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Sheet Metal for Specialty Hi-Tech Facilities

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Topics of Discussion

- Cannabis Cultivation and Manufacturing
  - What makes these spaces unique
  - Unique construction requirements
  - Airflow

- Lithium Battery plants
  - Facility
  - Process overview
  - Duct Systems
  - Construction Challenges

Acknowledgements

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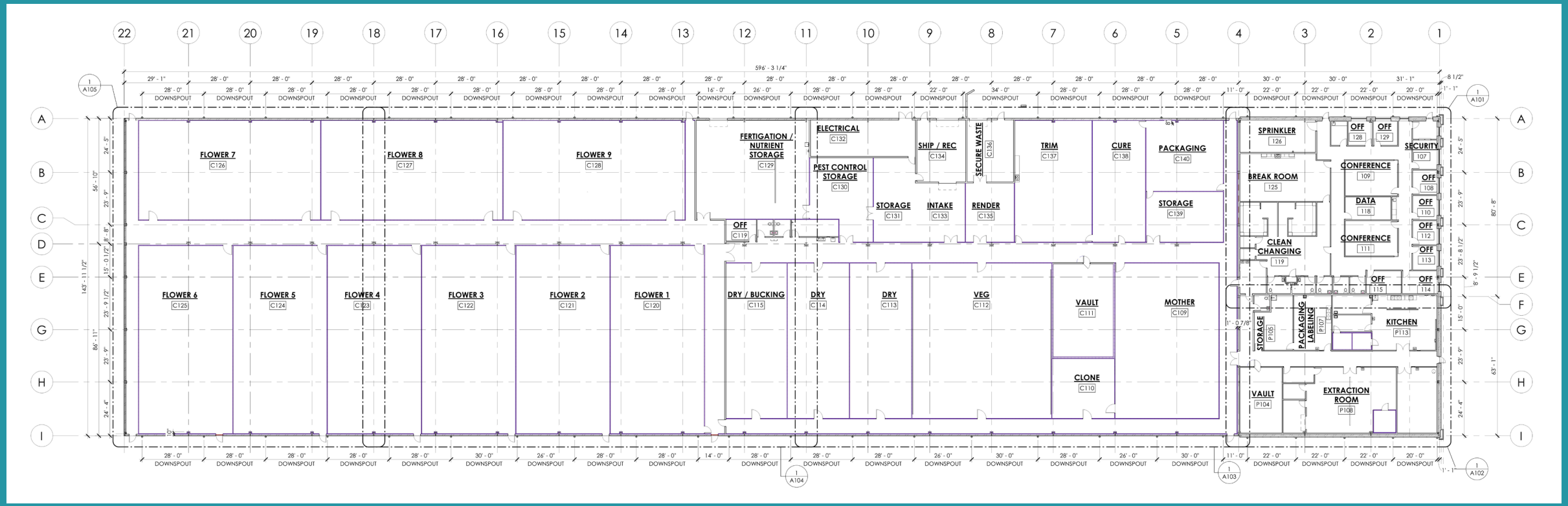
Space types for Indoor Grows



