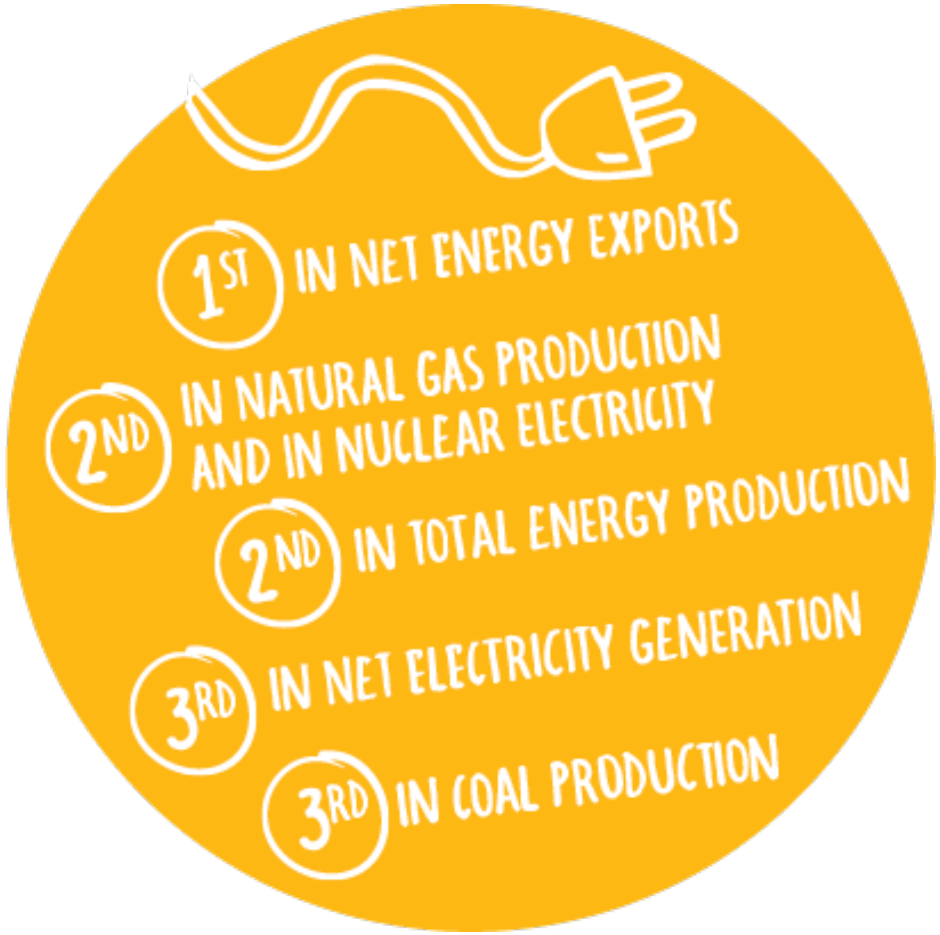
ENERGY IN PA

Opportunities for Hydrogen In A Changing Energy Landscape

Adam Walters
Senior Energy Advisor
Pennsylvania Office of Energy
adwalters@pa.gov

