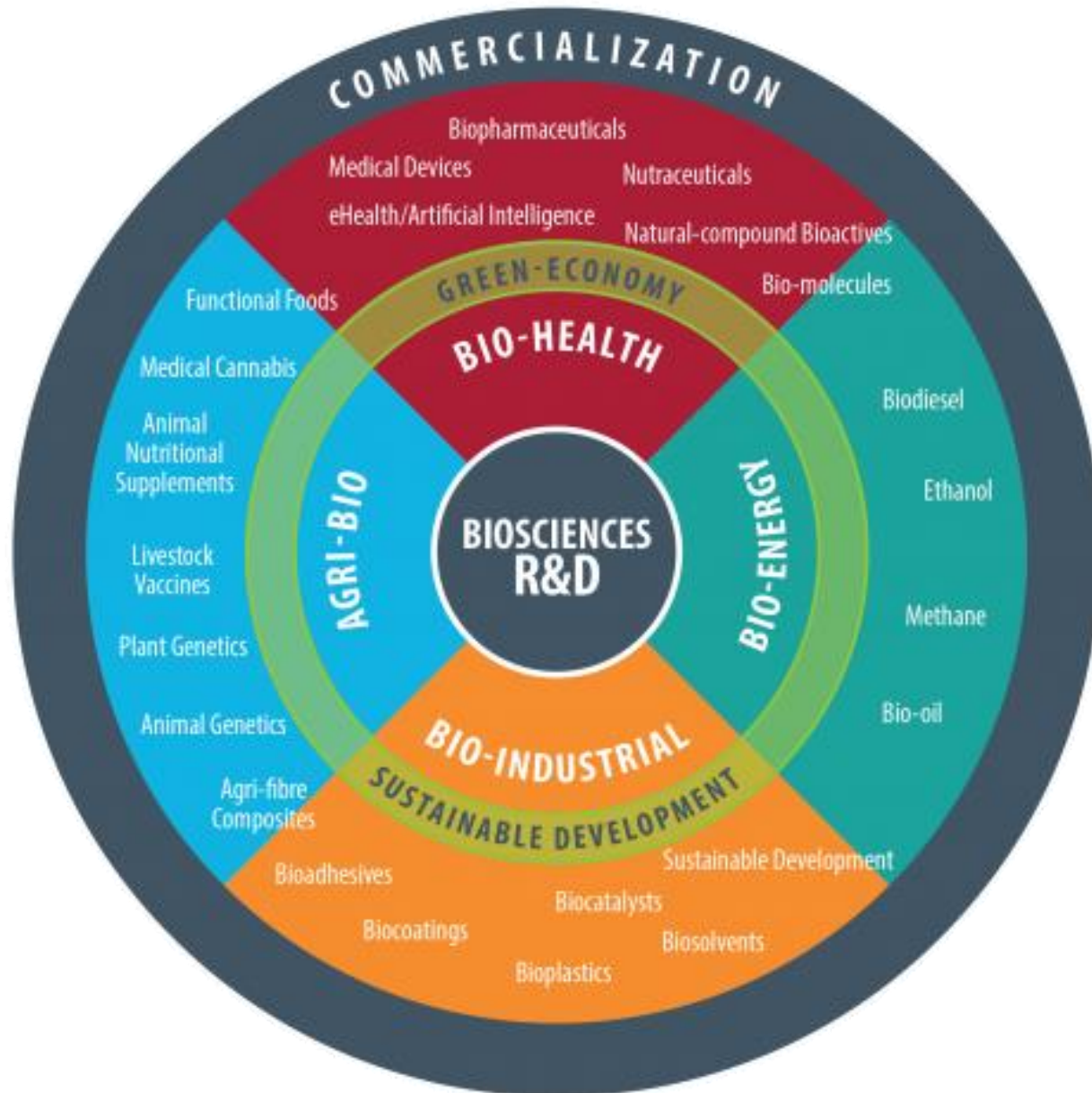
Less Talk, More Action

**Wal van Lierop, Executive Chair and
Founding Partner**



CHRYSALIX
VENTURE CAPITAL

THE BIOECONOMY OPPORTUNITY



Expectation:

Innovation will cause Accelerated Growth in Everything BIO



BIO REVOLUTION:

Transforming economies, societies, and our lives

BIO = BIG OPPORTUNITY



UN, ESG, IMPACT INVESTORS

BIGGEST OBVIOUS OPPORTUNITY:

HOW TO FEED THE 2050s MOUTHS?

