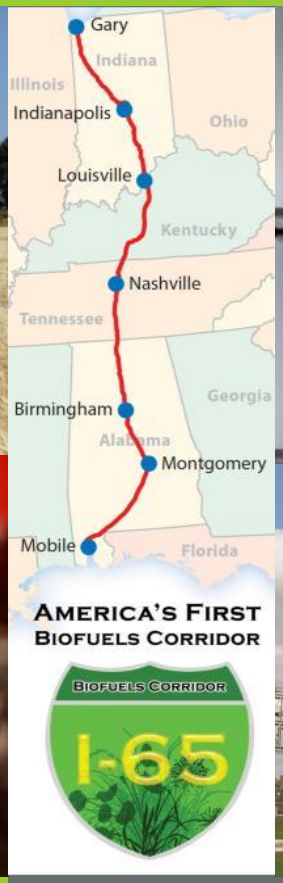
BIOENERGY TECHNOLOGIES OFFICE

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy



Integrated Biorefinery Lessons Learned and Best Practices – Breakout Session 1

July 29th, 2014

Session Moderator:

Glenn Doyle

U.S. Department of Energy

Bioenergy Technologies Office

Session Agenda

Lessons Learned and Best Practices Presentations

- BETO's Integrated Biorefineries
  - Glenn Doyle, Technology Manager, DOE
- USDA Loan Guarantee Programs
  - Chris Cassidy, National Business Renewable Energy Advisor, USDA
- American Process, Inc. pilot plant
  - Theodora Retsina, President, API
- INEOS-New Planet Bioenergy demonstration plant project
  - Dan Cummings, President, INPB
- **Interactive discussion**
  - **All in attendance invited to take part**
  - **Cards available to express areas of key interest**
  - **This room for 30 minutes after session -> Room 149 A & B if needed**

Integrated Biorefinery (IBR) Lessons Learned/Best Practices

DOE-BETO roles:

- Buy down risk of new bioprocess technologies
- Funding Opportunity Announcements (FOAs; solicitations) focused on reducing risks and leveraging technological advances
- Leverage IBR Return on Investment (information) to benefit of nation and bioindustry

The Opportunity:

- BETO has compiled a substantial number of Lessons Learned and Best Practices that it considers to be of potentially high value to the industry
- Dissemination of this information is a new role that BETO is initiating
- Protection of business sensitive information crucial

Photo INEOS Bio

IBR Lessons Learned/Best Practices: Industry Interest & Value

Interest:

Recent workshops highlight the call for BETO to expand its role based on bioindustry lessons learned

- Standards Development and Market Analysis
- Facilities/Test Beds
- Feedstock Handling
- Equipment Development
- Outreach and Partnering
- Economic Value
- Funding Support

Photo courtesy of Tim Volk (SUNY-ESF)

Potential Value:

- Reduce costs of future projects (federal or otherwise)
- Informs BETO investment strategy to reduce risk
- Reduce barriers to commercialization of technologies
- Reduce barriers to private financing of future projects

Lessons Learned & Best Practices Definitions

"A lesson learned is a knowledge or understanding gained by experience. The experience may be positive, as in a successful test or mission, or negative, as in a mishap or failure. Successes are also considered sources of lessons learned. A lesson must be significant in that it has a real or assumed impact on operations; valid in that it is factually and technically correct; and applicable in that it identifies a specific design, process, or decision that reduces or eliminates the potential for failures and mishaps, or reinforces a positive result."

- Secchi, P., Ciaschi, R., Spence, D.

- Essentially, a lesson has not been "learned" unless an impact is realized and an action taken that increases the potential to improve outcomes
- A Lesson Learned or multiple Lessons Learned could lead to a Best Practice

"A best practice is known as a technique, method, process, activity or incentive which has proven to be most effective in providing a certain outcome."

