BEYOND THE BRIDGE

Bringing
the
Future of Energy
to the
People of Today

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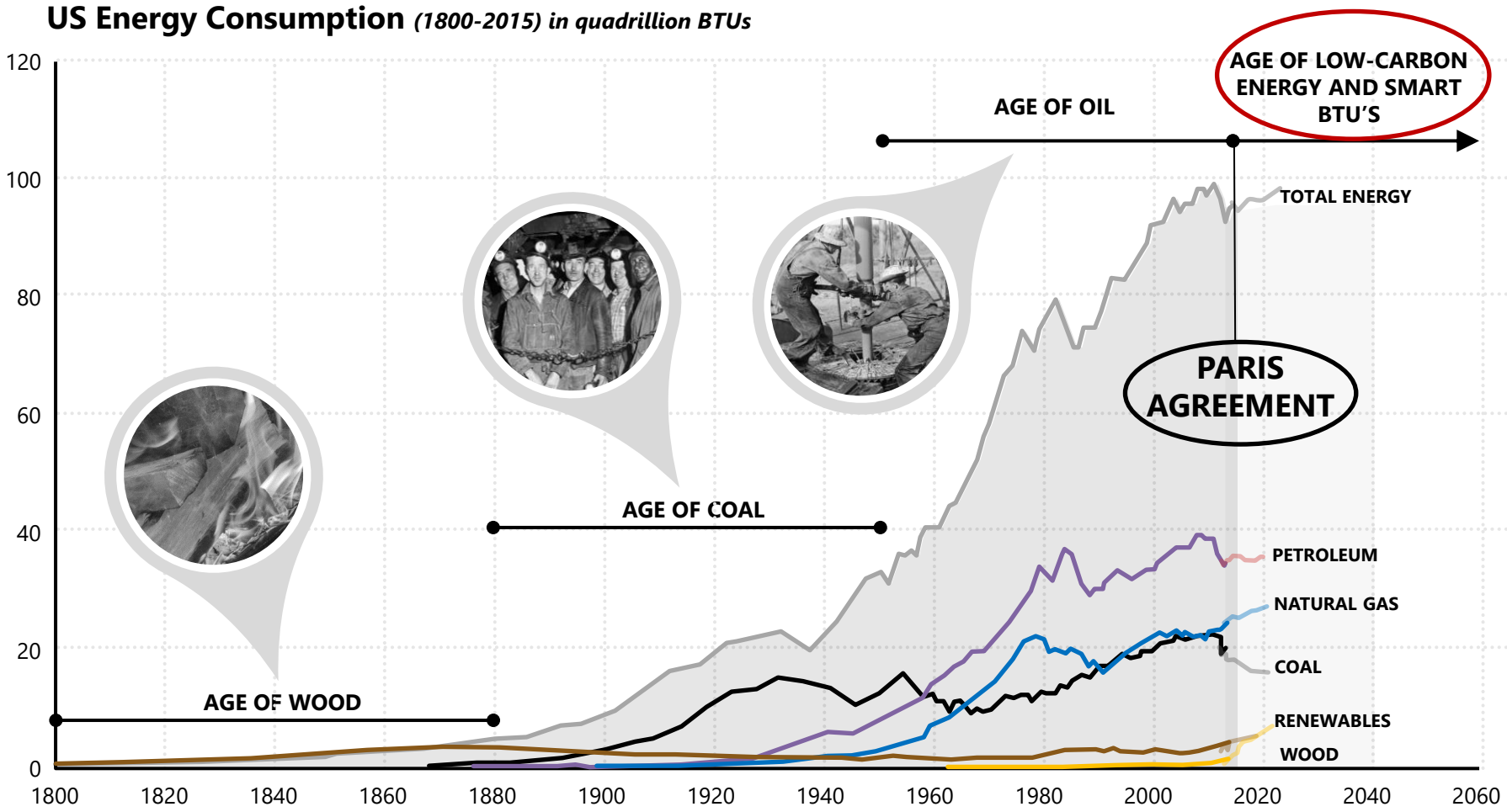
THE LOW-CARBON ECONOMY

PART 1- ENERGY AND THE LCE* TRANSITION

* Low-Carbon Economy

EVOLUTION OF U.S. ENERGY USE



Source: U.S. Energy Information Agency

THE LCE TRANSITION CHALLENGE

1. CAPITAL MARKETS

- Improve disclosure of climate-related risks.
- Monitor capital flows for consistency with Paris goals.
- Avoid systemic risks to capital markets.