Global
**food
production**

will need to increase

70%

by 2050



POPULATION GROWTH
CHANGING DIETS

FAO Animal Production Outlook from 2010 to 2050



Thought-provoking discussion from the
Royal Geographical Society (with IBG)

www.21stcenturychallenges.org

Source: SciDev.Net, 2014

ALSO BIGGEST PROBLEM?

NITRATE: THE ENVIRONMENTAL CRISIS YOU HAVEN'T HEARD OF YET



Chrysalix Focus: Help Decarbonize Hard To Abate Industries

	PROCESS IMPROVEMENT	FUEL & FEEDSTOCK SWITCH	MATERIAL EFFICIENCY & SUBSTITUTION	CIRCULARITY	CCUS
REDUCE EMISSIONS	<ul style="list-style-type: none"> Energy efficiency ● ● ● ● ● ● Automation ● ● 	<ul style="list-style-type: none"> Alternative fuels ● ● Renewable energy ● ● ● ● ● ● Electrification ● ● ● ● ● Biomass ● ● Hydrogen ● ● ● ● Nuclear fusion ● 	<ul style="list-style-type: none"> Alternative & novel materials ● ● Biobased materials ● Synthetic fuels ● ● 	<ul style="list-style-type: none"> Secondary raw materials ● ● ● ● Waste sorting & recovery/recycling ● ● ● Waste-to-value ● ● ● ● 	<ul style="list-style-type: none"> Capture ● ● ● ● ● ● Utilization ● ● ● ● ● ● <ul style="list-style-type: none"> Mineralization Chemical Biological Storage ● ● ● ● ● ●
	CARBON CREDITS	NATURE-BASED SOLUTIONS		BECCS	DACCS
REMOVE EMISSIONS	<ul style="list-style-type: none"> Marketing, trading and sale 	<ul style="list-style-type: none"> Land Management Forest Management Ocean Fertilization 		<ul style="list-style-type: none"> Biomass for energy (incl. CO2 capture) 	<ul style="list-style-type: none"> Geological storage Mineralization

