



COLLABORATION & PARTNERSHIPS AS KEYS TO ADDRESSING THE DUAL CHALLENGE

STS-AIChE Dinner Meeting
October 5, 2023

GREATER HOUSTON
PARTNERSHIP

FOUR KEY THOUGHTS

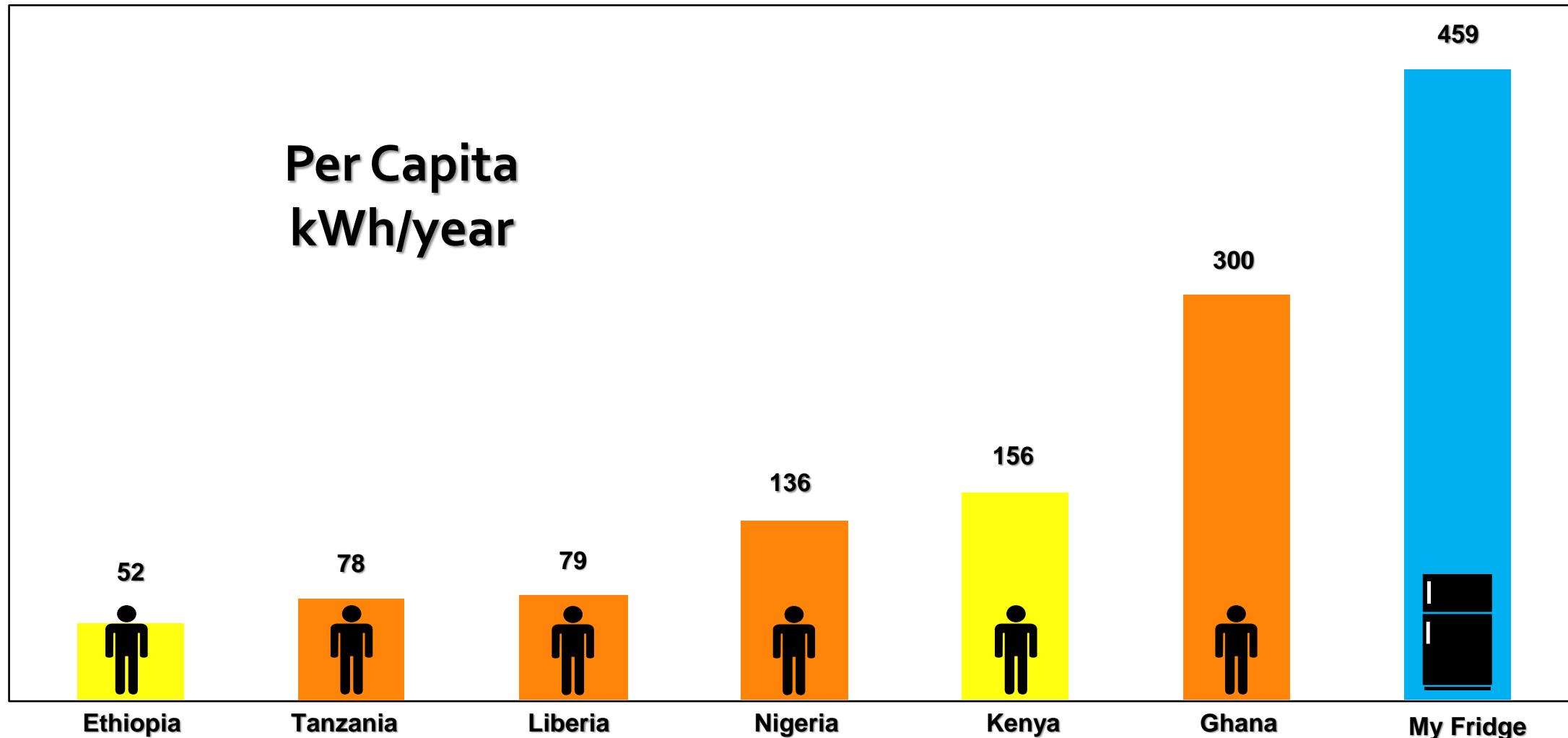


1. We are facing a dual challenge – the world needs significantly more energy while also significantly reducing emissions
2. Our energy sector must continue to evolve to meet the needs of a rapidly changing world
3. Partnerships and collaboration hold the key to unlocking an energy abundant, low-carbon future
4. Houston can continue its leadership in energy as we transition to a low-emission future

1. WE ARE FACING A **DUAL CHALLENGE** – THE WORLD NEEDS SIGNIFICANTLY MORE ENERGY WHILE ALSO SIGNIFICANTLY REDUCING EMISSIONS