Mother/ Clone

82F and 70%RH

18-24hrs/day

Mother – entire life span

Cone – 2 weeks

Vegetation

- 82F 70% RH
- 18-24 hrs/day of light
- 1-3 weeks

Flower

82F / 50%RH

12 hrs/day of light

6-8 Weeks

Last week 78F / 55RH

Very sticky

Drying Room

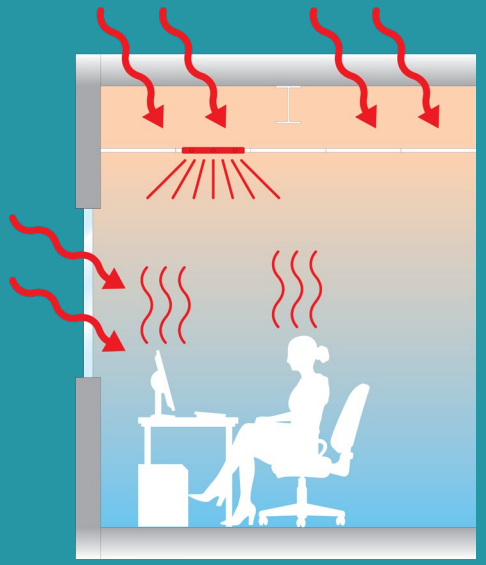
60F/ 50%RH

10 days

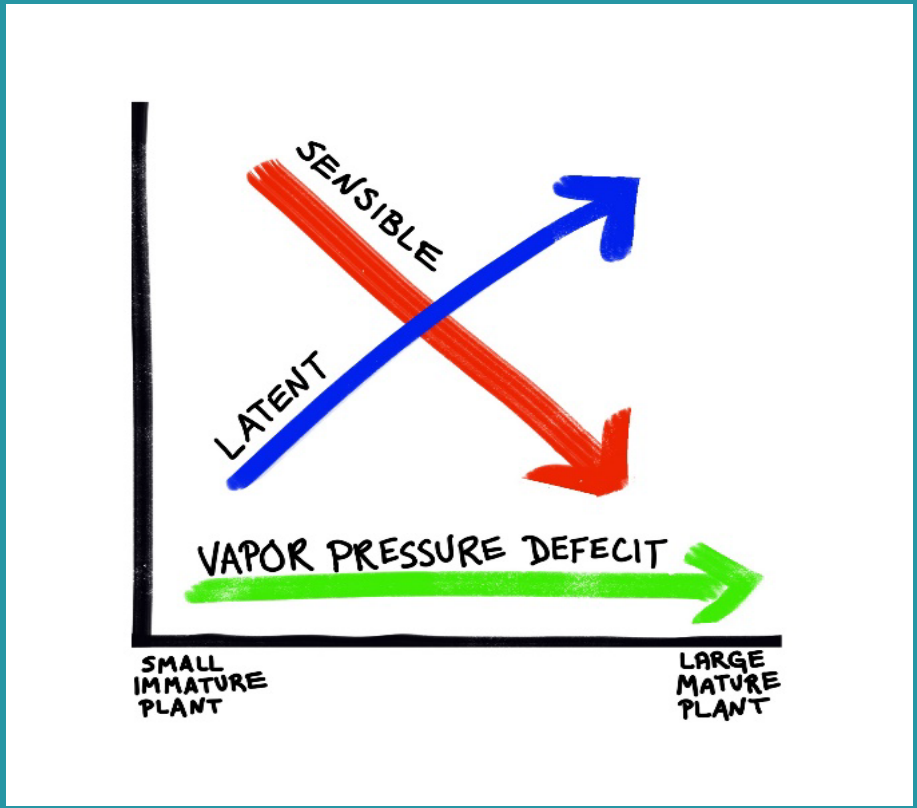
Remove 80-90%

No lights

Cooling Load Calculations



- Typical buildings with occupants
  - Envelope heat gain and loss
  - People
  - Lighting, computers, printers, etc.
  - Ventilation load
- Indoor agriculture
  - Envelope loads are much lower
    - R19 exterior walls/ R20 Insulated Metal Panels
  - Lighting – much higher than normal
    - 30-50 watts/sqft
  - Plants, water
  - Fewer people/ sqft
  - Ventilation kept to minimum
    - Pressurization only
    - CO2 Augmentation