Chrysalix Global Ecosystem for a Carbon Neutral World

EXISTING AND HISTORIC LIMITED PARTNERS



Some of our CO-INVESTORS



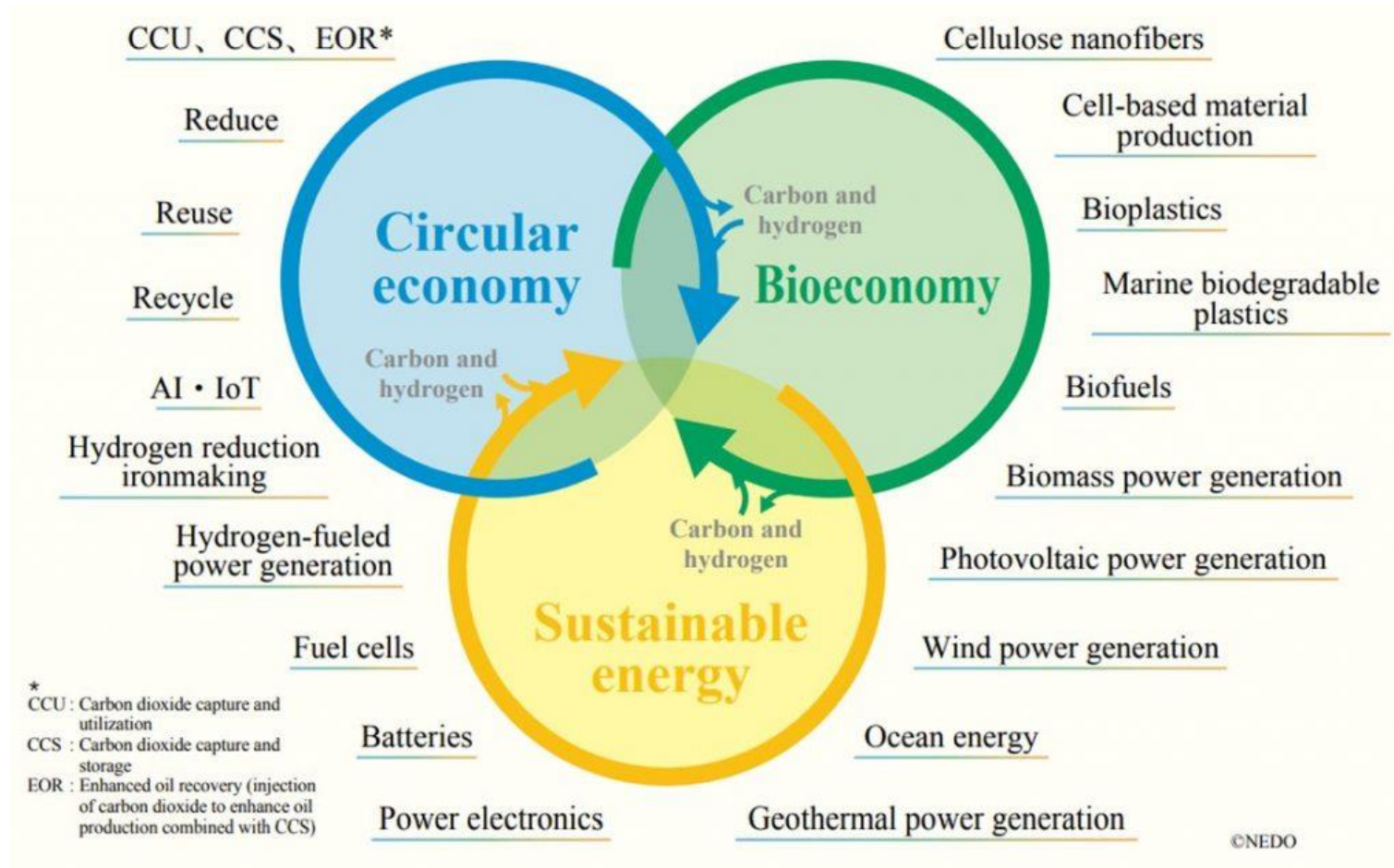
ACADEMIC AND KNOWLEDGE PARTNERSHIPS



FINANCE SUPPORT



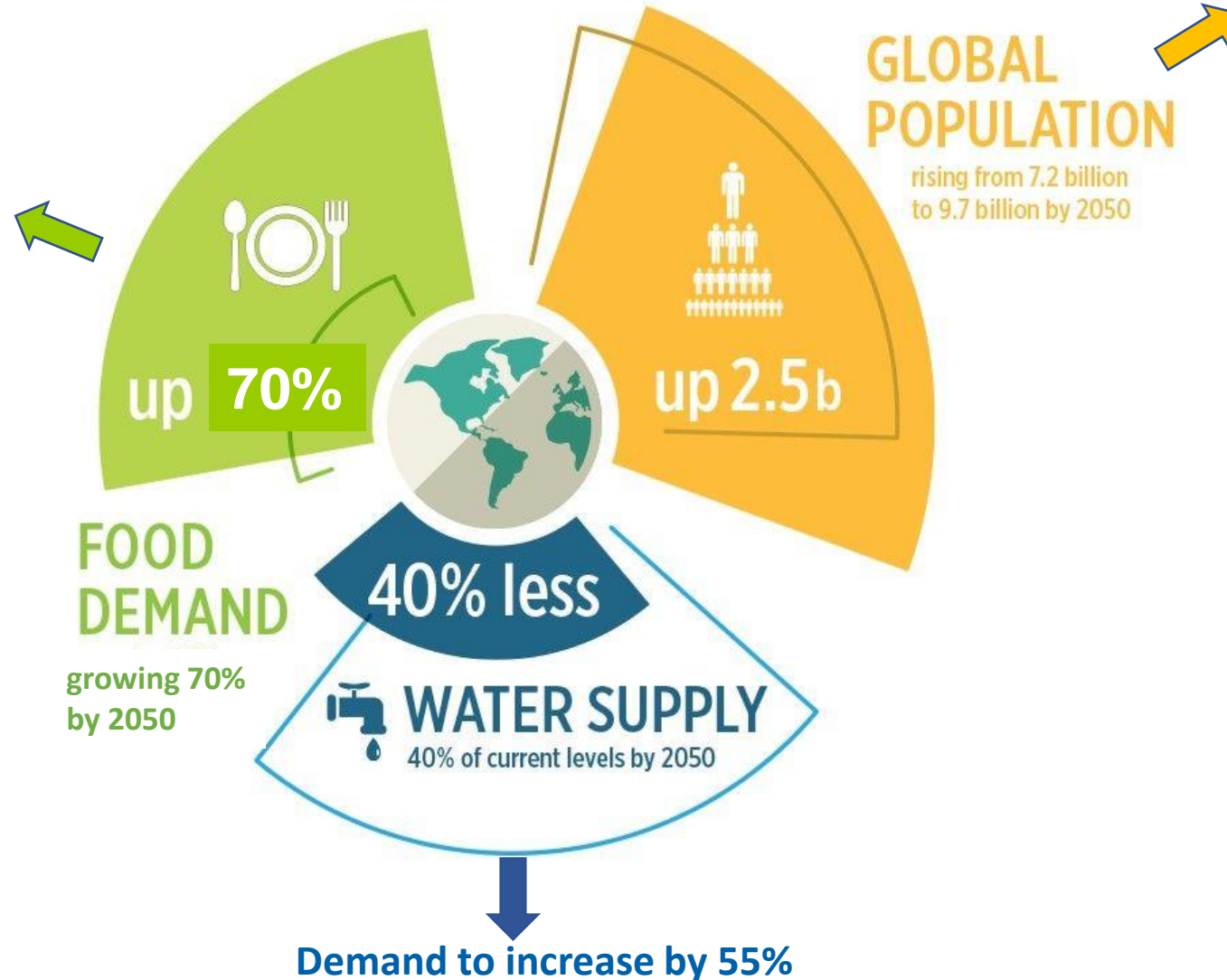
HOW PEOPLE THINK THE BIOECONOMY WILL WORK....