POWERING PENNSYLVANIA'S ECONOMY

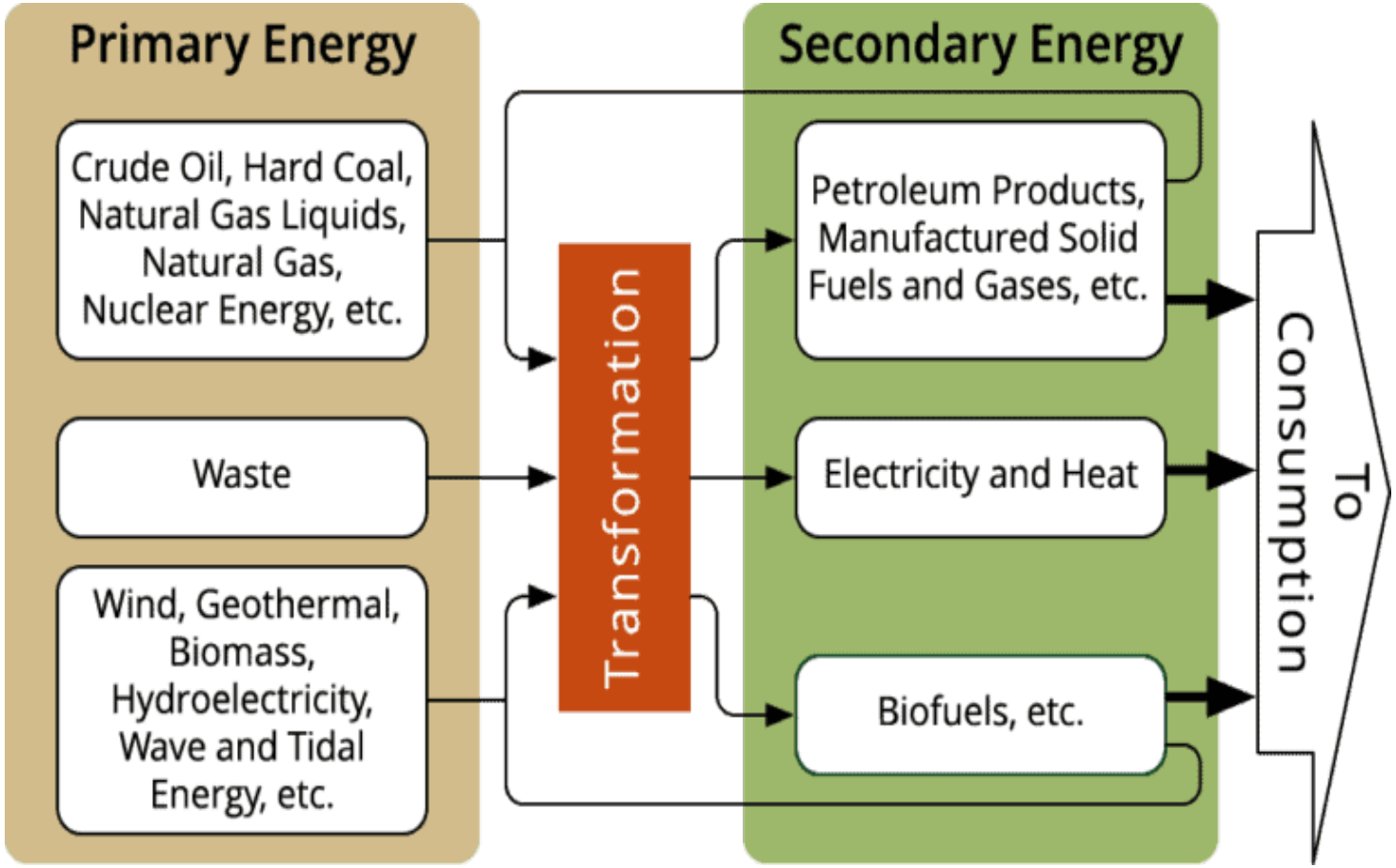


Our abundance of natural resources gives Pennsylvania the opportunity to play an important role in national energy production and positions us for unparalleled growth in the energy and manufacturing sectors.

HYDROGEN (H_2) 101: AN ECONOMIC DEVELOPER'S EXPLANATION

- Hydrogen is a small, lightweight, and abundant molecule
- Hydrogen gas is primary form
  - Two hydrogen atoms (H) are bonded to form H_2, or diatomic hydrogen
  - Colorless, odorless, tasteless, non-toxic, and combustible
- Existing uses for hydrogen include:
  - Coolant – power stations use H_2 to cool generators due to its thermal conductivity
  - Hydrogenation – converts unsaturated fats to saturated fats (margarine)
  - Refining – upgrading petrochemical fuels by reducing sulfur content
  - Fertilizer production – ammonia fertilizer is mostly hydrogen atoms