Load Conundrum

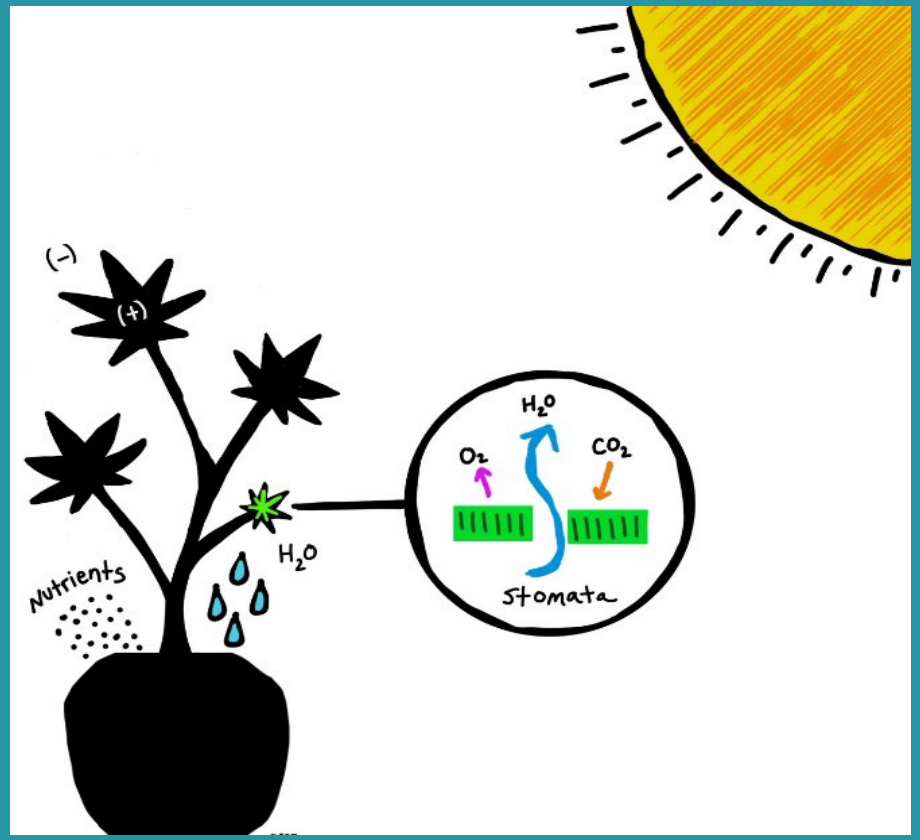
The load is very variable

0.75 SHR to as low as 0.30

When plants are small latent is low and sensible is high

As the plants grow, more water, more transpiration and higher latent loads

Sensible is less due to evaporative cooling



Moisture

Transpiration

- Release of Moisture to the space
- Exhalation of water vapor from the plant
- Delivered through the Stomata
- Evapotranspiration

Why is this important?

- How the plant receives nutrients
- Water hydraulically moves through the plant
- Delivering dissolved nutrients from the soil

Temperature and Humidity are the Drivers for Nutrient Delivery

Air flow in grow rooms

- Supply air to the space
  - Supply Air temp above space dewpoint 82F 50% RH
  - If the space 82F 50% RH correlates to approx. 63F
- Air Changes per Hour
  - 30 to 50
  - De-coupled fans in space
  - Attempting to minimize Micro-climates

Air flow

- Supply and return air high
  - Short circuiting of air
  - Supply air very close to room temp
  - Air is very velocity dependent

- Supply high, return low
  - This insures best air movement
  - Difficult to blow air through canopy
  - Air tends to bounce off
  - Best to draw air through canopy
  - Velocity @ plant 0.5-1m/s or 100-200fpm
    - Max of 2m/s or 400fpm
  - Very difficult to penetrate canopy

Room pressurization

- Rooms need to be sealed weather tight
- Blower room door test
- Room separate from ductwork
- Leakage Rate of Less than 0.2 ACH at 2.0 inches W.G. (50 Pascals)

Dry Room Air Flow

TELLUS

Tellus Health Corp
Butler, MO

Airflow Demonstration
Drying Room

Test 2.1
Inject tracer smoke in center of room, at center height of supply/return banks.

