

Colorado State University

PhD Advising Topics

Preliminary Examination

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Overview

- Preliminary Examination Preparation and Expectations
 - Process Overview
 - Document Description and Expectations
 - Presentation Description and Expectations

Preliminary Examination Process

- According to my appendix to the grad student handbook, the preliminary exam is the opportunity for the committee to evaluate the student's research readiness
 - Knowledge-base
 - Research process
 - Scope, duration and data needs
- Format is
 - Document (20pp-150pp), and
 - Presentation (40 mins, 10 mins Q&A)
- On *your* timeline

Preliminary Examination

- Think of the exam not as an examination, but as a communication device with your committee. Your job is to convince them
 - You know what you are doing,
 - You have a process,
 - You are implementing your plan to date,
 - Results to date are a significant contribution to the completion.
- This suggests that the “exam” is actually an exercise in committee management

Preliminary Examination

- Committee Makeup
 - 1ea Your Advisor
 - 1ea Member of the SE Department
 - 1ea Member of any CSU Dept (including SE)
 - 1ea Outside Committee Member
 - From CSU, but not anywhere on the SE webpage
 - <https://www.engr.colostate.edu/se/faculty/>

Preliminary Examination

- Document Outline (aim for 20 pages w/o App)

1. Abstract
2. Introduction and Background
3. Research Questions and Tasks
4. Timeline
5. Work to Date
6. Research Contributions
7. Conclusions
8. Appendix

No need for a template, but put your affiliation as:
*Colorado State University
Department of Systems
Engineering.*

November 16th 2012. 

Subject: Ph. D. Proposal
By: Liam Batain
Date: December 6th, 2012
Time: 3:30 - 5:00
Location: Dean's Conference Room (Engineering 8214)
Committee: Dr. Thomas Bradley (Advisor)
Dr. Bryan Willson (ME)
Dr. Anthony Marchese (ME)
Dr. Gregory Craft (DAER)
Dr. Keith Paustian (NRES)

LIFE CYCLE AND TECHNO-ECONOMIC
ANALYSIS OF MICROALGAE-BASED BIOFUELS

ABSTRACT

Microalgae biofuel is a potential replacement for fossil fuels in transportation needs, subjected to intensive research and development. Many approaches and technologies are still being investigated and commercial ventures are moving into pilot and larger projects, having the energy security, climate change concerns and renewable fuel targets as main drivers. The other appeal of microalgae are its high growth rate, no quality land requirement and low quality water utilization.

Despite this, there are technological challenges that need to be overcome to commercialize this process. Although many life cycle assessment studies were performed, with more focus on open pond systems, the lack of standards, inconsistency of boundaries, design specific assumptions and projections have added difficulties to compare microalgae performance to fossil fuels and other feedstock biofuels also due to immaturity of the technology; many economic studies are based on extrapolations or unrealistic productivities or focused solely on the technological cost and capital investments.

This research effort proposes an integrated life cycle assessment with techno-economic analysis of an enclosed photobioreactor system for production of microalgae biofuels, respective risk analysis in the capital investment. This integrated assessment will be applied to the evaluation of the sustainability and feasibility of microalgae-to-biofuel process. Based on the results of the integrated assessment of microalgae biofuels, we will gain better understanding of the environmental performance of microalgae biofuels compared to petroleum and biofeedstock based

1

Preliminary Examination

- Abstract ([link](#))
 - The function of an abstract is to describe, not to evaluate or defend, the preliminary exam.
 - 25% of the space on the purpose and importance of the research (Introduction)
 - 25% of the space on what you did (Methods)
 - 35% of the space on what you found (Results)
 - 15% of the space on the implications of the research

Preliminary Examination

- Introduction and Background
 - You all are ready and able to do this through:
 - Observe – Reflect – Articulate
 - There is some potential role for a background into your industry/project/funder
- Research Questions
 - You all are ready and able to do this
- Research Tasks
 - Outline form is good, with exposition on the front end and takeaways on the back end.

Preliminary Examination

- Research Tasks Ex.