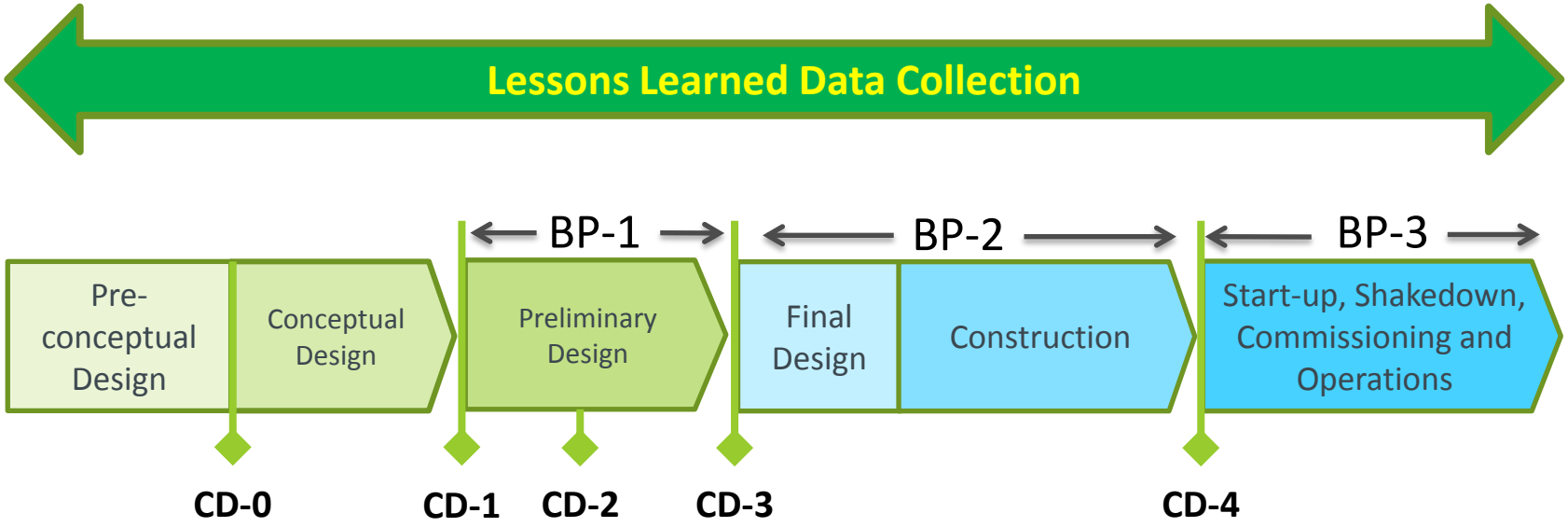
– bestpractice.com

BETO IBR Lessons Learned/Best Practices History

- Since 2006, $980M in federal funding for 29 IBR projects of varying scales (pilot, demo, commercial)
- Obtained Lesson Learned/Best Practice information from projects
- Development of a systematic method and database to document this information

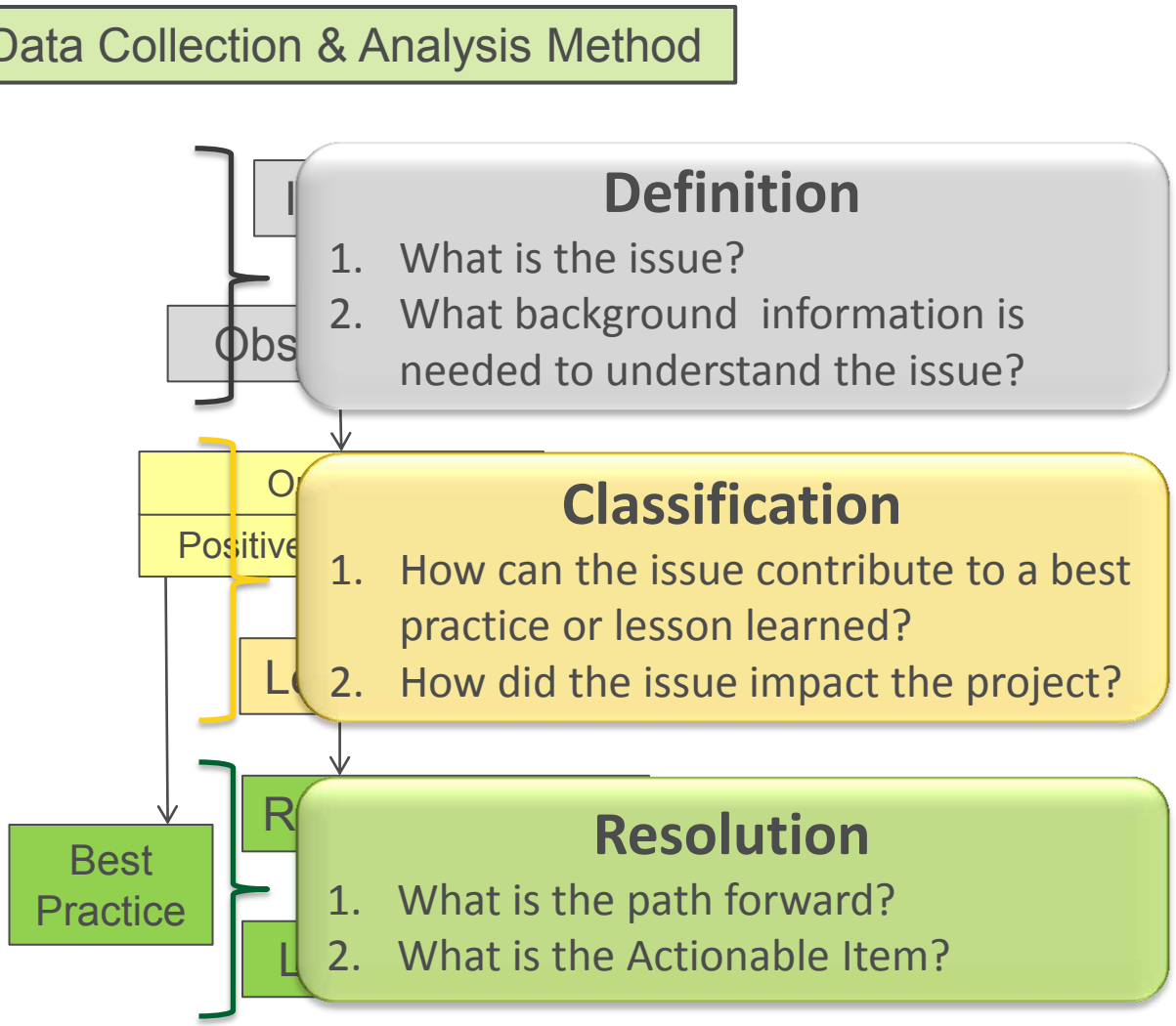
Integrated Biorefinery (IBR) Lessons Learned/Best Practices