Materials

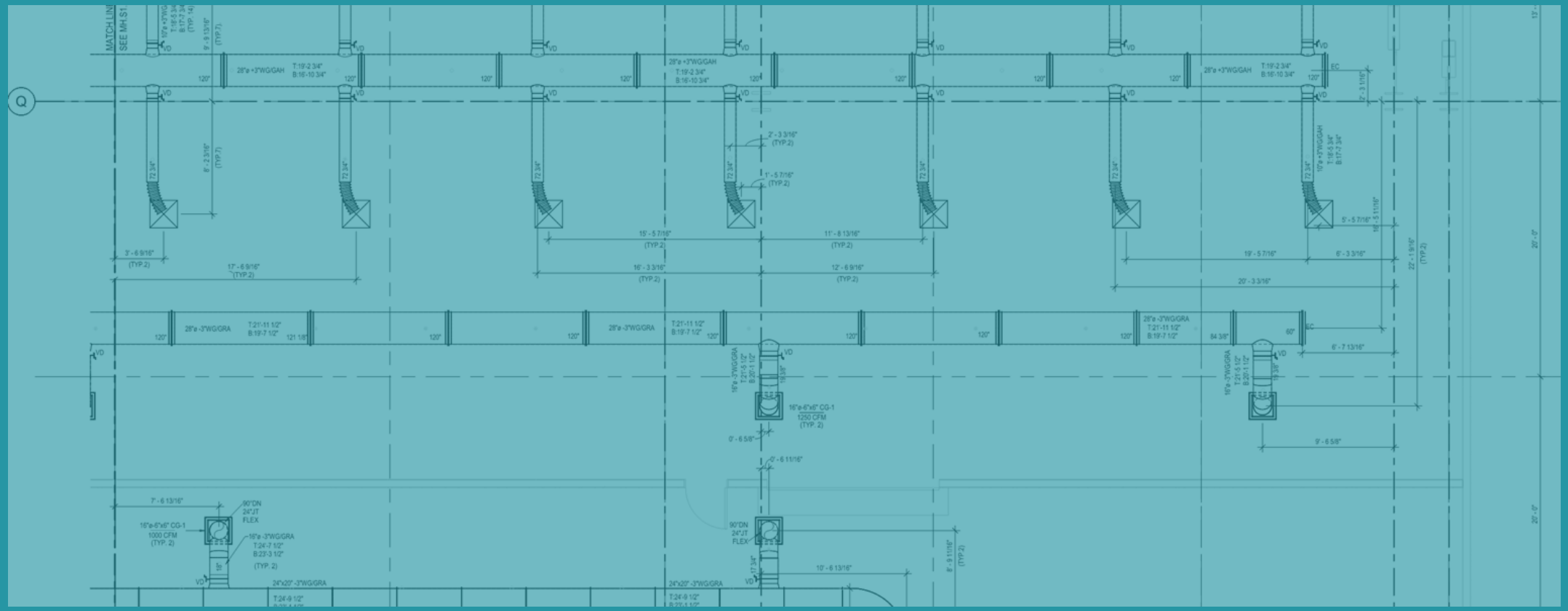
- Stainless Steel?
- Aluminum?
- Galvanized works fine
- Best to keep ductwork out of the room
- Insulate with polystyrene board with lagging or alumi-gaurd

Lithium Battery Plant Opportunities and Challenges

Exploring Construction, Manufacturing, and HVAC Integration

Introduction

- Overview of specialty industrial lithium battery plants
- Importance of HVAC and sheet metal systems
- Unique construction characteristics and challenges



What is a Lithium Battery?

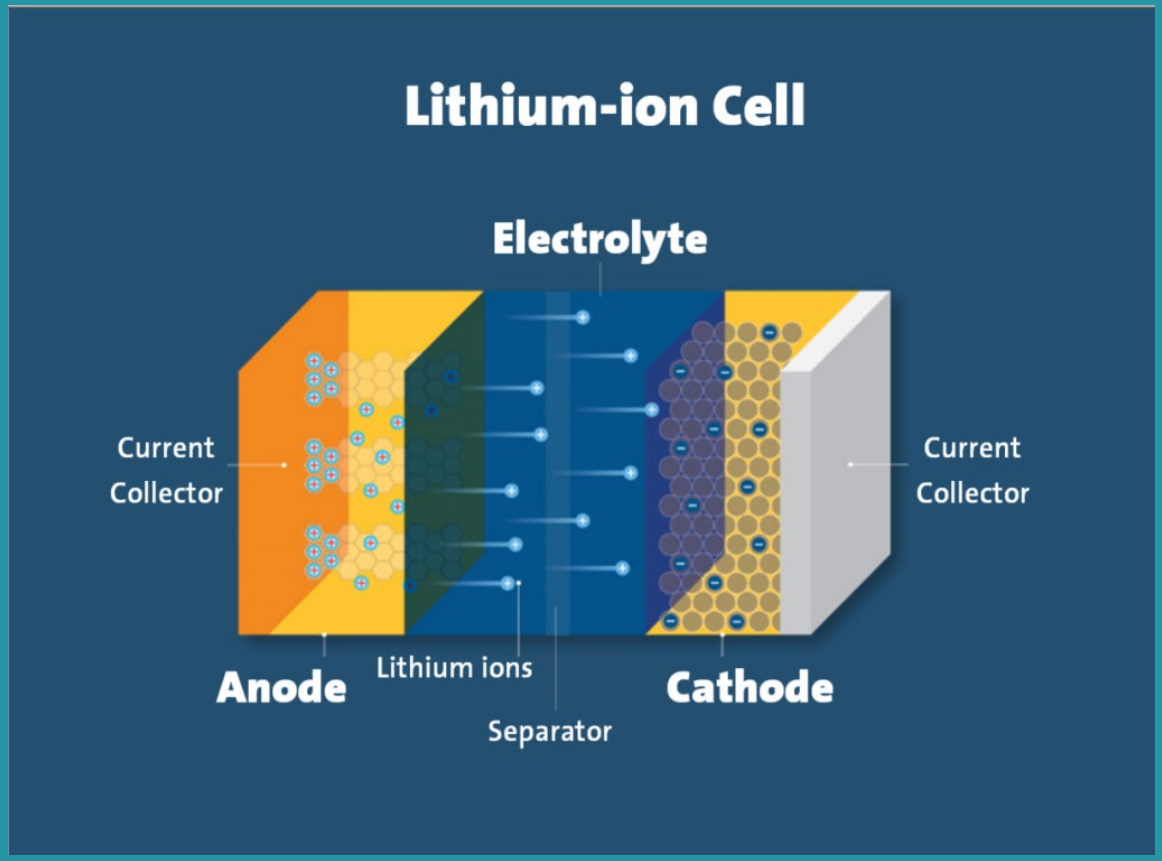
Unlike traditional lead-acid or nickel-based batteries, lithium-ion batteries are known for their high energy density, long lifespan, and lightweight design.