Task is labelled and explained

Technical Language Compact O-R-A

Takeaways and Question Answering

Research Question 2) Define the substantive shortcomings of currently available constructs (SDP, SQP, heuristics) compared to RL as applied to the ES application. The tasks for defining the benefits of RL in the application and for multi-objective comparison to other ESO methods are:

Task RA2.1 – Comparison between RL and other SO methods using Economic Metrics Studies of ES business cases must connect the capabilities of individual ES systems to one of the proposed economic values for ES. This task will compare the economic value of ES as derived using RL to the value as derived using SDP and other ESO methods. These results will allow for the definition of economically near-optimal energy consumption, market participation, and revenue streams for ES.

Task RA2.2 – Comparison between RL and other SO methods using Environmental Metrics As a renewable energy enabling technology with a small net energy consumption, evaluation of the net GHG emissions or net environmental impacts of ES is difficult when conventional attributional lifecycle assessment techniques are employed [42]. Because the environmental benefits of ES are realized indirectly, only a controls and economics-integrated consequential LCA can assess the changes to electricity's lifecycle that will be caused by ES. This task will compare the consequential lifecycle assessments of electricity with and without ES and using the ES control policies derived from ESO algorithms including SDP.

Task RA2.3 – Comparison between RL and other SO methods using Utility-centric Technical Metrics This task will consider the changes to the above-defined RL-based energy management policies that will result from the inclusion of constraints on ES system reliability, availability, and contract size. This task will assess the effect of the coordinated control of aggregations of ES units on these metrics.

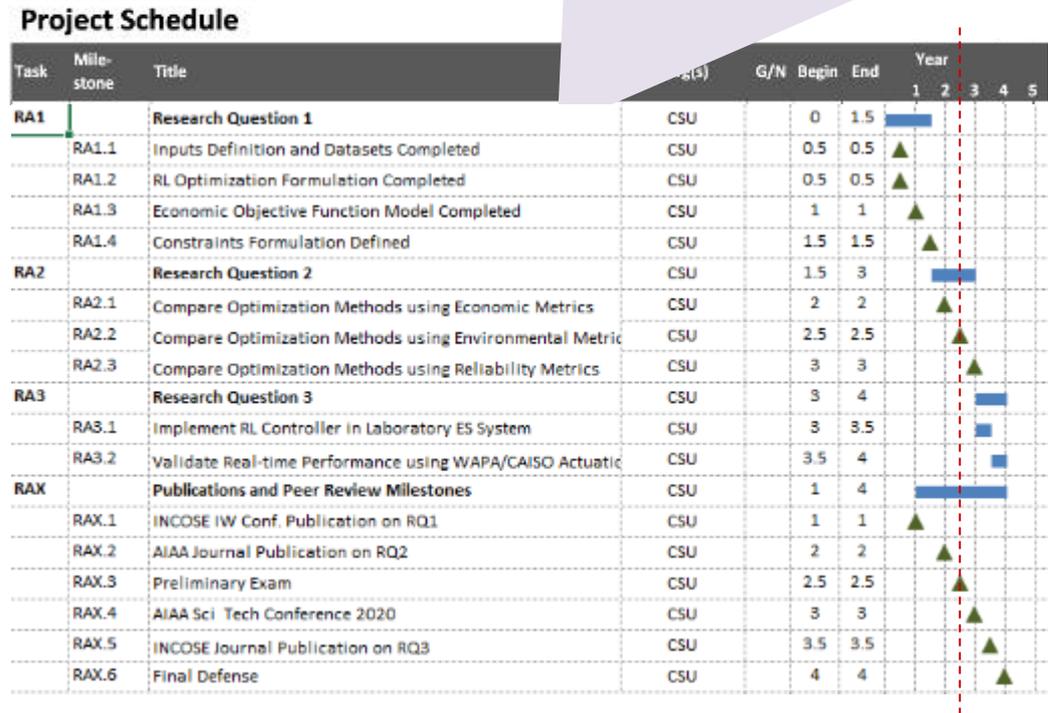
The results of these tasks will be guidance to the field of ES device management regarding the tradeoffs that are present among the various ES metrics of performance and among the computation methods available for ES management and control.