....BUT CAN IT AT SCALE and ON TIME ?

MEGATRENDS 2050

- Efficiency improvement with tech and software
- Bio-fertilizers
- Urban farming
- Substitutes



- Explosive demand housing and infrastructure
- Mega Cities
- More AC

- Need for more wastewater treatment, desalination and geoengineering

What Is Behind All These Trends?

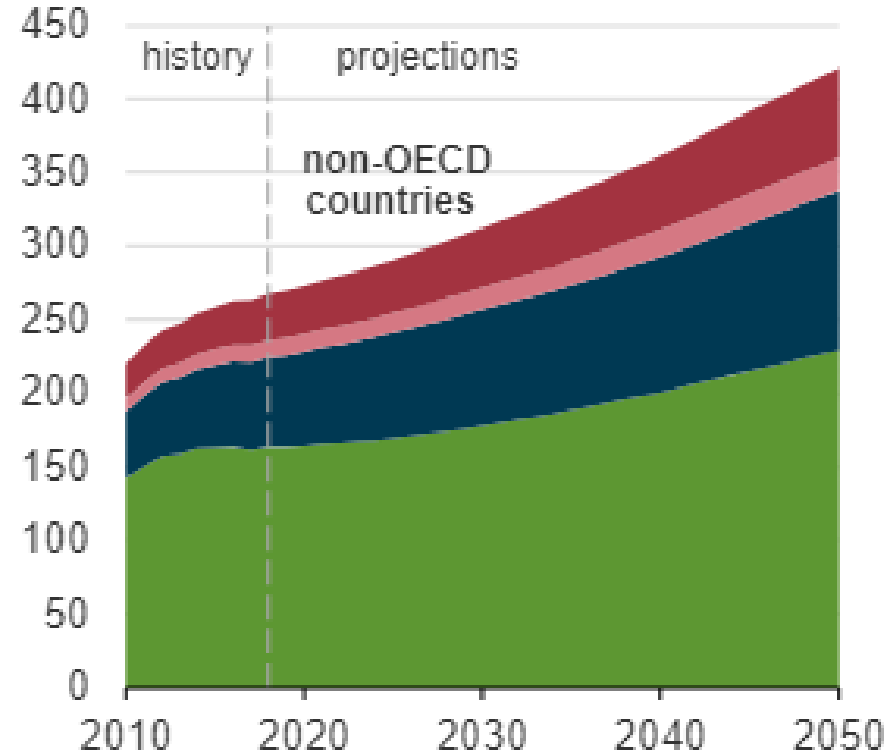
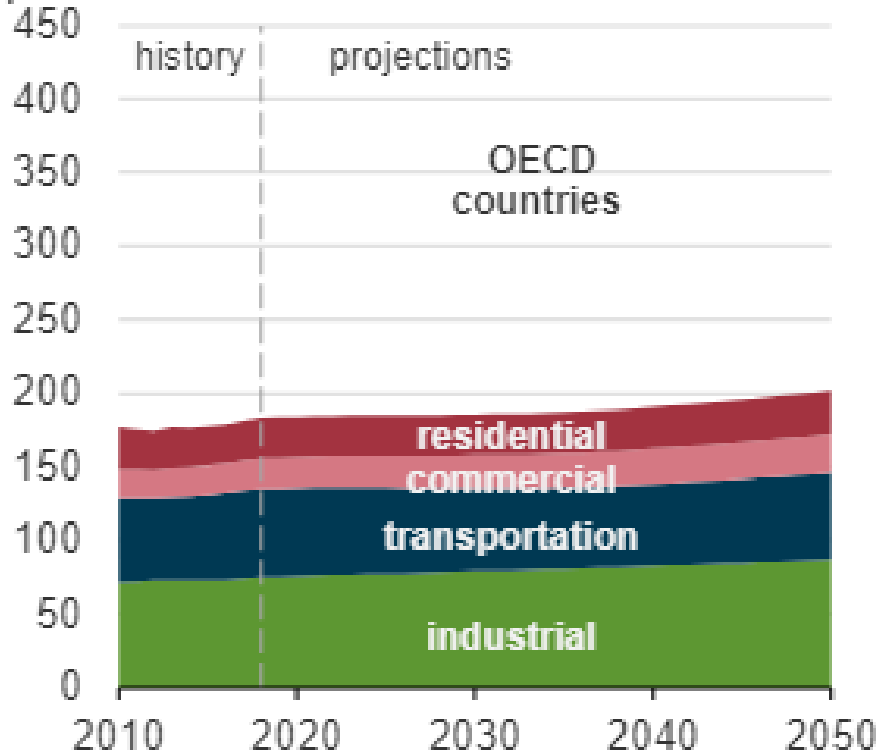
What Is Behind All These Trends?