2. ENERGY MARKETS

- Promote LCE business models driven by energy productivity.
- Ensure price stability and reliability of energy supplies.
- Ensure efficient and equitable allocation of carbon budget.

3. LCE TECHNOLOGIES

- Increase government R&D spending for all LCE technologies.
- Incentivize LCE infrastructure investment.
- Eliminate non-cost barriers to deployment of new technologies.

4. PUBLIC SUPPORT

- Provide clear vision of the LCE and its benefits.
- Identify LCE transition risks.
- Develop regional strategies to mitigate transition risks.

THE LOW-CARBON ECONOMY

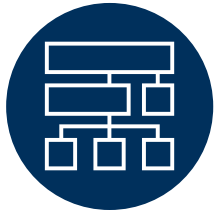
PART 2-THE LCE TRANSITION AND NATURAL GAS

NATURAL GAS TRANSITION CHALLENGES

Methane Emissions

Transition Risk Disclosure

Evolving Energy Markets



Outdated Business Models

1. METHANE EMISSIONS

Emission Levels

- Measurements at the source (“bottoms-up”) indicate emissions are close to inventory estimates.
- Measurements using aircraft (“top-down”) indicate emissions are higher than inventory estimates.

Regional Variations

- There are significant regional variations among emission sources.
- Differences likely attributable to (i) type of natural gas production (i.e. wet gas-vs-dry gas) and (ii) the age, number and type of infrastructure.

Fat-Tail or Super-Emitter Phenomenon

- A relatively small number of emission sources are responsible for a disproportionately large number of emissions.
- Important to recognize there are three (3) types of super-emitter: chronic, episodic and malfunctioning.

Cost-Effective Reduction Opportunities

- There are a number of cost-effective emission control technologies that can be employed today.
- Advances in emissions detection/monitoring technologies should follow reduction opportunities.

METHANE EMISSION POLICIES

TECHNOLOGY-BASED DESIGN

- Pre-defined emission control technologies are applied to all “affected sources”.
- Application of control technology is required regardless of the actual emission profile of the source.
- Technology-based design is more appropriate for a smaller population of homogenous emission sources.
- Monitoring, recordkeeping and reporting requirements are burdensome due to large number of emission sources.

PERFORMANCE-BASED DESIGN

- Performance-based design allows companies to focus on “super emitter/fat-tail” emission sources.
- Each company optimizes emission reductions by focusing capital deployment on its highest emitting sources.
- Technology-neutral approach encourages development of new technologies to achieve emission reduction goals.
- Intensity-based metrics enable bench-marking between companies, regardless of size.

2. TRANSITION RISK IN THE E&P SECTOR

Energy Transition Risk

Energy Transition Risk is the inherent risk to existing economic, social and political systems associated with the global transition to a low-carbon economy. **Asset Value at Risk** is the metric we use to quantify the impact of different carbon budget scenarios on an E&P Company's asset portfolio.

Revenue Risk

The risk of **decreased revenues,** as compared to a business-as-usual scenario.

Volume risk

The risk of "**stranded assets**" that carry no/reduced value under a given carbon budget scenario, as compared to business-as-usual.

Price risk

The risk of realizing **lower product prices** under a given carbon budget scenario, as compared to business-as-usual.

Cost Risk

The risk of **increased expenses**, as compared to a business-as-usual-scenario.

Carbon price

The risk of **increased operating expenses** associated with carbon pricing programs.

Carbon intensity

The risk of **disproportionate devaluation** of high carbon intensity assets.

TRANSITION RISK DISCLOSURE

Purpose of Disclosure

- Inform investment, asset valuation and voting decisions.
- Enhance allocative efficiency of capital markets.

Decision Useful Information – What is it?

- Relevant, comparable, timely, reliable, verifiable and objective.
- TCFD disclosure principles.
- Importance of scenario analysis in assessing transition risk.

