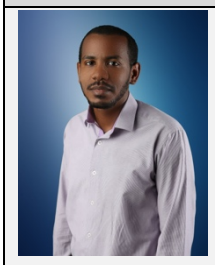
Academic Plan

Student: Mohamed Alhaj, PhD student in Sustainable Energy (210003978)

Adviser: Dr. Sami G. Al-Ghamdi, Assistant professor of Sustainable Development, College of Science and Engineering, Hamad Bin Khalifa University (HBKU)

Last Update: February 3, 2019

About the Student



Mr. Mohamed Alhaj is a PhD student in Hamad bin Khalifa university and his PhD research focuses on the technical, economic, and environmental assessment of solar desalination systems. Mohamed has a MSc in Energy Technology from the National University of Malaysia and a BEng in Mechatronic Engineering from the University of Nottingham. Having developed strong interest and technical knowledge in renewable energy systems throughout his graduate studies, Mohamed is interested in exploring the potential of integrating concentrated solar power with thermal desalination processes.

Degree Pursued

- Doctor of Philosophy (PhD) in Sustainable Energy.
    - Start Date: August 2015.

Degree Focus:
The College of Science and Engineering's PhD program in sustainable energy provides students with extensive knowledge in topics related to sustainable energy and the impact urbanization, transportation and manufacturing have on energy sustainability. The program also looks at the implications and drivers of sustainable policymaking on society, the economy and the environment. A key component of the degree is original and scientifically significant research in energy science, as well as technologies that support sustainable development. The multidisciplinary approach to the curricula allows for engagement in cross-disciplinary science and builds fundamental knowledge that evolves with developments within the energy field, equipping graduates with the tools needed to pursue a wide variety of career paths.

Mr. Alhaj's research explores the potential and challenges of powering thermal desalination plants with solar thermal energy by conducting extensive computer simulations under real climate conditions. This PhD research is motivated by the need to address water security challenges in Qatar, which relies on desalination for 99% of its municipal water consumption, and the region as a whole through sustainable energy technologies. Qatar has abundant solar energy resources (estimated at 2000 kWh/m^2/year) which can be used for power generation and seawater desalination.

Hence, this research proposes an optimized solar-driven desalination process using the low-pressure multi-effect distillation process and supplied with solar heat from a linear Fresnel collector. The objective of this work is to simulate the performance of a solar-driven desalination plant under Qatar's climate, optimize the overall process and plant configuration, investigate the potential environmental impacts of the plant using life cycle assessment, and investigate the economic feasibility and market commercialization barriers.

Educational Background

- 2012 - Bachelor of Engineering Honours (BEng) in Mechatronic Engineering, The University of Nottingham.
    - Graduation Project: Design and development of a solar water boiler based on a parabolic trough collector.
- 2014 - Master of Science (MSc) in Energy Technology, The National University of Malaysia.
    - MSc Thesis: Comparative study of photovoltaics and dish Stirling engines for decentralized power generation in Sudan.

List of Publications and Achievements

Publications:

- Manan M, **Alhaj M**, Mabrouk A, Al-Ghamdi SG. (2019). Examining the life-cycle environmental impacts of desalination: A case study in the State of Qatar. Desalination 2019;452:238–46. doi:10.1016/j.desal.2018.11.017.
- **Alhaj M**, Al-Ghamdi SG. (2018). Reducing electric energy consumption in linear fresnel collector solar fields coupled to thermal desalination plants by optimal mirror defocusing. Heliyon 2018;4:e00813. doi:10.1016/j. Heliyon.2018. e00813.
- **Alhaj M**, Mabrouk A, Al-Ghamdi SG. (2018). Energy efficient multi-effect distillation powered by a solar linear Fresnel collector. Energy Convers. Manage 2018;171:576–86. doi.org/10.1016/j.enconman.2018.05.082.
- **Alhaj M**, Hassan A, Darwish M, Al-Ghamdi SG. (2017). A techno-economic review of solar-driven multi-effect distillation. Desal Wat Treat 2017;90:86–98. doi:10.5004/dwt.2017.21297.
- **Alhaj M**, Mohammed S, Darwish M, Hassan A, Al-Ghamdi SG. (2017). A review of Qatar's water resources, consumption and virtual water trade. Desal Wat Treat 2017;70:70–85. doi:10.5004/dwt.2017.21246.
- **Mohamed Alhaj**, Ashraf Hassan, and Sami G. Al-Ghamdi (2018). Solar power integration with desalination: A systematic assessment of the potential environmental impacts. Qatar Foundation Annual Research Conference Proceedings 2018: EEPP667. http://doi.org/10.5339/qfarc.2018.EEPP667.
- **Mohamed Alhaj**, Alex Amato. (2016). Implementation of rooftop solar in Qatar: Lessons learnt from SolarCity business and finance models in the U.S.. Qatar Found. Annu. Res. Conf. Proc., Doha: 2016. doi:doi.org/10.5339/qfarc.2016.EEPP2390.

Papers under review:

- **Alhaj M**, Al-Ghamdi SG. (2019). Environmental assessment of solar-driven thermal desalination. Journal of Cleaner Production. 2019. Under Review.
- **Alhaj M**, Al-Ghamdi SG. (2019). Integrating concentrated solar power with seawater desalination technologies: a multi-regional environmental assessment. Environmental Research Letters. 2019. Under Review.
- **Alhaj M**, Al-Ghamdi SG. (2019). Why is solar thermal desalination expensive? Assessing economic feasibility and market commercialization barriers. Energy Policy. 2019. Under Review.