ANNUAL ENERGY CONSUMPTION TODAY

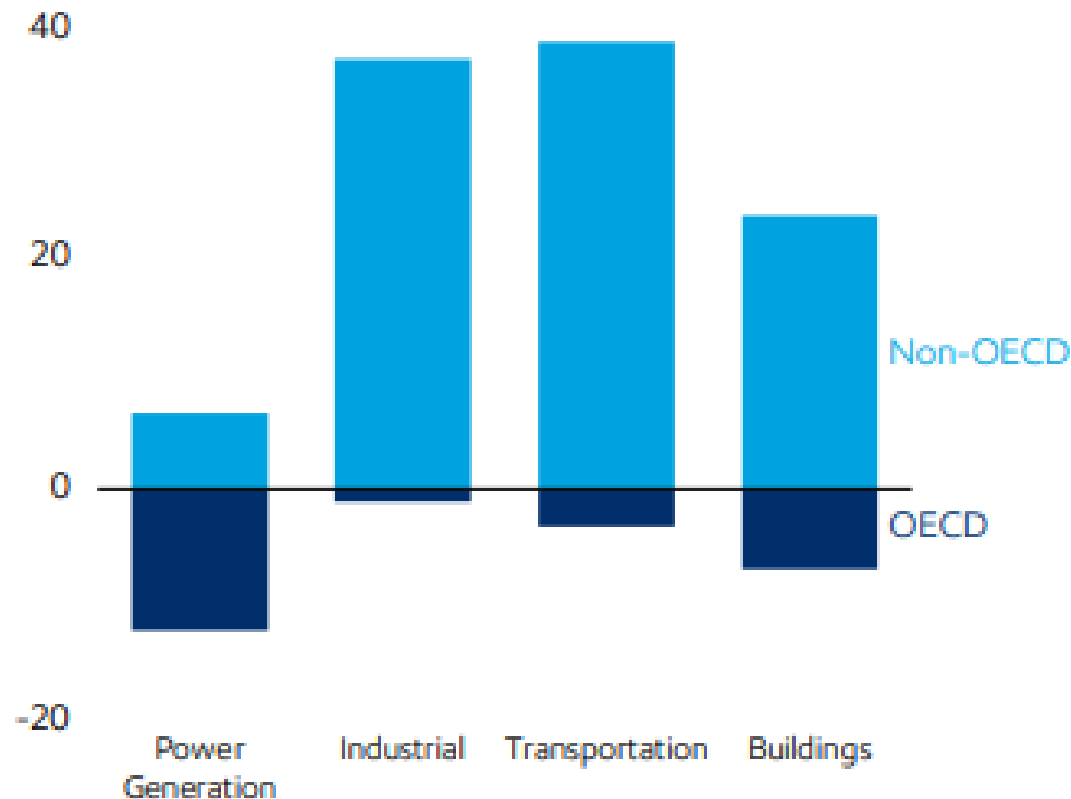
>60% OF WORLD'S POPULATION LIVE IN SOME LEVEL OF ENERGY POVERTY



INCREASING GLOBAL POPULATION AND IMPROVED QUALITY OF LIFE DRIVE WILL GLOBAL ENERGY GROWTH

Global energy growth, 2021-2050

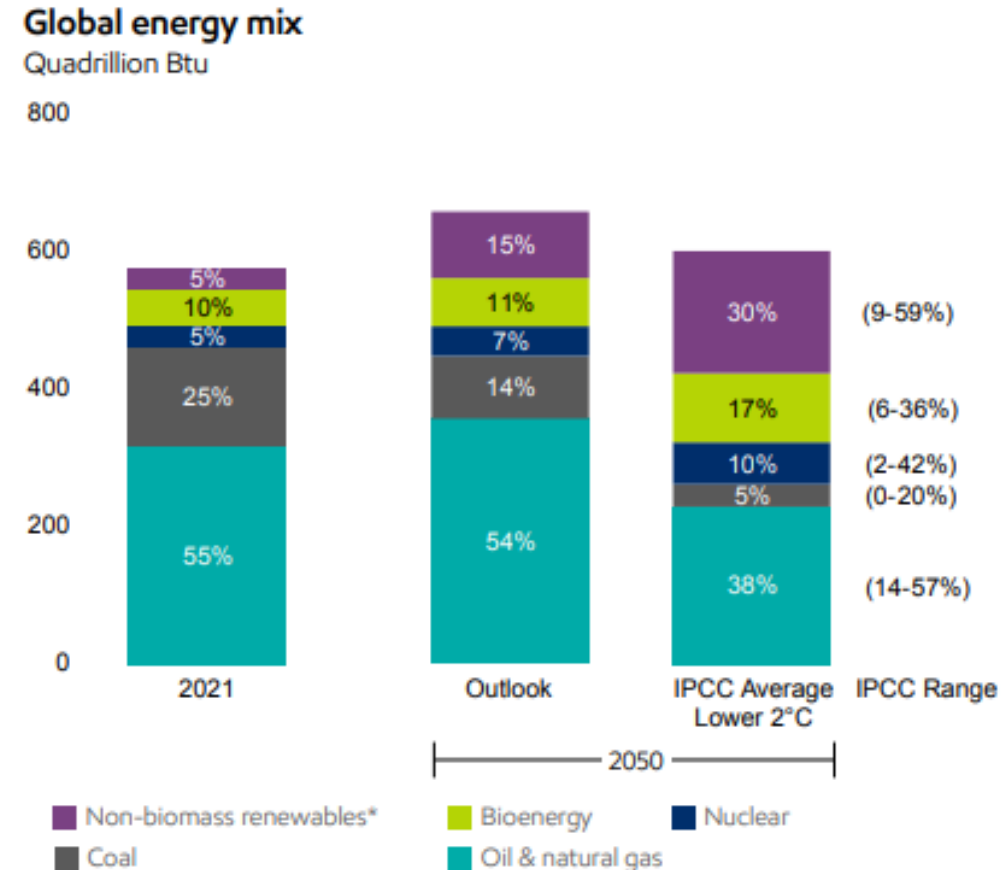
Quadrillion Btu



- Global population grows by 2bn people (25%)
- Developing regions require energy to unlock prosperity
- Developed regions have declining energy use – driven by declining population, efficiencies

AS A RESULT, THE GLOBAL ENERGY MIX CHANGES AND GROWS

- Five times greater use of wind & solar energy forecasted
- The world still needs both electrons and molecules
- Hydrogen & modern biofuels help decarbonize the energy mix



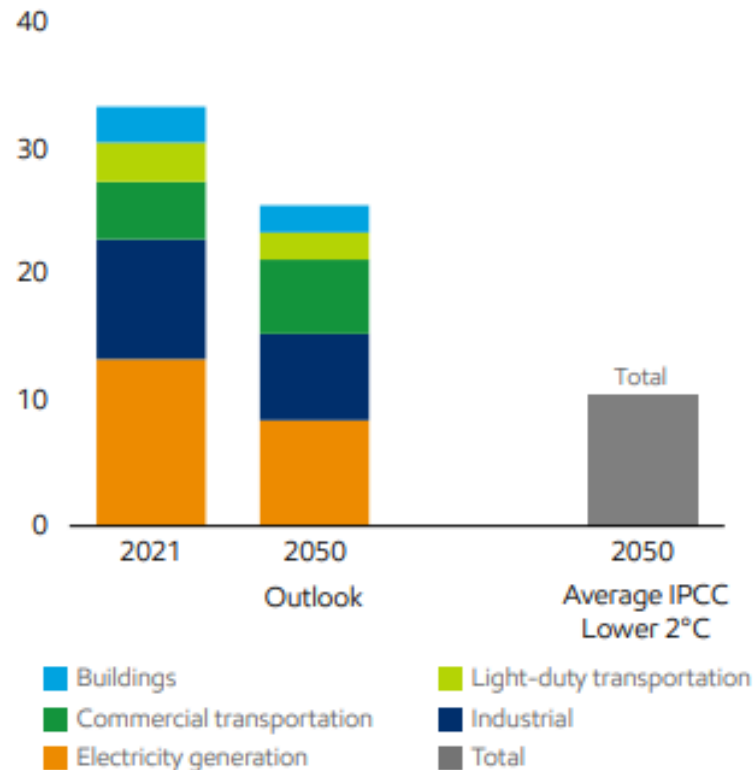