ENERGY

EIA* Projects Nearly 50% Increase In World Energy Usage By 2050, Led By Growth in Asia.....

Global energy consumption by sector (2010-2050)

quadrillion British thermal units



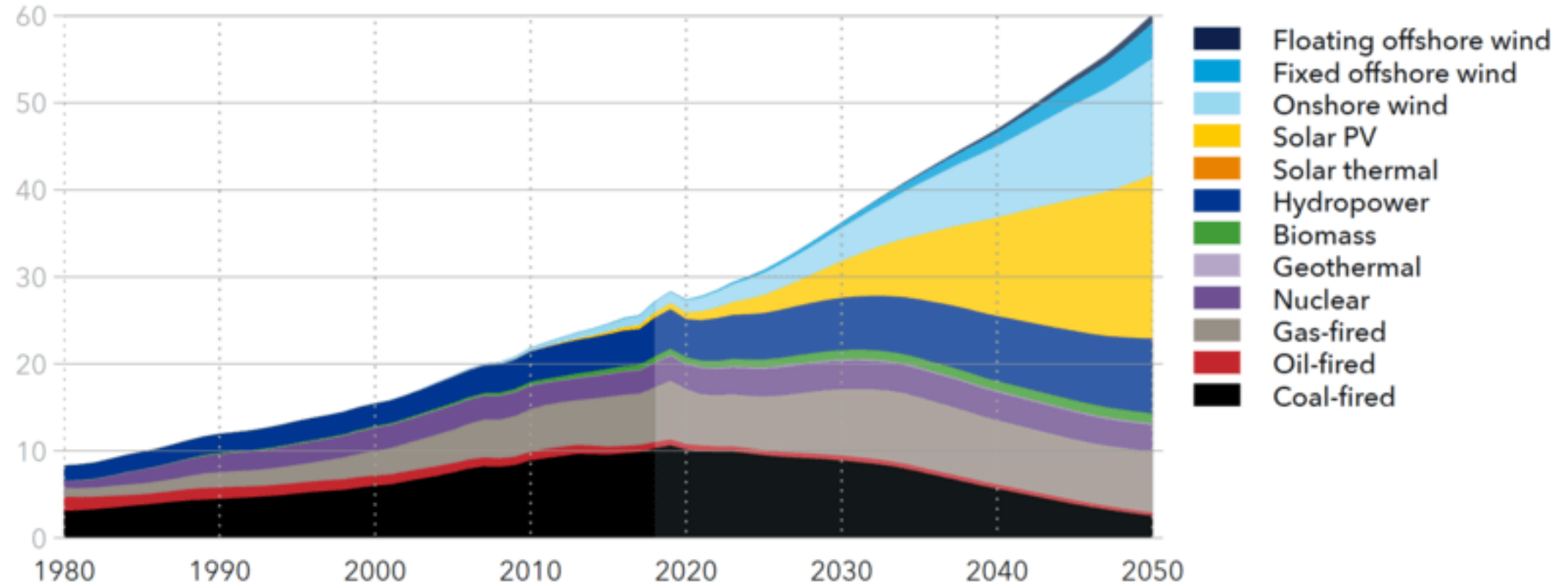
..... And It Should Be Sustainable Energy