Scenario Analysis

- Selecting a 2℃ Scenario.
- Model assumptions and input variables (future energy demand, cost and availability of LCE technologies, strength of LCE policies, emission levels of non-CO2 forcing agents, probability of achieving target).
- Need for asset-level data on production volumes, capital investments, operating expenses, production costs and carbon intensity.

Scope of Disclosure

- Impact on business models, strategic planning, capital allocation decisions and financial performance.
- Materiality, business judgement rule and standardized disclosures (e.g. SEC PV-10 disclosures).

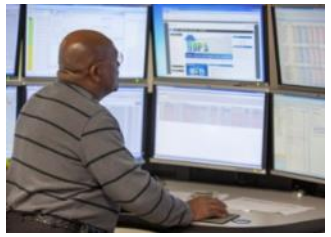
3. EVOLVING ENERGY MARKETS

Adequacy of Supply

(Are the ***reserves*** there?)

Deliverability of Supply

(Can you get it ***where*** you need it?)



Reliability of Supply

(Can you get it ***when*** you need it?)

Competitive/Market Pricing

(Are the markets ***liquid*** and ***competitive***?)

CHALLENGES FOR US LNG

Supply

- Large global supply of natural gas below $3.00 per MMBtu (at the wellhead).
- Transportation risk - availability of LNG carriers and volatility of charter rates.

Demand

- Competition from coal and renewables keeps a lid on demand and downward pressure on prices.
- US LNG acts as “physical collar” for Russian supplies to Europe.
- Global efforts to reduce carbon emissions and plastics pollution will erode demand.

Market Maturity

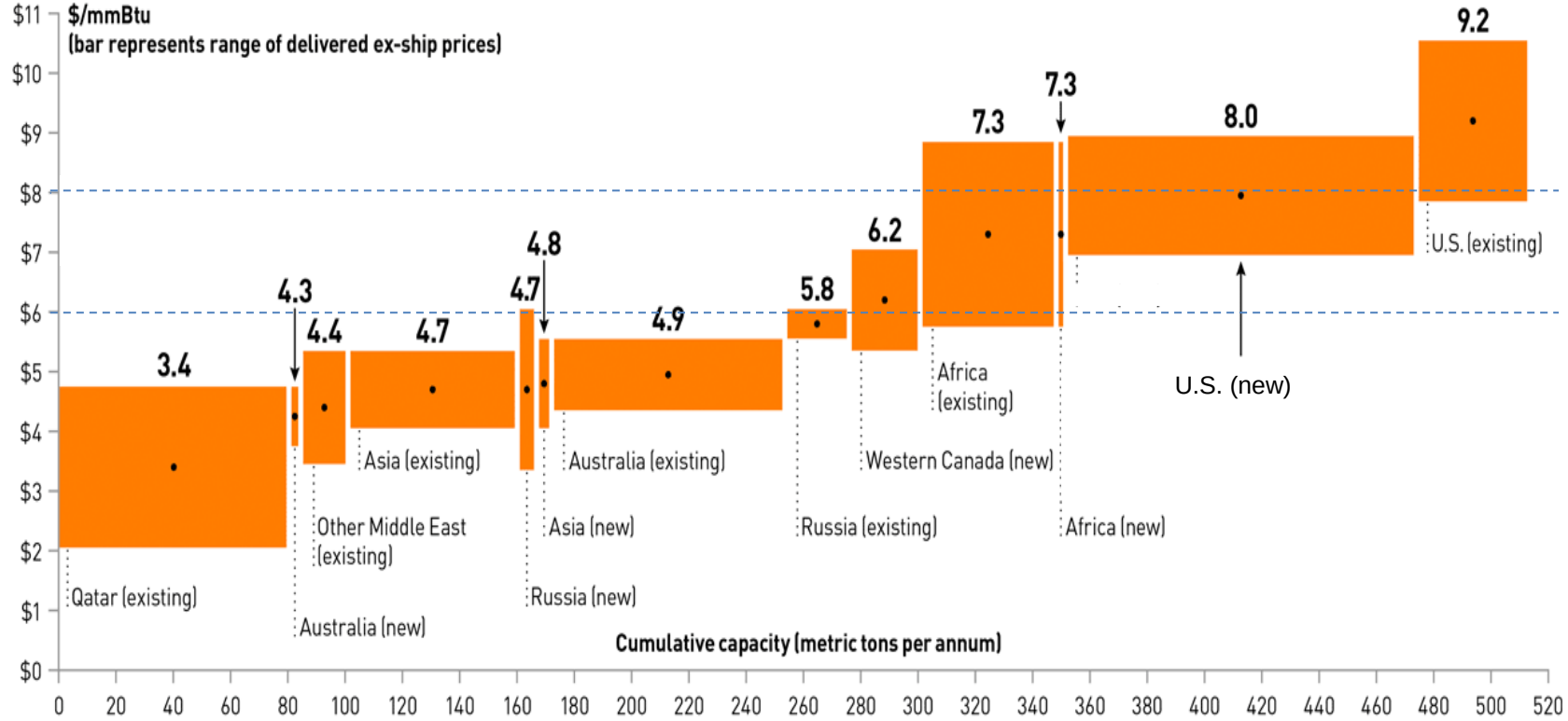
- Lack of market liquidity and transparency in Asian markets.
- Lack of natural gas infrastructure in key export markets.
- Lessons learned from evolution of US natural gas market (i.e. take-or-pay litigation, market restructuring problems).