HYDROGEN AS AN ENERGY CARRIER



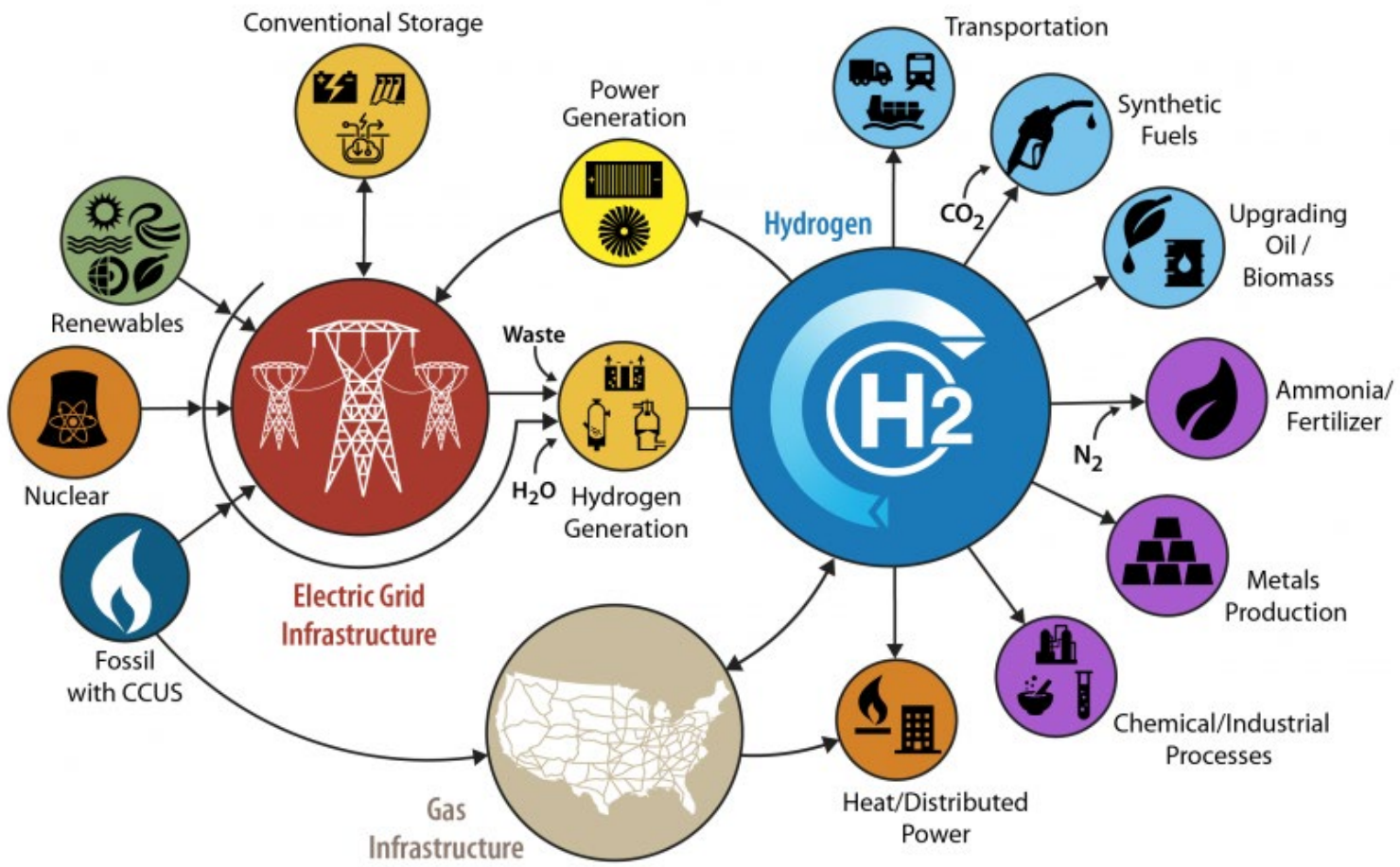
Source: https://www.watt-watchers.com/activity/energy-resources-primary-vs-secondary/

- Hydrogen is NOT a primary energy resource
  - Primary sources have not been subject to human intervention
  - E.g., petroleum, coal, natural gas, wind, solar
- It is a secondary energy source
  - It is made available to us as energy by storing its energy content from the conversion of other (primary) energy resources

MODES OF HYDROGEN PRODUCTION: THE H_2 RAINBOW

- Hydrogen production methods are often identified by color-coding
- Grey – natural gas (methane) molecules are split by steam methane reforming (SMR)
  - Vast majority of current H_2 production today
  - Emits large amounts of carbon dioxide CO_2
- Blue – similar SMR process, but includes carbon capture technology
  - CO_2 can be permanently stored or used in various commercial applications
- Green – electrolysis using renewable electric generating sources
- Pink – electrolysis using nuclear power

A LOW CARBON FUEL WITH MANY USES



Source: https://www.energy.gov/eere/fuelcells/h2scale

- Hydrogen is a versatile fuel with the potential to help us decarbonize multiple economic sectors
- Reducing emissions in already noted applications
- Transportation (fuel cells)
- Heating and utility adoption (blending with natural gas)
- Power generation
- Heavy industry (metals production and chemical industries)

TOWARDS A HYDROGEN FUTURE: FEDERAL GOVERNMENT APPROACH

- Federal Infrastructure Investment and Jobs Act (IIJA)
  - Develop and demonstrate new technologies for hydrogen electrolyzers - $1 billion
  - Advance new technologies across production, processing, delivery, and storage - $500 million
  - Regional clean hydrogen hubs - $8 billion
    - Minimum four hubs nationally
    - Meet certain criteria for production, end use, and geography
  - US Department of Energy RFI

TOWARDS A HYDROGEN FUTURE: PENNSYLVANIA'S APPROACH

- Response to US DOE H2Hubs Request for Information
  - Proximity to energy resources and diverse end-use market are key
- Governor Wolf's proposed 2022-23 budget
- Pennsylvania Energy Horizons Cross-Sector Collaborative
  - Focused on multi-sector decarbonization
  - Hydrogen and carbon capture technologies as enablers
  - Driven by the private sector and non-governmental organizations
  - First step towards durable public-private partnership

LOOKING AHEAD: WHERE DO WE GO FROM HERE?

- Pennsylvania will be engaged in this work for the long-term
- Leverage our nationally relevant position in energy production
- Lead in the energy transition
- We have everything we need here
  - Natural resources and a large energy sector
  - Capable workforce
  - Aggressive decarbonization goals