*) US Energy Information Administration

ELECTRIFICATION Even Growing Faster

World Electricity Generation By Power Station Type

Units: PWh/yr



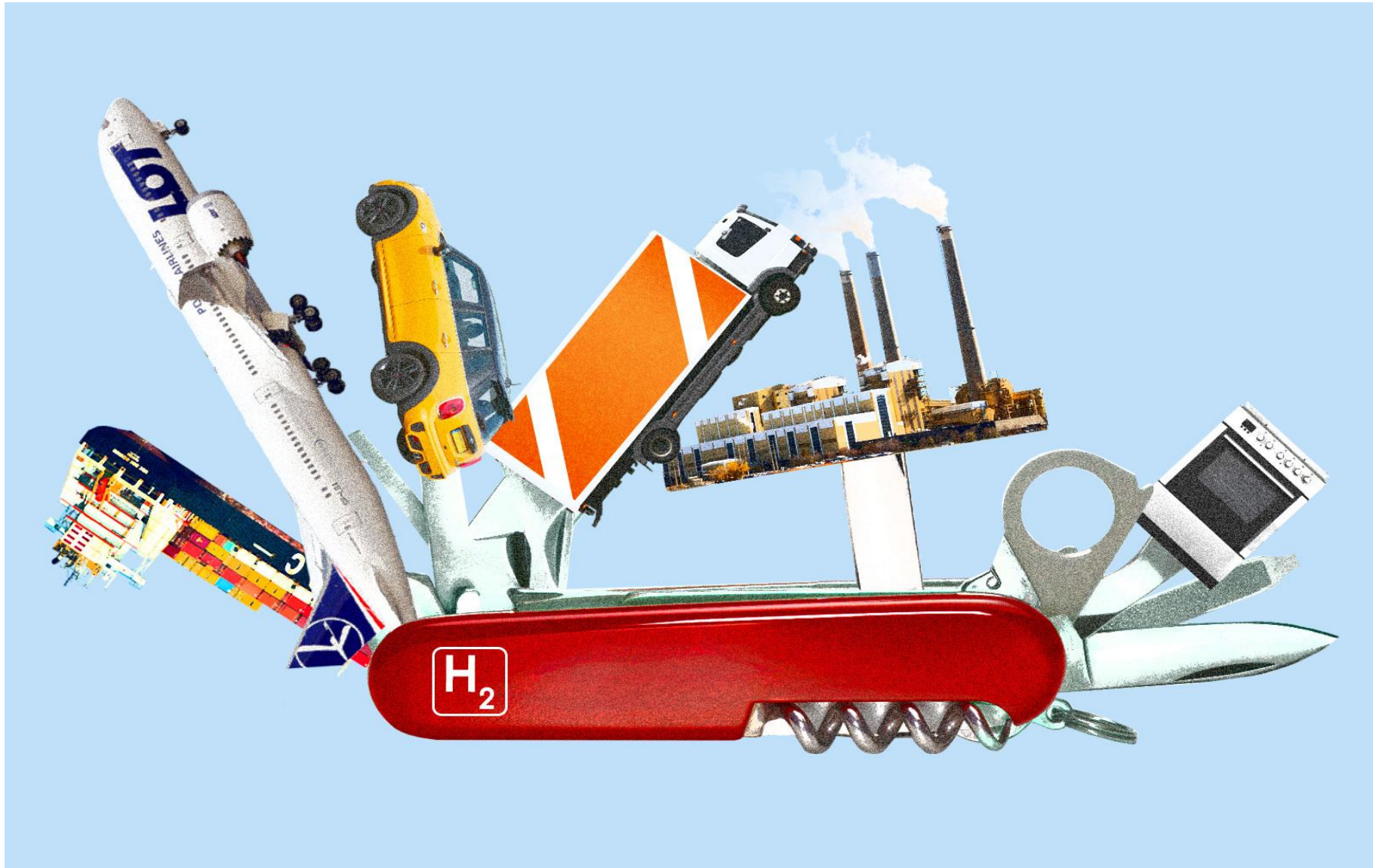
©DNV GL 2020

Historical data source: IEA WEB (2019), IRENA (2019)

But.... How To Make Hard To Abate Industries Carbon Neutral?