Preliminary Examination

- Timeline

- Can have task completion %
- Should have a steady slope of progress back to Y1
- Should have data needs or gathering activities
- Semesterly or Quarterly planning is ok

Example of the order of magnitude of planning required (details of this adapted timeline are not quite right)



Preliminary Examination

- **Work to Date**
 - This is the place where you can demonstrate that you have made progress against the first research questions
 - An appropriate outline for this section might be:

Work to Date

Work in response to RQ1 (3 pages)

Work in response to RQ2 (3 pages)

Conference Paper abstract (1 pages)

Data set description for RQ3 (1 pages)

Preliminary Examination

a·nal·y·sis noun

1. detailed examination of the elements or structure of something.

- Research Contributions

- Research is a systematic process for finding new knowledge.... What did you research?
- Use research words (assessment, evaluation, analysis)

“Upon completion of this research project, the research contributions of this dissertation are anticipated to be:

1. A scholarly review of the literature on model-based systems engineering applied to system safety.
2. ...
7. A survey-based experimental understanding of engineering staff’s acceptance of MBSE-derived revisions to the requirements engineering process in a major US automaker

Preliminary Examination

- Conclusions

- Conclusions in a technical paper are really closer to a summary ([link](#)), no new ideas, no new words
- No need for future work section in the prelim document
- Here is your prompt:

“This proposal has defined a series of tasks to address the primary research challenges associated with...

... The result of this proposed research will be an improved and generalizable understanding of how and to what degree MBSE can realize psychological and cultural improvement in team cohesion during design.

Preliminary Examination

- Appendix (optional)
 - Can be for any other documents that you might want to show the committee, but that do not fit into the main document
 - Detailed Methods Descriptions (surveys, statistical tests)
 - Data sharing agreements
 - Whole workproducts that you have cut from to populate the main proposal (papers, presentations, code)
 - Your CV/resume

Preliminary Examination

- Steps for success
 - Work with your advisor and committee to have your document at 100% highest quality ~1 mo in advance
 - Use Doodle or other professional tool to find time to do the presentation (choose among 5 ± 2 options)
 - Work with Ingrid.Bridge@colostate.edu to reserve Zoom/SE Conference Room and send out calendar invites
 - Send your document (send as pdf) to the committee. They must have 10 business days to review. Do not send PPT.
 - You are invited to do the presentation on campus, online is also acceptable.
 - Business professional attire (<https://www.pinterest.com/wisconsinbba/> , profs may not always conform)

Preliminary Examination

- Preparation for the preliminary examination presentation and Q&A
 - Complete the prelim exam document (aka proposal)
 - Practice using precise and technical language
 - Practice the presentation 5 times, including Q&A
 - Review and define key terms of art

Preliminary Examination

- Presentation Content
 - Title Slide
 - Acknowledgements
 - Outline/Agenda
 - Introduction and Background
 - Research Questions and Tasks
 - Work To Date
 - “Visual” Methods, Results, Discussion for each RQ
 - Timeline
 - Research Contributions
 - Conclusions
 - Thank you, Q & A Prompt

40 mins of presentation
~30 slides

▶ Enabling Predictive Energy Management in Vehicles

Introduction > Research Question 1 > Research Question 2 > Research Question 3 > Summary

Acknowledgements

University Faculty

- Dr. Tom Bradley
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- Dr. Andrew Frank
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- Dr. Fanoosh Banai-Kashani
- Dr. Steve Trageser
- Dr. Ilya Kolmanovski
- Dr. Regan Zane



Graduate Students

- David Yinko
- David Baker
- Jordan Tunnell
- Evan Spruel
- Carlos Quiroz
- Van Wifvat
- Tom Cummings
- Jamison Bair
- Robert Fitzgerald
- Vipin Kumar Kukkula
- Gabe Di Domenico
- Matt Knopf
- Matt Reese