* Includes hydro, wind, solar, and geothermal

Source: IPCC: AR6 Scenarios Database hosted by IIASA release 1.0 average IPCC C3: "Likely below 2°C" scenarios; ExxonMobil analysis

EMISSIONS DECLINE, BUT IT MAY NOT BE ENOUGH

Energy-related emissions

CO₂ Billion metric tons



Source: IPCC: AR6 Scenarios Database hosted by IIASA release 1.0 average IPCC C3: "Likely below 2°C" scenarios; ExxonMobil analysis

Emissions do not contain industry process emissions or land use and natural sinks

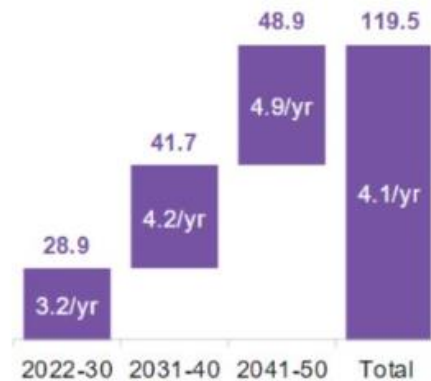
- Given existing technologies, the ExxonMobil outlook forecasts a 25% reduction in emissions by 2050.
- Growth in electrification and renewables is only part of the solution.
- Further innovation and development of new technologies and solutions is needed to achieve deep decarbonization goals.