Market Distortions

- Natural gas pricing mechanisms (e.g. oil indexation, regulated prices, government subsidies, etc.).
- State capitalism, subsidies for state-owned enterprises, abuses of market power (by both sellers and buyers), energy security concerns, etc.

CAN US LNG COMPETE?

Lower Cost Supplies



Demand Destruction

Source: Oxford Institute for Energy Studies, Argus, Strategy& analysis

Estimates based on 2025 deliveries to NE Asia.

4. OUTDATED BUSINESS MODELS

Traditional Business Model Assumptions

- Resource scarcity.
- Growing demand.
- Upward pricing trends.

New *Theory of the Business** for E&P Companies

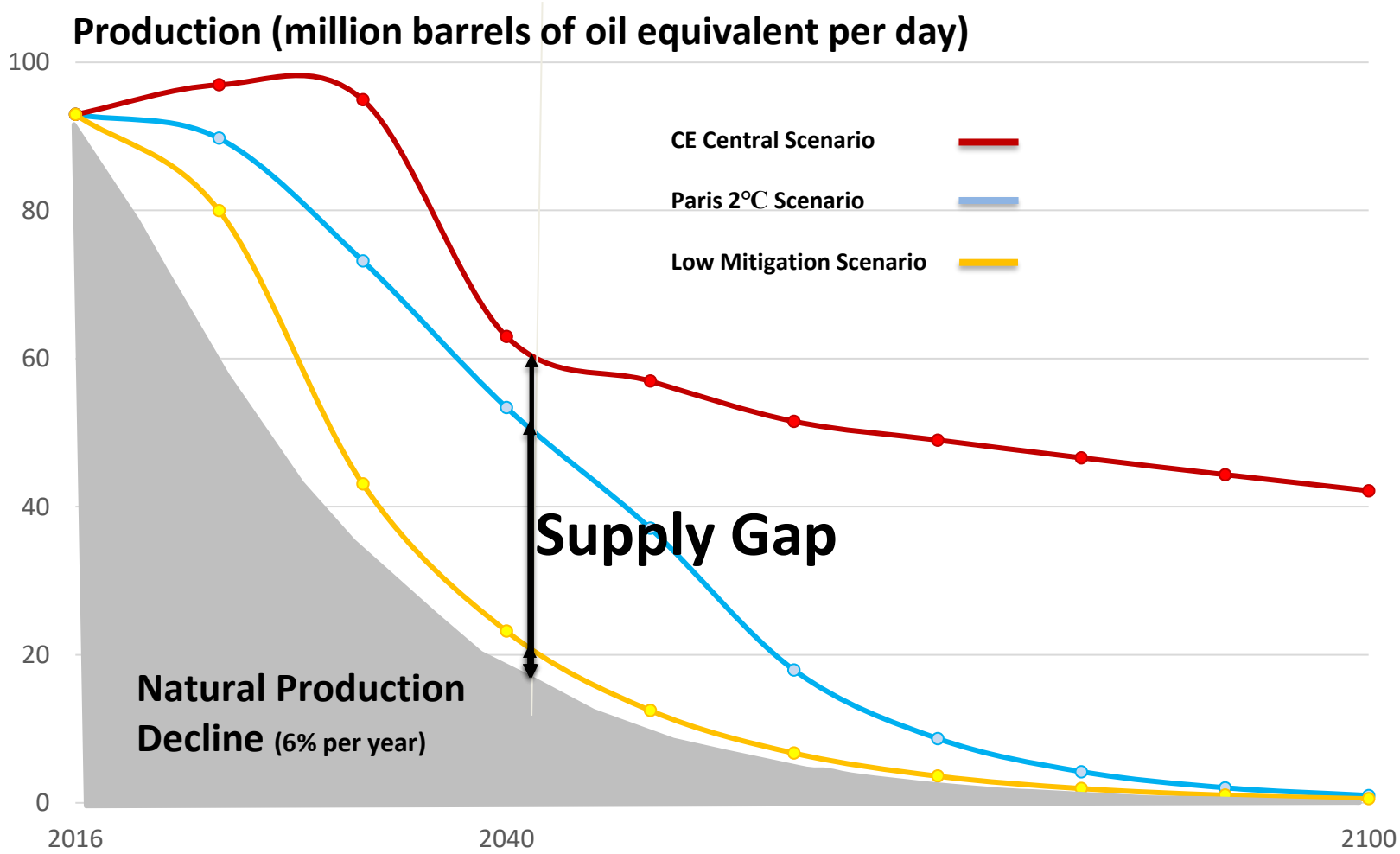
- Unconventional resources have shifted industry to resource abundance.
- Economic growth is uncoupling from energy demand.
- Aggregate hydrocarbon demand is flattening (Asia is the exception).
- LNG is globalizing the natural gas industry.
- Renewable energy is cost-competitive with fossil fuels in many areas.