HYDROGEN: “Silver Bullet” For Many Applications

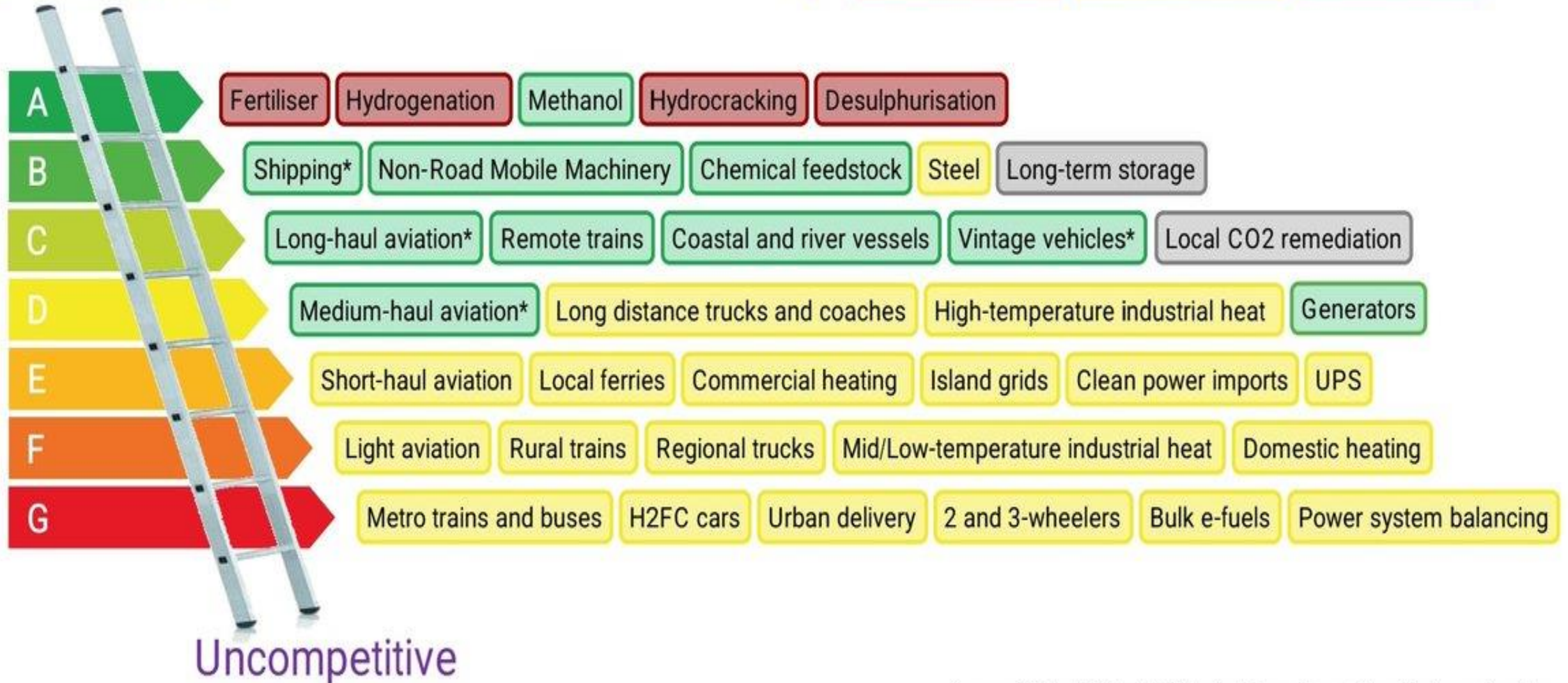
Especially Green Hydrogen From Renewables - Including Biomass