Framework for Executing DOE Project Management for Integrated Biorefinery Projects



BP = Budget Periods
CD = Critical Decision Points

Integrated Biorefinery (IBR) Lessons Learned/Best Practices



Integrated Biorefinery (IBR) Initial Lessons Identified

1. Greater emphasis needs to be placed on **scale up risks** where data validation and piloting efforts should be seriously considered prior to design of an integrated facility
2. Fully **integrated pilot plant** tests are essential for
   - Refining the scale-up design
   - Testing modifications
   - De-bottlenecking
3. Projects without **fully developed designs** that were sent out for bid resulted in inaccurate cost estimates, schedule slip, and large cost overruns

Photo courtesy of NREL

Integrated Biorefinery (IBR) Initial Lessons Identified (Cont.)

4. Project location **weather and climate** should be considered in the plant design and construction:
   - How will humidity impact your process?
   - How will the plant start-up in a freeze?
   - Do heat traces need to be in place?
   - Are there related local climate related policies that will affect construction?
5. **"Commercially available" equipment** for a new function or scale needs to be treated as new technology
6. Oversight of **long lead equipment manufacturers** is important including:
   - Site visits at key manufacturing points
   - Verification of correct materials of construction
   - Interaction with the fabrication shop to ensure the finished product meets specifications
7. Appropriate risk mitigation plans should be created for even minor **heat or power disruptions**, especially during start up
8. Feeding solid biomass to reactors continues to be a challenge

Integrated Biorefinery (IBR) Initial Lessons Identified (Cont.)

9. Overaggressive **schedules** mask risks and could result in YEARS of delay
10. Well balanced, **diverse project teams** are vital to the project success. The following can result in significant delays or cost overruns:
    - Misaligned expertise
    - Inexperience of key personnel
    - Over reliance on expertise of vendors
    - Legal counsel not used to review contracts (EPC/M, PPAs, vendors, etc.)
    - PMs inexperienced managing large, complex construction projects
    - Inappropriate expertise to review vendor's designs
11. Consider **additional contingency** during commissioning due to unknowns with starting up first-of-a-kind units

Photo courtesy of REII

Photo courtesy of POET

IBR Lessons Learned/Best Practices: Dissemination Opportunities

- Incorporate LL/BP into Funding Opportunities
- Non-proprietary Reports to Electronic Newsgroups (BETO email list)
- Bioenergy Knowledge Discovery Framework (KDF)
- Collaborative partnership – BETO, industry, financial community
- Technical Conferences, Workshops
- Journal Articles
- Interagency collaborations
- **Other ideas**

Photo courtesy of Myriant

Thank you

Questions?

Please visit the poster session:

Feedstock Effects on DOE Funded Integrated Biorefinery Projects

Dr. Arthur Wiselogel
CNJV Principle Engineer II, Contractor to the DOE GFO