Impact of New Theory of the Business

- Resource abundance is making position on supply cost curve **very** important **(**exploration's new role is "portfolio improvement").
- Resource abundance is driving a downward pricing trend.
- Demand destruction from energy efficiency, EV's and renewables will continue to soften prices.
- Carbon budget threatens asset values, especially assets "higher up" on the supply cost curve.

* Peter Drucker, the father of business management, said every successful business must have a valid "***theory of the business***" that is based on three basic assumptions, each of which must fit reality and fit one another. These three assumptions relate to : (i) the environment in which the business operates (i.e. social, economic and regulatory trends, markets, customer preferences and technologies); (ii) the mission of the enterprise; and (iii) the core competencies needed to accomplish the mission of the enterprise.

EXPLORATION'S NEW ROLE- PORTFOLIO IMPROVEMENT



Demand profiles are provided until 2040 for the 450 Scenario (WEO, 2015) and CE Central Scenario (Future of fossil fuels, 2017), while demand profiles are provided until 2050 for the Paris 2˚C Scenario (Perspectives for the Energy Transition (IEA/IRENA), 2017). Fuel specific decline rates are assigned after 2040/2050 to create profiles towards 2100 aligned with the total CO2 budget for each scenario. The Low Mitigation Scenario is a scenario constructed by Rystad Energy, where demand drops by 8.5%, 6% and 5% for coal, oil and natural gas respectively from 2020-2100 to be in line with the fossil fuel budget of 580 GtCO2 over the period 2016-2100.

Source: Rystad Energy and 2C Energy research and analysis

THE LOW-CARBON ECONOMY

PART 3- THE ROLE OF NATURAL GAS *BEYOND THE BRIDGE*

THE LOW-CARBON ECONOMY

ENERGY DEMAND

Increasing Demand for Zero-Carbon Energy

ECONOMIC GROWTH

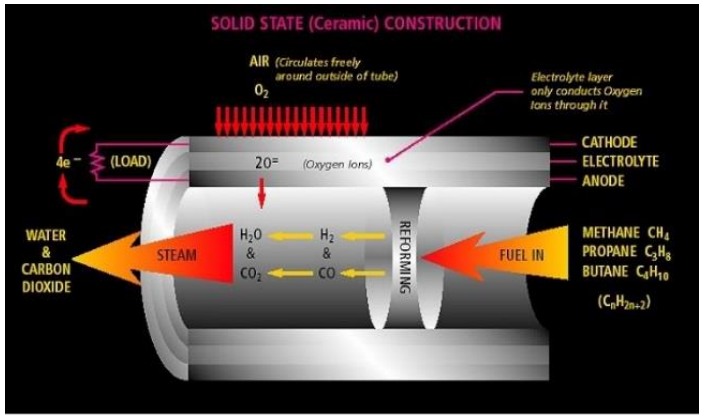
Increasing Focus on Sustainable Development