Clean Hydrogen Ladder: Competing technologies

Unavoidable

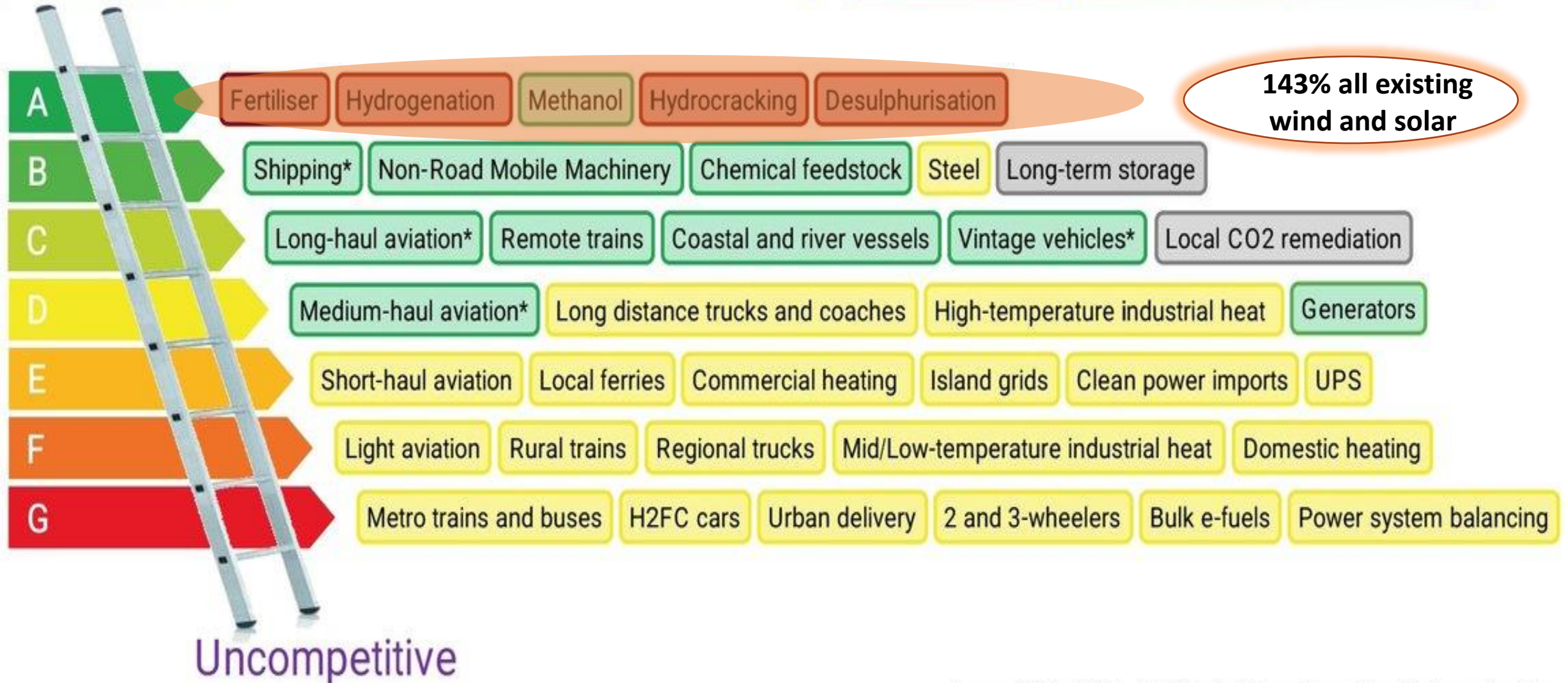
Key: No real alternative Electricity/batteries Biomass/biogas Other



Clean Hydrogen Ladder: Competing technologies

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143% all existing wind and solar

Massive Shortage Of Green Hydrogen

For Today's Economy:

- Wind and solar important – but not enough
- Natural Gas as “Grey Hydrogen” dominant Transition Fuel
 - With Carbon Capture “Blue Hydrogen”
- Limited role bio in hydrogen: AND SHOULD NOT PLAY!
- Need alternatives, e.g. more nuclear – preferably fusion

For Tomorrow's Economy:

**Need alternatives to reduce and change demand:
basic materials, production processes etc.**

The Bio Revolution

- Will transform what we eat, wear, materials, medicines, our way of life
- 60% physical inputs global economy could be produced biologically
 - 1/3 are already biological materials (wood or animals bred for food)
 - 2/3 non-bio (plastics or fuels) could be biologically produced or substituted
- Biological science breakthroughs are fueling new wave of innovation:
 - **Biomolecules:** think Gene Therapy for diseases
 - **Biosystems** including stem-cell technologies; think Cultured Meat
 - **Biomachine Interfaces:** think Prosthetics
 - **Biocomputing:** think Data Storage in strands of DNA
- Direct annual global impact of the Bio Revolution could be \$2Tr to \$4Tr in 2030-40 (McKinsey)



Bioeconomy Opportunity for Canada?

McKinsey:

annual impact next 20 years

- **Agri, Aqua, Food**
\$0.8T-\$1.2T
- **Materials, Chemicals, and Energy**
\$200Bn-\$300Bn
- **Human Health:**
\$0.5T-\$1.3T
- **Consumer products and services**
\$200Bn-\$800Bn

- **Efficiency improvements**

- Agriculture, Forestry and Aqua need to become Clean & Intelligent

- **Innovation**

- Soil Management – e.g. Terramera
- Bio based fertilizers and biopharmaceutical anti-viruses
- Heat, drought and pest resistant variants
- Solutions to convert CO₂ or nitrogen from bio-based industries into added value bio-based chemicals – think around pulp mills
- Low carbon circular economy solutions e.g.
 - Arbios, the Canfor – Licella Biotech JV
 - Advanced biofuels for Sustainable Aviation Fuels
- Bio-CHEMICALS, Bio-PHARMA, Bio-HEALTH

- **Bio Innovation Risk Management and Standards**

The Bio Revolution

Essential for NET ZERO 2050

- Will transform entire value chains
- Companies in virtually every sector will need adaptation strategies

Less Talk, Focus, More Action Now