Industry/Gov./Lab Collaborators

- Haraldo Stefanon
- Josh Payne
- Dr. Ben Geller
- Dr. Ken Butts
- Mike Huang
- Abril Galang
- Anthony Navarro
- Hansel Mahajan
- Joe Olsen
- Nawa Baral



3



Preliminary Examination

- Committee management topics for the presentation
 - Label the presentation and work as Colorado State University work, not corporate work, [PPT](#)
 - Slide numbers
 - Encourage clarification questions, Break the ice pause for questions on slide ~5
 - Use visual methods, results, discussion in PPT
 - Use “rate of completion visualizations” to help the audience

Visual Methods Communicate complicated methods visually

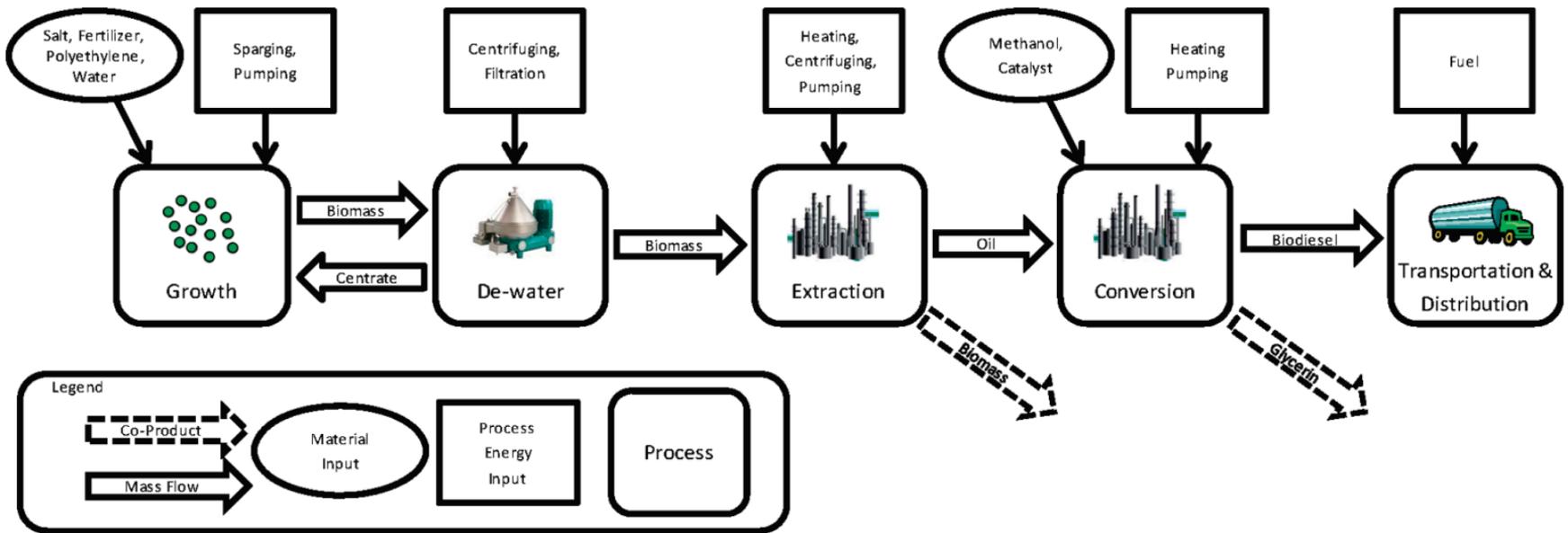


FIGURE 1. Microalgae biodiesel processing and lifecycle analysis model overview.

