

## Breakout Session 6: Environmental Management

### A - Needs, Barriers, & Challenges for Environmental Management

- What is the industrial interest in EM. Is it an afterthought or a base part of a business plan? Industrial and Federal investment meet a range of mission goals. Aside from bottom line, EM is a distinct part of being competitiveness in today's marketplace.
- **Metrology enabling characterization of existing environmental issues resulting from legacy processes.**
- Advances resulting from good stewardship of resources and innovation to achieve goal not solely as result of regulation. Stakeholder awareness of issues and state-of-the-art
- It's difficult to establish ROI for EM, awareness of possible liability will drive advances
- **Design processes to consume near all raw/input materials (minimize raw required materials and supply chain) used in process and to develop means to utilize any generated "waste stream"**
- Enabling modular processing of effluents on-site to reduce exposure and liability. Enabling "plug and play", possibly to facilitate power co-generation
- Heat recovery from stacks, possibly collaborations with other entities to sell/share energy loss with other entities (industrial eco-systems)

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### B - R&D Needs for Environmental Management Processes

- **Design materials for recyclability, such as thermo-set polymers, other polymers and glasses and even cured reacted materials.** Developing “life-cycle” maps and determining impact of new materials, such as “nanomaterials”
- Enabling easier recognition of content within material sets.
- **Need for greater access to mobile labs and pilot plants and other service providers enabling on-site test and characterization of new waste streams and product lines for chemistries. This includes access to service providers, such as at labs MDF, etc.**
- Development of test protocols which are simpler, provide rapid results, reproducible, sensitive, enhanced resolution, less complicated and timely
- Enhanced less energy intensive water extraction from gas, solid and liquid effluents, such as alternative evaporation techniques, trace metal extraction besides settling, etc. This includes extraction/separation of very dilute concentrations.
- Consideration of development of secondary sources to “feed” supply chain
- Development of process routes which are more “green” for existing products.
- **Enabling enhanced modelling/simulation capability**

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### C - Metrics and Impacts Environmental Management Processes

- **What are realistic reduction goals for carbon and other materials. Using generic “50%” is a huge stretch.**
- Establish goals related to reduction of rates of contract for various illnesses as a measure of success, such as emphysema. Need then exists to determine unity measures for the control population. Possibly use same type impact of other animals/vegetation.
- Toxicity of waste/unit product (embodied toxicity vice embodied carbon/energy/etc.)
- Sustainability goals of established values.
- Grand Challenge for separations: Liquid/liquid – especially for water (50%), gas/gas (75%), solid/solid (TBD)
- Urban sustainability of smaller footprint sites.
- Consider design of “0” waste processes and packaging
- Design means to determine consumer awareness of need, introduction of rules to force compliance, educate and include population in developing attitude/motivation to create the culture.
- Global inclusion (metric)

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### D - Other Technology Advancement Considerations of Environmental Management Processes

- Encourage industry to continue engagement in EM concerns, including free exchange of waste stream data
- **Provide accessible tools for stakeholders to determine issues regarding chemistry of materials, waste-streams, etc. earlier in the process.**
- **Merge industry with academic and national laboratory efforts. This to familiarize each with the others concerns and needs. This may possibly be addressed by increased number of “user facilities” or “clearing houses” which reach-out to industry.**
- More assured ownership of IP by the industrial stakeholder and/or greater protection/right to use developed IP. Further, technology developed be made available to designated industrial partners to support innovation.
- Increase number of recognition programs to acknowledge attainment of EM related activities/goals.
- Expansion of environmental education programs at college and vocational level