Cathode (positive electrode): Contains lithium compounds that vary by battery type

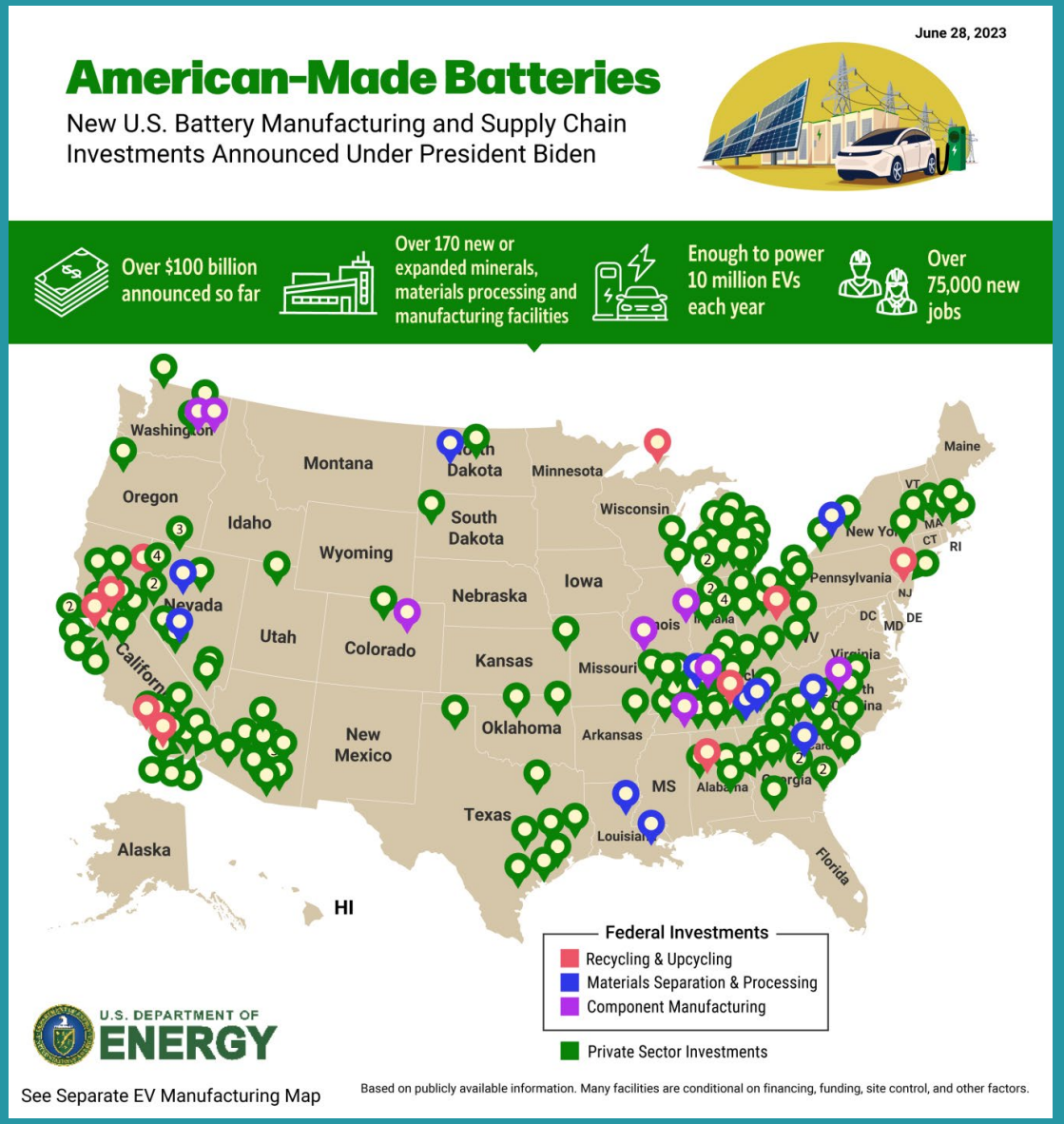
Anode (negative electrode): Typically, graphite carbon, though some use lithium titanate