2. OUR ENERGY SECTOR MUST CONTINUE TO EVOLVE TO MEET THE NEEDS OF A **RAPIDLY CHANGING WORLD**

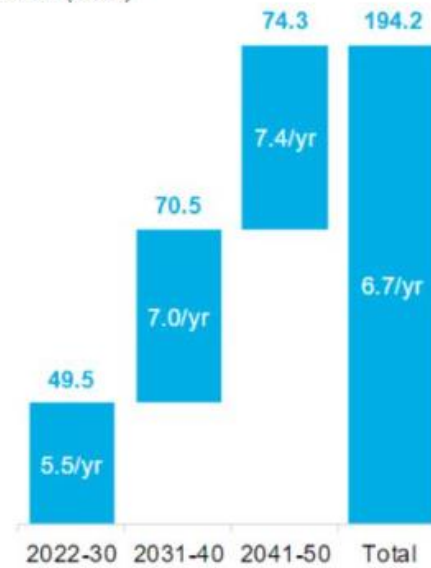
INVESTMENT NEEDED TO ACHIEVE NET ZERO

Global investment needed

Economic Transition Scenario
\$ trillion (2021)

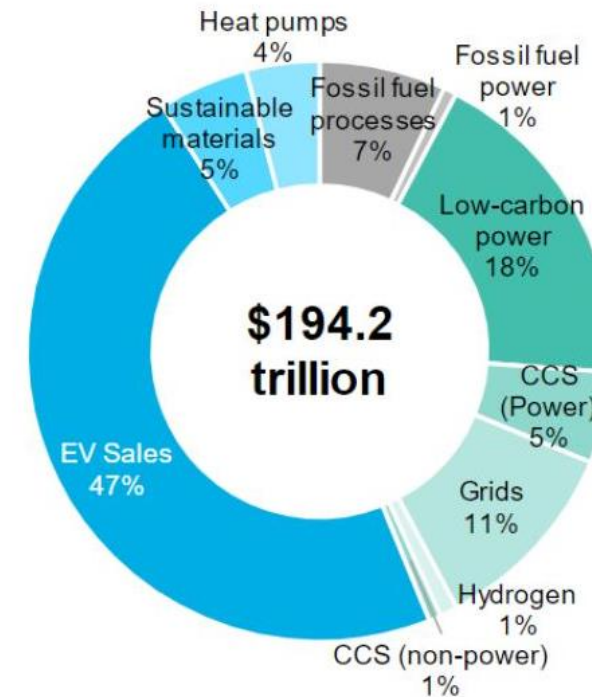


Net Zero Scenario
\$ trillion (2021)