Preliminary Examination

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The highlighting in this bar increments from section to section (colored manually the night before)

Dynamic programming is used to determine the optimal control

Gen. 3 (2010-2016) Toyota Prius applied form

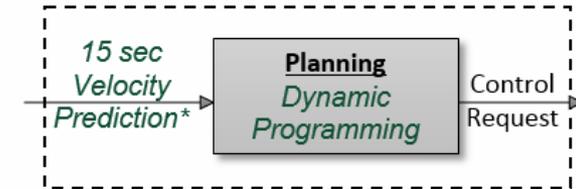
$$SOC(k+1) = SOC(k) - A_1 + A_2 \sqrt{A_3 - A_4 v(k) + A_5 v(k)^3 + A_6 \dot{v}(k)v(k) - A_7 P_{ICE}}$$

$$Cost = \sum_{k=0}^{N-1} f(P_{ICE}) + W (SOC_f - SOC(N))^2$$

$$40\% \leq SOC(k) \leq 80\% \quad (k = 0, \dots, N)$$

$$0 \text{ kW} \leq P_{ICE}(k) \leq 73 \text{ kW} \quad (k = 0, \dots, N-1)$$

$$C_1 [f(P_{ICE})] + C_2 v(k) \leq C_3$$



SOC = State of charge m_{fuel} = Mass of fuel
 P_{ICE} = Engine power
 v = Vehicle velocity

A_{1-7} = Constants
 C_{1-3} = Constants
 W = Penalty Weight

Preliminary Examination

- Committee management topics for the presentation
 - Humanize complicated results and put into commonsensical terms
 - List papers, conferences, presentations and other workproducts
 - Memorize a “big intro” and a “bit outro”
 - “Thank you very much (for your attention!)”, applause, **then**, “I’m happy to take any questions”

Preliminary Examination

Task 2.3) Extreme Price Events

Introduction

Background

Questions

Work to Date

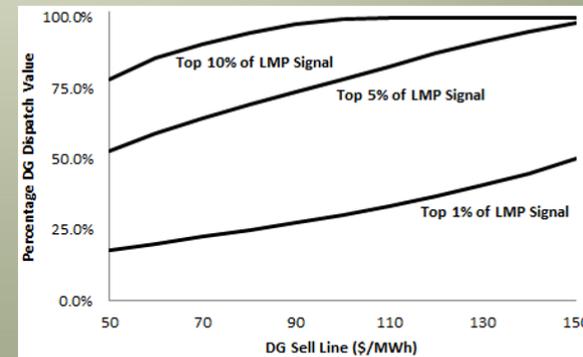
Conclusion

Research Question (1)

Research Question (2)

Research Question (3)

Whether building RTP forecast models or promoting the value of daily peak-shaving, we can't ignore the value of extreme price events.



How does daily peak shaving in a traditional market compare with RTP?



24

Preliminary Examination

- Committee management topics for the presentation
 - Humanize complicated results and put into commonsensical terms
 - Reference your papers, conferences, presentations and other workproducts
 - Memorize a “big intro” and a “bit outro”
 - “Thank you very much (for your attention!)”, applause, **then**, “I’m happy to take any questions”

Preliminary Examination

- Q&A – stand up, answer questions, and try or pretend to take notes



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– Typical Softball Q&A:

- I did not understand that method, can you go through that flow chart in detail?
- What do you think is the most challenging part?
- Which SE classes are you leaning on to do this research?

Preliminary Examination

- Typical Hardball Q&A
 - You said the word “XXX”, can you define that for me?
 - I don’t understand how answering RQ1 contributes to the big effort, explain how they are connected?
 - Your language was not very precise when you described your optimization, what are you really going to do/use?
 - I think that you missed a lot of the literature on XXX, you need to reference ABC
 - Where are you going to get the data for Task 1.3?
 - I worry a lot about the scope of this project OR(“it’s too big” , “not enough content”)
 - In my experience, Task 3 will be very difficult. I don’t think that you will be successful there.
 - What is new here?

Preliminary Examination

- Committee will excuse you to the hall to come up with recommendations
- You are invited in for congrats and communication of takeaways (95% pass)
- 1 week later
 - Compose an email memo to address any remaining questions or concerns, provide any additional backup information, thank the entire committee

Preliminary Examination

- The prelim exam is a “contract” between you and the committee
 - Do what you say and you will pass the final exam
 - Don’t let yourself be surprised by the same critique when you reach the final defense
 - This gives you the license to move forward with exactly these tasks