ACCESS TO CAPITAL

Paris Compliant Investments

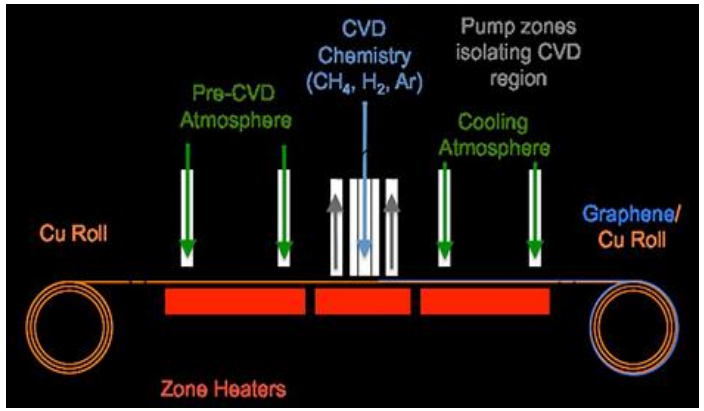
SELECT "NATURAL GAS FOCUSED" LCE TECHNOLOGIES

Energy Conversion



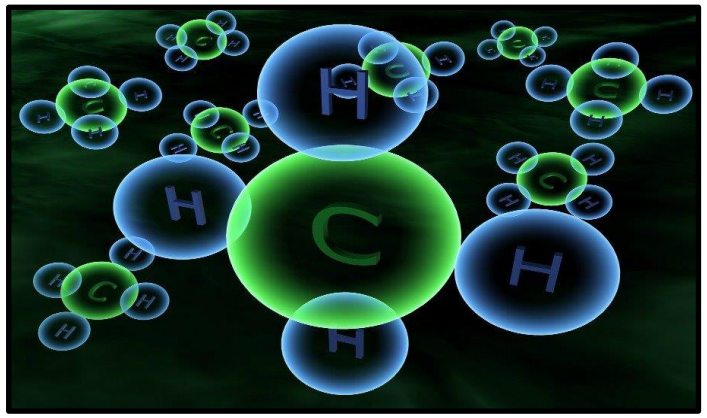
Solid Oxide Fuel Cells

New Products



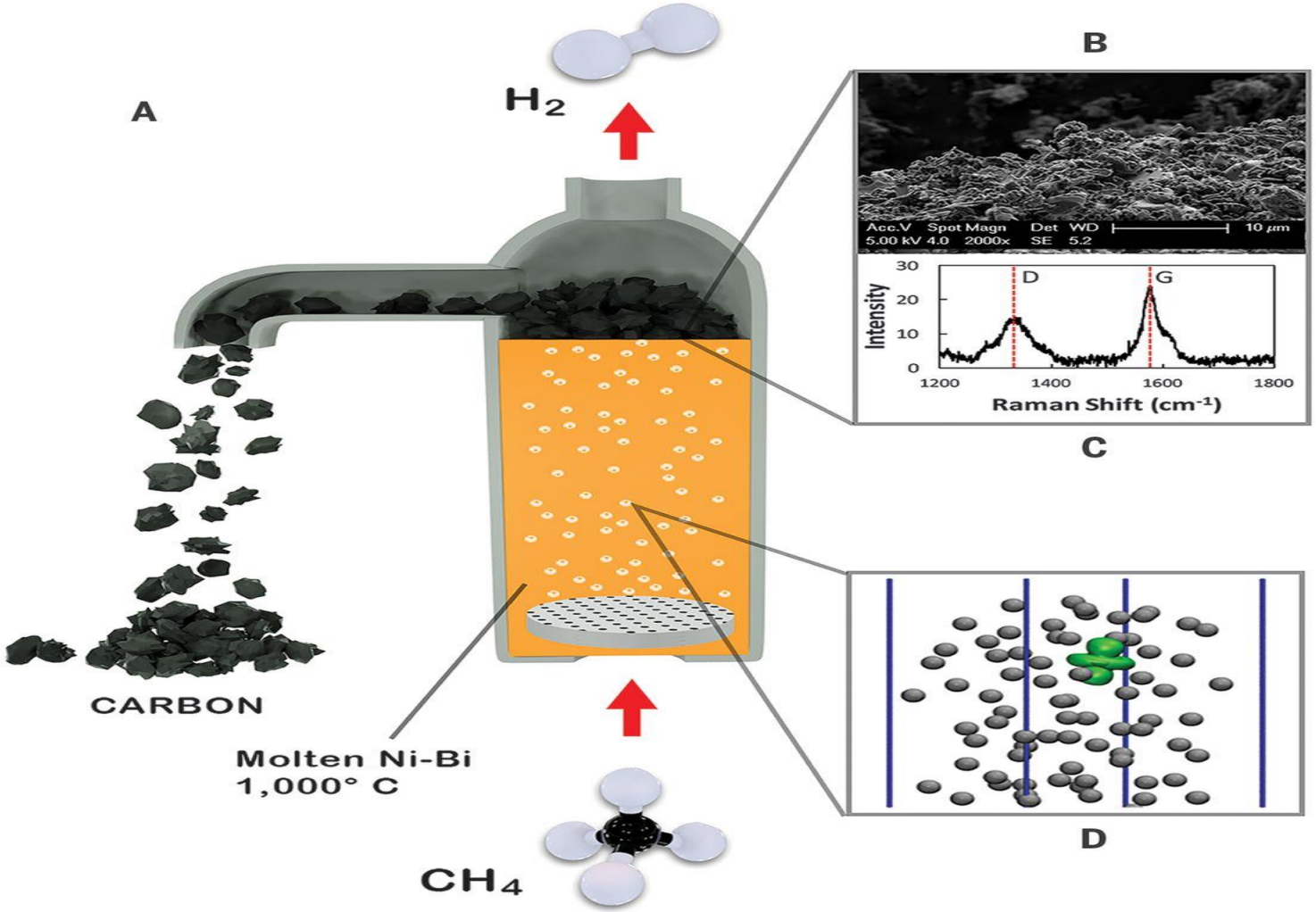
Graphene and Carbon Fiber

New Processes



Methane to Hydrogen and Liquid Fuels

PRODUCING HYDROGEN AND SOLID CARBON FROM METHANE



D. Chester Upham et al. Science 2017;358:917-921

NATURAL GAS - THE VALUE PROPOSITION

ZERO-CARBON ENERGY

Power Sector

- Flexible generating capacity.
- Long-duration energy storage.
- Progressive decarbonization of power (CH4 to H2).

Industrial and Buildings Sectors

- Feedstock and process heat (e.g. steel, cement and chemicals).
- Space heating and solid oxide fuel cells.
- Service-based business models.

Transport Sector

- Heavy-duty vehicles.
- Shipping and aviation.
- Methane to liquid fuels.