Global investment needed for net-zero goal

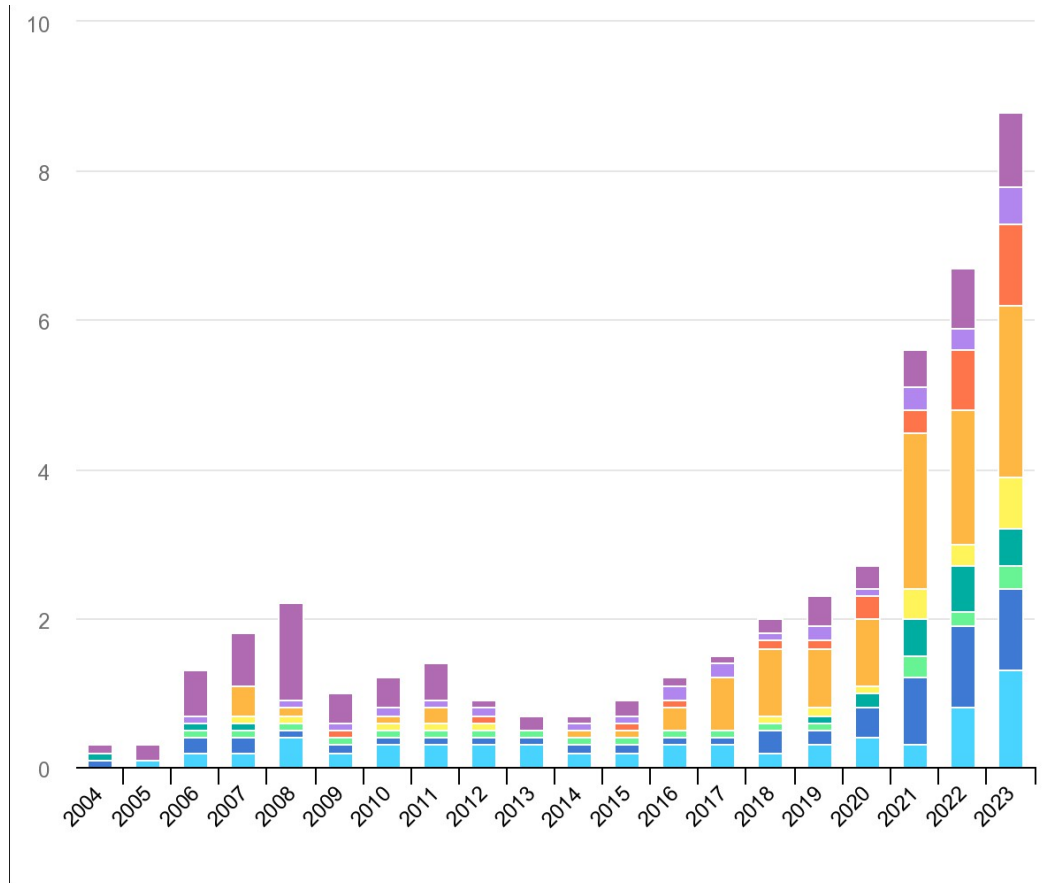
Net Zero Scenario



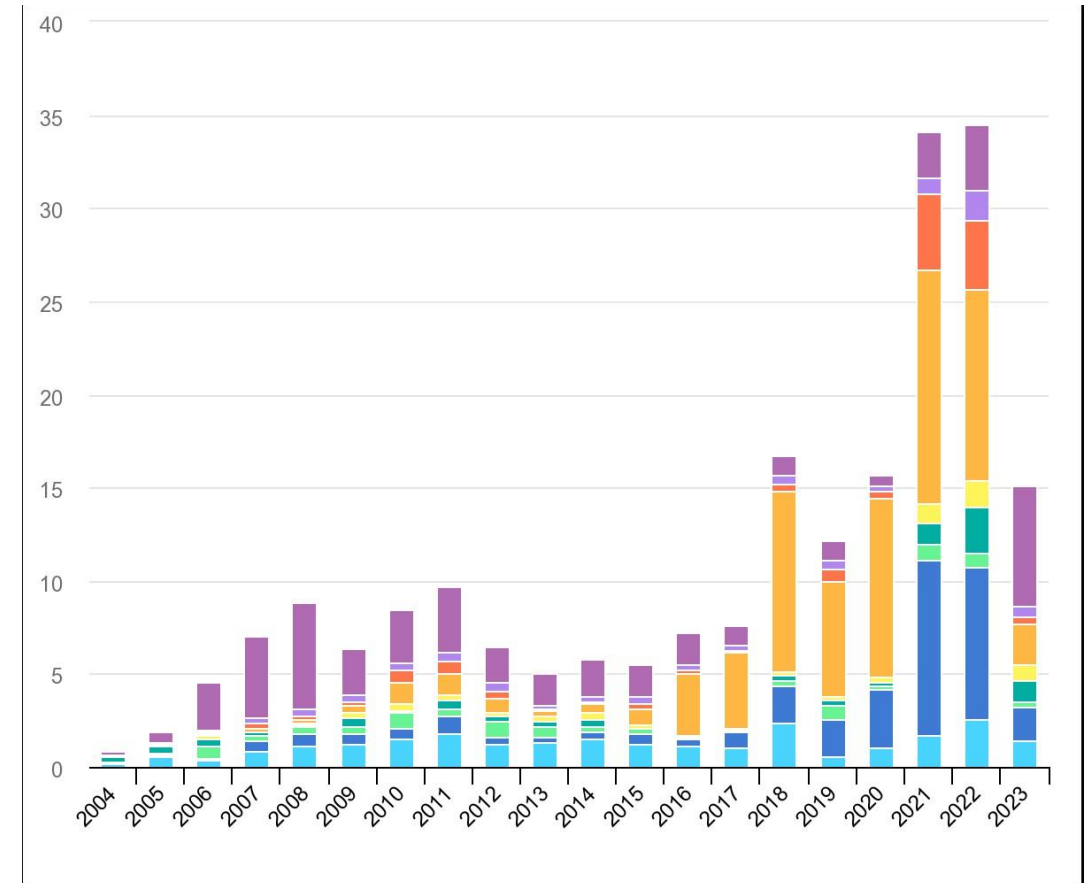
Source: BloombergNEF. Note: CCS refers to carbon capture and storage.

2023 SAW ROUGHLY \$24BN VENTURE INVESTMENT

Venture capital investment in energy start-ups, by technology area, for early-stage deals, 2004-2023



Venture capital investment in energy start-ups, by technology area, for growth-stage deals, 2004-2023



● Energy efficiency
 ● Energy storage and batteries
 ● Fossil fuels
 ● Hydrogen and fuel cells
 ● Industry
 ● Mobility
 ● Other
 ● Other power and grids
 ● Renewables