Separator: An insulating layer that allows lithium ions to pass while blocking electrons

Electrolyte: The medium through which lithium ions travel between electrodes



Facility Construction & Growth in the US



Project Kansas: Facility Overview

- “2170” battery
- 15wh battery
- Over 1M fabricated
- 32 GWH capacity a year (2M batteries)

Process Overview

Step-by-Step Manufacturing Process

1. Raw Material Preparation

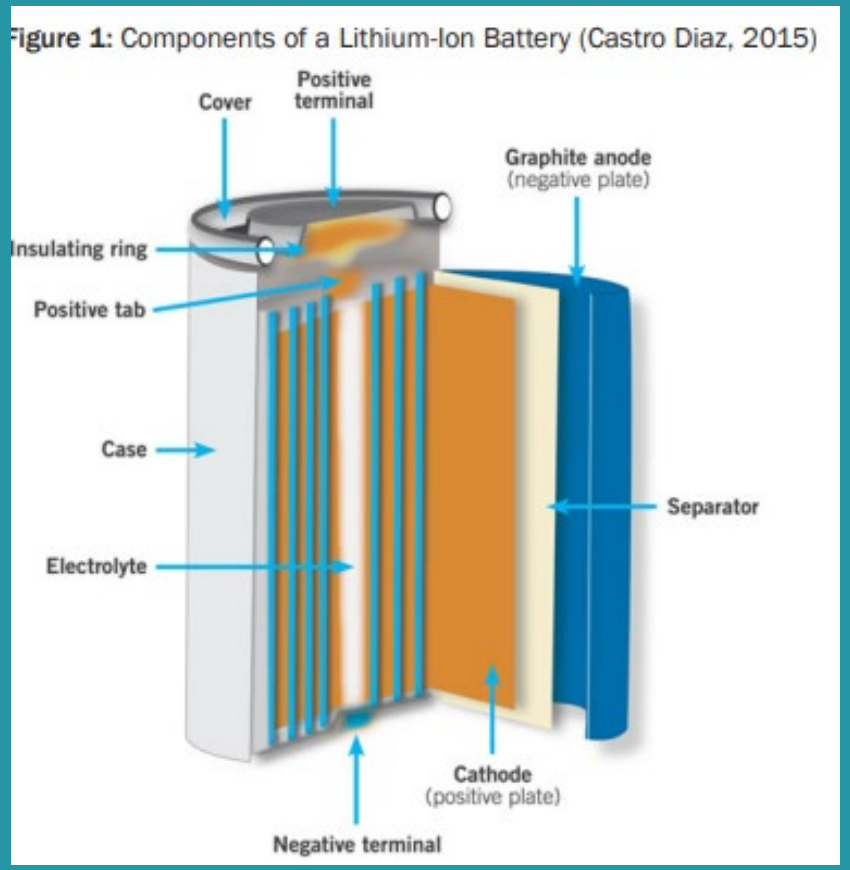
- **Cathode slurry**
- **Anode slurry**
- **These slurries are the “inks” that will be coated onto metal foils.**

2. Electrode Fabrication

- **Cathode slurry → coated onto thin aluminum foil.**
- **Anode slurry → coated onto thin copper foil.**
- **Drying & calendaring: The coated foils are dried, then compressed between rollers to achieve precise thickness and density.**