SUSTAINABLE ECONOMIC DEVELOPMENT

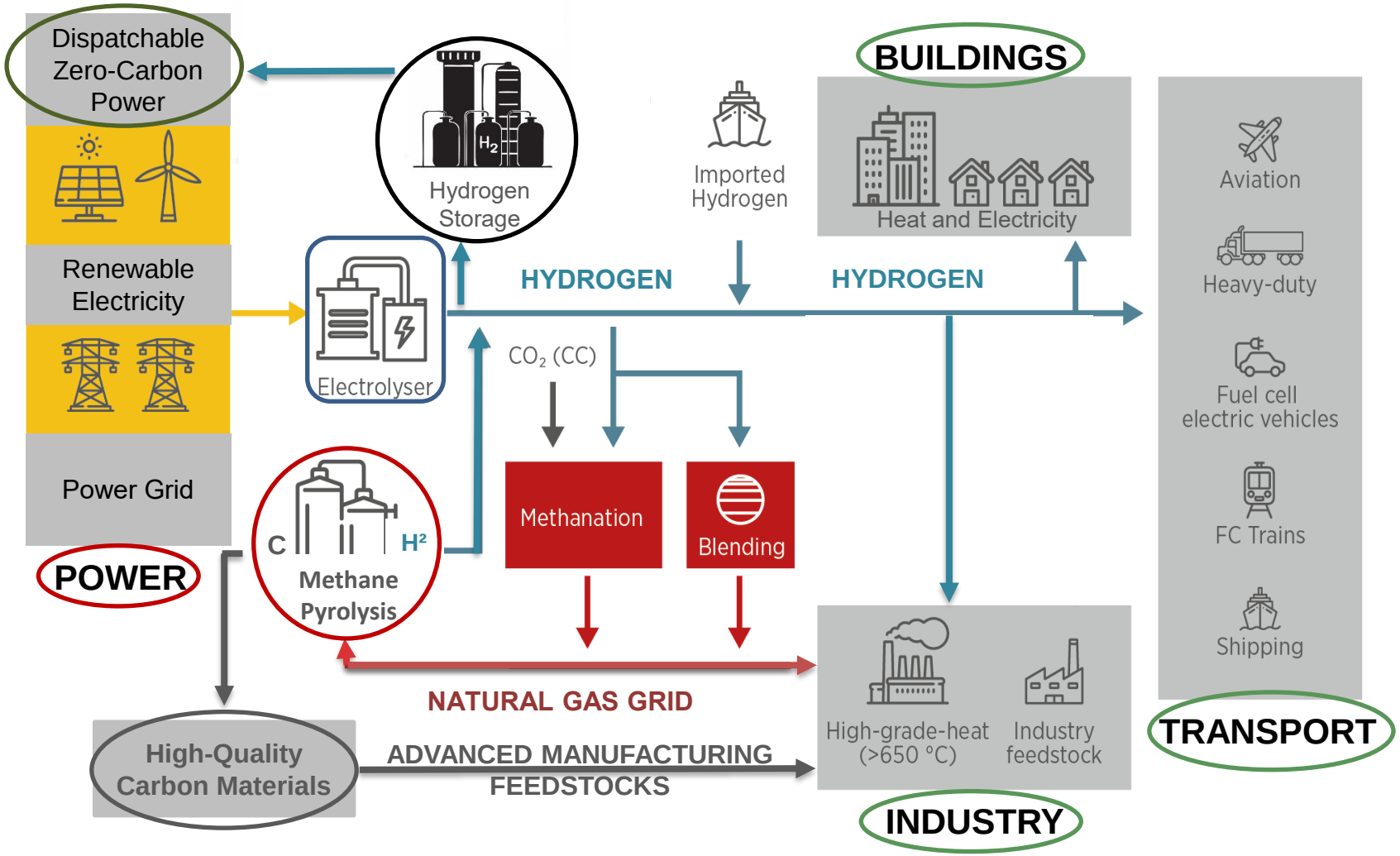
Advanced Manufacturing Feedstocks

- Graphite.
- Carbon fibers.
- Graphene.

Energy-Manufacturing Synergies

- Waste-heat recovery and utilization.
- Integrated energy solutions.

NATURAL GAS, HYDROGEN AND THE LOW-CARBON ECONOMY



Source: IRENA and 2C Energy, LLC.

OUR "BEYOND THE BRIDGE" INITIATIVE

Reshore US manufacturing jobs by creating regional manufacturing centers, utilizing advanced manufacturing technologies, circular economy principles and low-carbon energy.

American Energy Innovation

- Sustainable natural gas development.
- Energy productivity and decarbonized natural gas.
- Full Energy System Integration (electrons, molecules and Smart Btu's).

Additive Manufacturing (AM) and the Circular Economy (CE)

- Products designed to facilitate AM and CE.
- Carbon-based materials developed to optimize AM and CE products.
- Optimize energy-manufacturing synergies.

Access to Capital

- Public-private economic development partnerships.
- Infrastructure buildout for AM, CE and LCE technologies.
- Innovative financing for energy productivity investments.