3. PARTNERSHIPS AND COLLABORATION HOLD THE KEY TO UNLOCKING AN ENERGY ABUNDANT, LOW-CARBON FUTURE

AN ENERGY-ABUNDANT, LOW-CARBON FUTURE REQUIRES ALL ENERGY COMPANIES



INCUMBENT ENERGY FIRMS

actively
decarbonizing their
own operations



RENEWABLE COMPANIES

with established
and growing
presence in Texas



MAJOR INTEGRATED ENERGY FIRMS

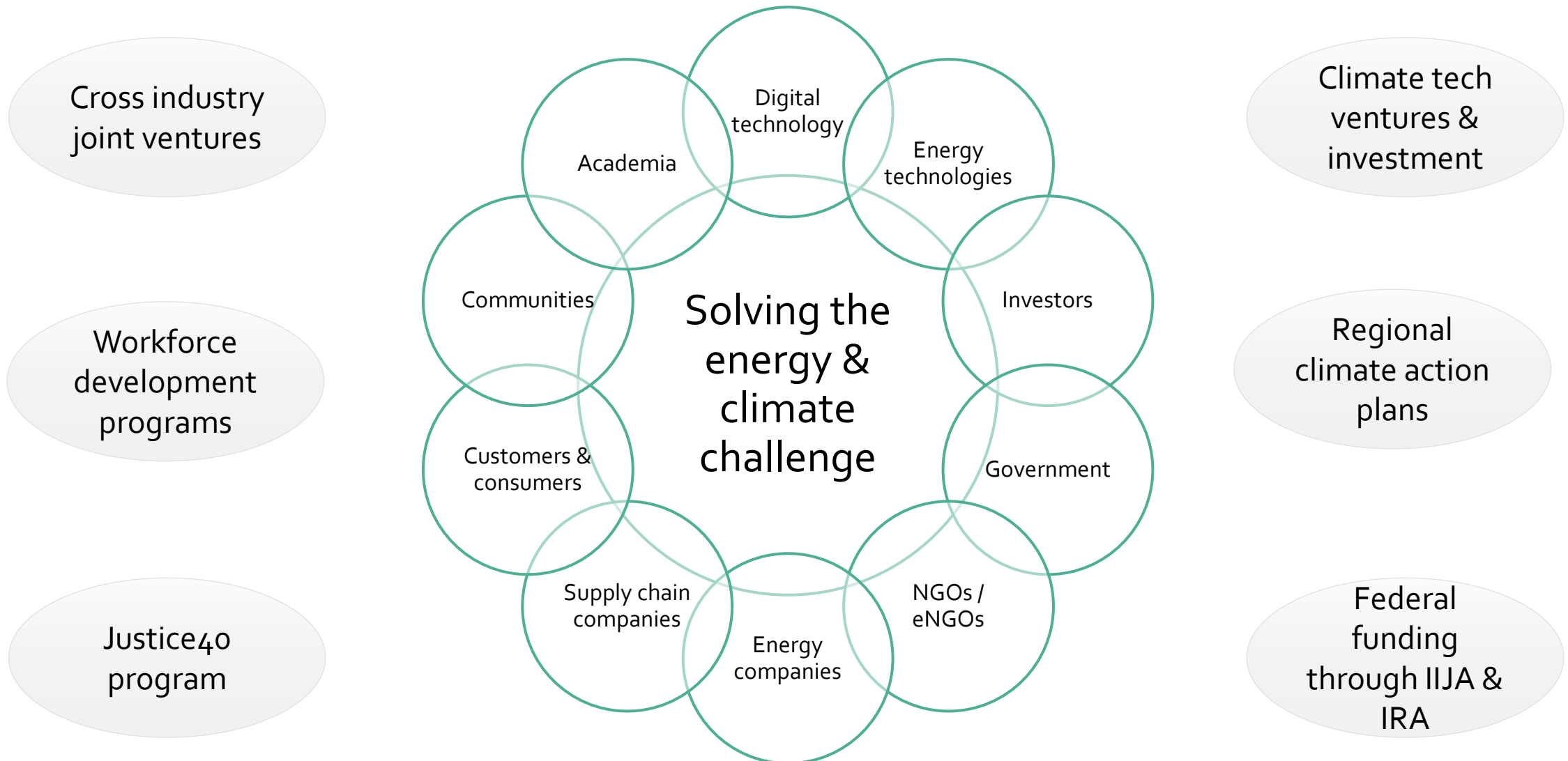
investing significant
capital into
new, low-carbon
businesses



NEW ENERGY FIRMS

bringing new
technologies and
solutions, backed by
venture capital /
private equity

COLLABORATION ACROSS ALL SEGMENTS IS KEY



4. HOUSTON CAN CONTINUE ITS LEADERSHIP IN ENERGY AS WE TRANSITION TO A **LOW-EMISSION** FUTURE

VISION



Leverage Houston's energy leadership to accelerate global solutions for an energy-abundant, low-carbon future.

Drive sustainable and equitable economic growth in the Greater Houston region through a portfolio of technology, policy, and market initiatives that embrace and create value from the world's transition to low-carbon energy systems.