3. Cell Assembly

- **Cutting & stacking: The foils are cut into long strips. A separator film (microporous plastic) is layered between anode and cathode.**
- **Jelly roll winding: These layers are wound into a tight spiral — the classic cylindrical “jelly roll” structure.**
- **Insertion: The jelly roll is inserted into a steel cylinder can (21 mm × 70 mm). *“canning”***



Process Overview

4. Electrolyte Filling

- **A liquid electrolyte (typically lithium salt in organic solvents) is injected into the can.**
- **The electrolyte enables lithium ions to shuttle between anode and cathode during charging/discharging.**

5. Sealing & Formation

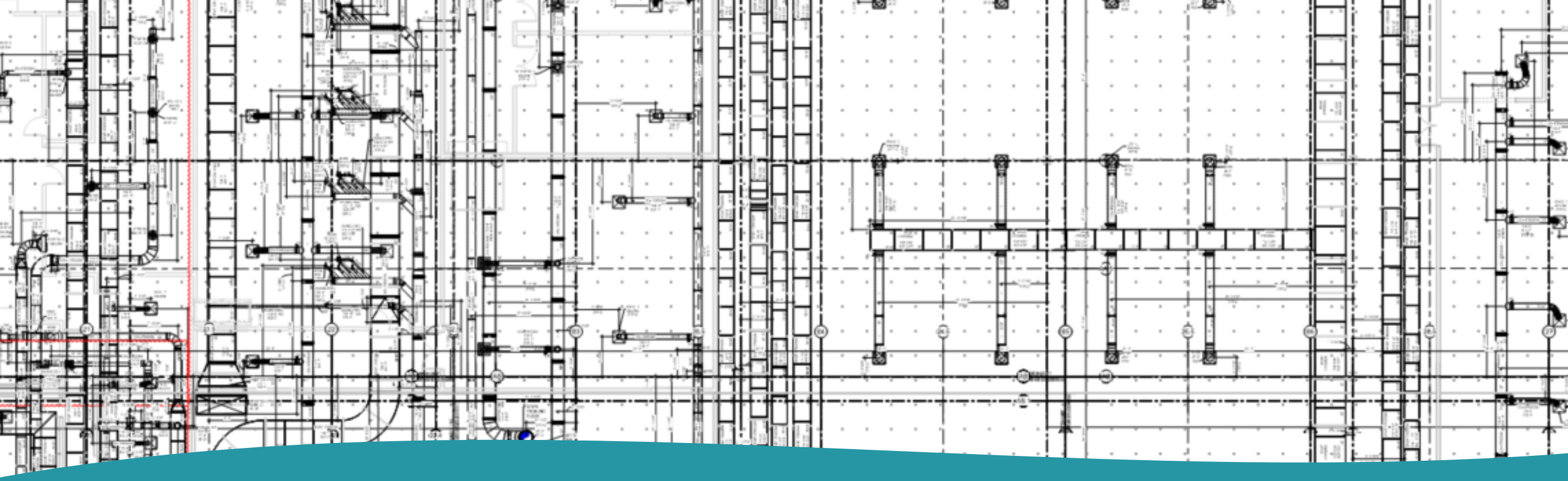
- **Sealing: The can is capped with a safety vent and terminals.**
- **Formation cycling: The cell is charged and discharged under controlled conditions to form a stable solid electrolyte interphase (SEI) layer on the anode.**
- **Aging: Cells rest for days to weeks to stabilize chemistry and allow quality checks.**

6. Testing & Sorting

- **Each cell is tested for capacity, internal resistance, and safety.**
- **Cells are sorted into performance bins before being grouped into modules and packs.**

Duct Systems

- Galvanized ducts for general air distribution (supply, return, exhaust)
- Galvanized and SS in cleanroom areas
- Specialty Exhaust: particulate, electrolyte
- Dry room return: **welded**



Construction Challenges

- **10 + local and national mechanical firms working on this project**
- **Travelers**
- **Worksite challenges/non working delays**
- **Working from tall heights**
- **Payment**

Key Takeaways

“More than a village” — large, complex coordination

Facilities cost billions; mechanical scope worth hundreds of millions

Slow, methodical work

Turnover dates are critical

Please take a moment to complete the session survey provided to you.