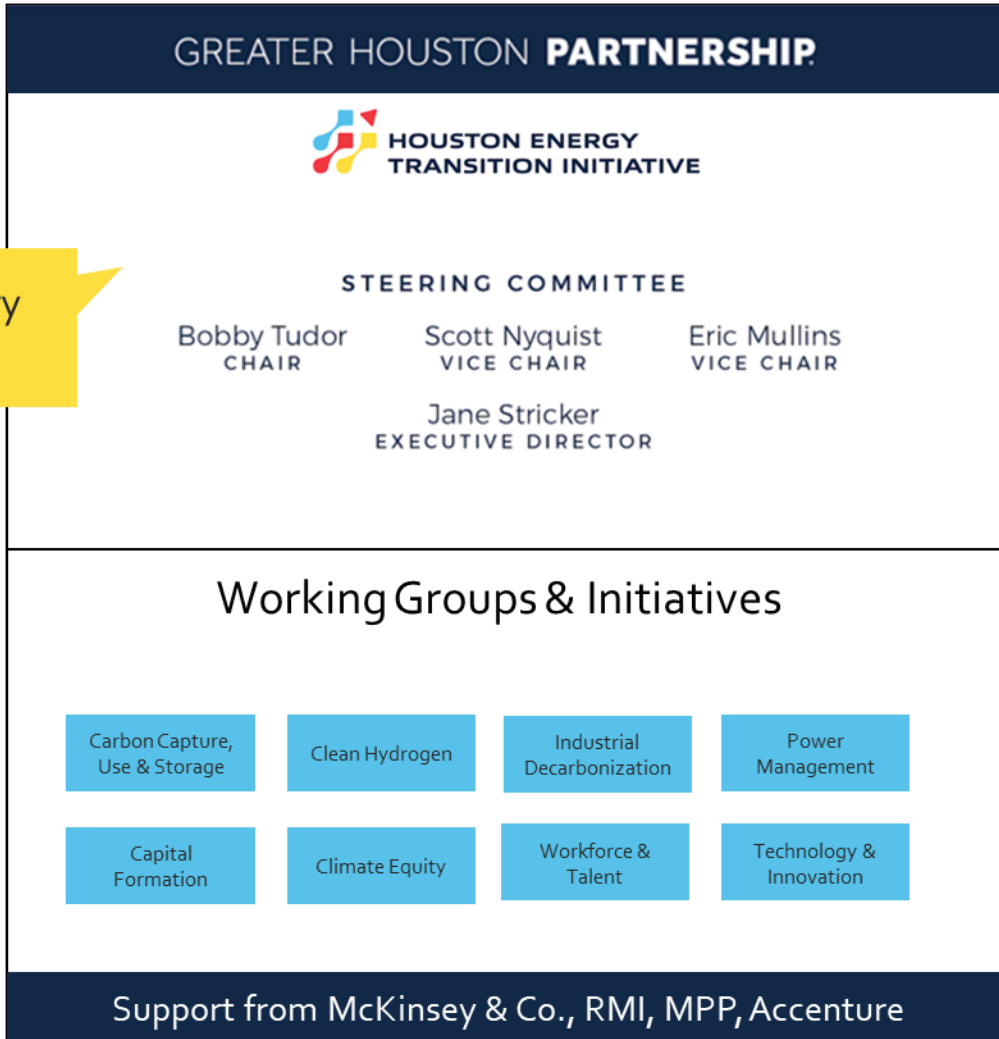
Delivering on this vision requires us to **build upon our history of leadership in the energy and chemical industries, provide new opportunities to our people, and leverage our assets and existing expertise, while creating conditions to attract new and innovative talent and capital.**

A successful effort would result in **economic growth and positive impact on the environment, thereby placing Houston as the leading hub of energy and clean tech innovation.**

STRUCTURE

Attributes: Light touch governance; executed through the Partnership; resources/participation tailored to individual value-chain initiatives; consistent communication among ecosystem players; fast start; phased growth

Advisory Board



- Steering Committee
- Meets bi-annually on priorities, key decisions and progress.
 - Each member assigns a delegate which meets quarterly to monitor and progress initiatives.

- Advisory Board
- ~40 senior stakeholders representing:
 - City/County government
 - Academia
 - NGOs/e-NGOs
 - Trade associations
 - Community organizations
 - Provides input and ongoing guidance on HETI priorities
 - Connects the dots with other efforts in the region

EXECUTIVE MEMBERS



MEMBERS

- | | | | | | |
|--|---|--|---|--|---|
| <p>Air Liquide
ABS
AEP
Bloom Energy</p> | <p>Chart Industries
Energy Transfer
Equinor
Evonik</p> | <p>FuelCell Energy
GCL Solar Materials
Gulf States Toyota
HyAxiom</p> | <p>Linde
LowCarbon America
Mitsui
Motiva</p> | <p>NextEra Energy
Phillips 66
Plug Power
Sempra</p> | <p>Sodexo
Sumitomo Corporation of Americas
Thyssenkrupp nucera
Vopak North America</p> |
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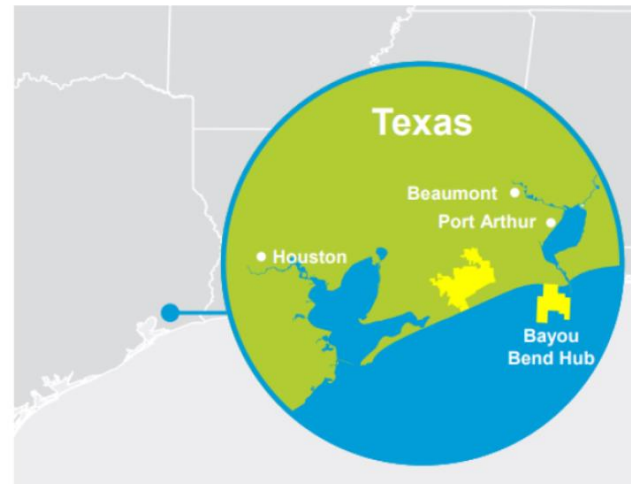
PARTNERS

- Accenture McKinsey & Company Mission Possible Partnership Rocky Mountain Institute

HOUSTON PARTNERSHIPS ARE ENABLING THE TRANSITION TO A LOW-CARBON WORLD



chevron announces investment in carbon clean CO2 capture technology business

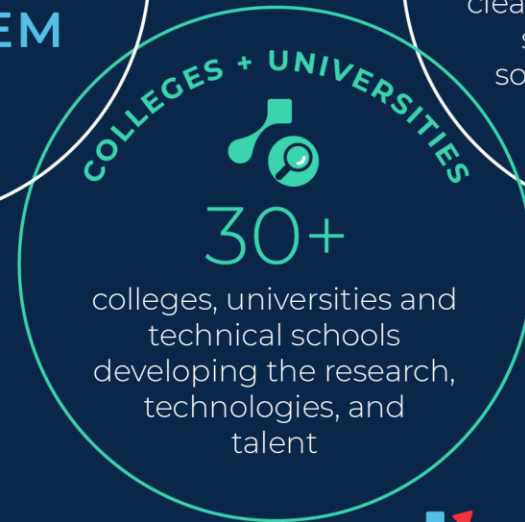
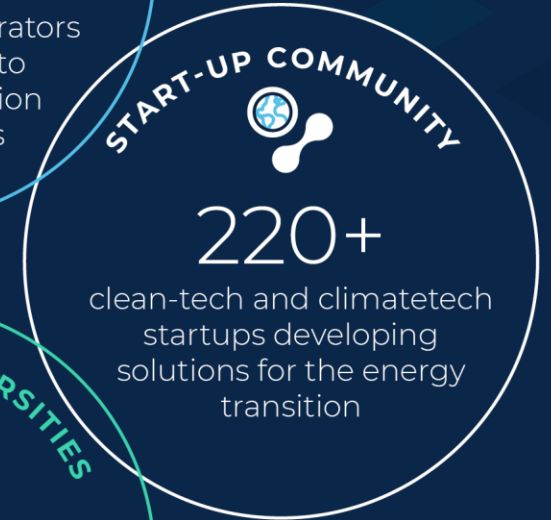
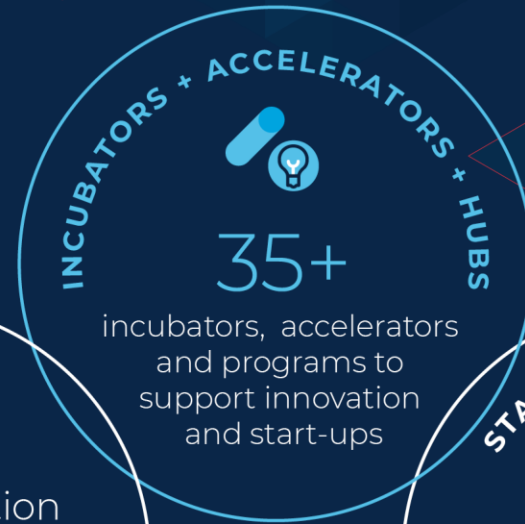
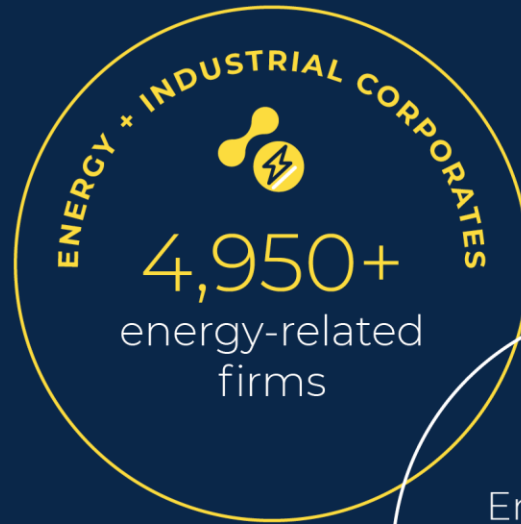


4 energy companies join forces on low-carbon ammonia project on the Houston Ship Channel



bp & Linde plan major CCS project to advance decarbonization efforts across Texas Gulf Coast

HOUSTON IS HOME TO A FAST-GROWING ENERGY TRANSITION INNOVATION ECOSYSTEM



Houston Energy Transition
INNOVATION ECOSYSTEM