Conference Presentations:

- **Mohamed Alhaj** and Sami G. Al-Ghamdi (2019). Technical and environmental perspectives on solar-driven seawater desalination: Case study of multi-effect distillation. *World Environmental and Water Resources Congress* 2019 (American Society of Civil Engineers ASCE). Pittsburgh PA, May 19-23 2019. Accepted.
- Conference Participation: Delegate at the *Young Water Leaders Summit* 2018. I was selected by the Singapore National Water Agency to participate in this summit which is part of the Singapore International Water Week 2018 (one of the largest events for the global water industry).
- Conference Presentation: *The International Symposium for Sustainable Systems and Technologies (ISSST 2018)* Buffalo NY U.S.A: "Life Cycle Environmental Impacts of Solar-Driven Desalination".
- Panelist at the *"Smart Urban Water Management Event*" hosted by Qatar Green Building Council (QGBC) and the Qatari Public Utility Company (Kahramaa) on March 2018.

Awards:

- "*Best Green Sustainable Initiative*" Award (2018) (Initiative on: Solar-driven Multi-effect Distillation). This award was given by the Qatari National Program for Conservation and Energy Efficiency (TARSHEED) under the Ministry of Energy and Industry. The award was granted by the Prime Minister of Qatar during the 6th anniversary ceremony of TARSHEED.
- *Qatar Sustainability Award* (2017) – Green Research Category. This award was for one of my papers on: Policy recommendations for sustainable water resources management in Qatar. This paper is part of my PhD thesis. The award was given after a peer-review process by a number of sustainability academics and experts.
- *Solar Energy Research Award* (2016). This award, by the Qatar National Research Fund (QNRF), was for a poster I presented during the Building-Integrated PV workshop.

Skills and Professional Experience

Skills:

- Software Skills: Word – Excel – PowerPoint – Visio – Engineering Equation Solver – System Adviser Model – GaBi – HOMER
- Languages: English (fluent), Arabic (native) – IELTS Score: 8.0/9.0
- Leadership – Teamwork: I lead two university-level team projects. One project was on research methods and ethics. The other project was on investigating the economic incentives for scaling rooftop solar PV systems in Qatar.
- Other skills: Academic Writing – Life Cycle Assessment – Presentation Skills – Web Development.

Professional Experience:

- December 2016 – Present: Graduate Research Assistant/Teaching Assistant at HBKU

As part of this position (which is part of my PhD program), I worked on several research projects on renewable energy in Qatar such as: solar resource assessment (data analysis), estimating monthly solar radiation from historical data, techno-economic assessment of solar desalination, and life-cycle assessment. I am also a Teaching Assistant for the Research Methods and Ethics core class. I assist with in-class tutorials, grade assignments, and assist students develop their academic writing skills.

- May-August 2015: Business/Engineering Intern at Abu Jafaar Enterprise, Khartoum, Sudan

I worked on solar PV systems design, costing and I assisted in sales and marketing.

- May-August 2012: Research Assistant at The University of Nottingham, Malaysia

I participated in the Dean's Undergraduate summer research program. My project was on developing a mini solar water boiler for medical and domestic applications.

Personal Goals and Objectives

Mr. Alhaj is planning to:

- Develop professional experience in the renewable energy industry by working with multi-nationals and international organizations.
- Complete several professional certifications in renewable energy and energy efficiency such as CEM and certifications in management and finance of renewable energy projects.
- Start a clean energy enterprise that provides clean energy solutions in the on-grid and off-grid markets mainly targeting African countries.

Mohamed Atta Elmanan Bakhit Alhaj (210003978)
Doctor of Philosophy in Sustainable Energy

Work package number:	1 out of 7	**Start Date**	Aug, 2015	**End Date**	Mar, 2019
Work package title:	Solar-driven multi-effect distillation: A technical, economic, and an environmental study.				

Participant:	Mohamed Alhaj	Dr. Sami Al-Ghamdi	Prof. Muammer Koc	Prof. Gordon Mackay	Dr. Hamish Mackey	Dr. Yusif Bicer
Role:	PhD Student	Main-Advisor	RAC	RAC	RAC	RAC
Institution:	HBKU	HBKU	HBKU	HBKU	HBKU	HBKU

Participant:	N/A	N/A	N/A
Role:	Co-Author 1	Co-Author 2	Reviewer
Institution:	N/A	N/A	N/A

Objectives of this work package:

The motivation is to develop a sustainable solar-driven seawater desalination process and explore its suitability for Qatar. This will lead to reduced energy costs and minimized impacts on the environment. Seawater desalination is a critical process for water-scarce countries like Qatar, hence the importance of this research.

The objectives are:

1. Investigate the current state of renewable and non-water resources and consumption rates in Qatar.
2. Review the progress of solar-driven multi-effect distillation research.
3. Propose a control strategy for the solar field to minimize electric pumping energy consumption.
4. Investigate the overall plant performance and optimize the system based on: equivalent mechanical energy, storage system selection, and cooling system.
5. Investigate the economic feasibility of solar-driven MED by: calculating the levelized cost of water, conducting sensitivity analyses, and discussing the technological and regulatory market commercialization barriers.
6. Conduct a life cycle assessment on the solar-driven multi-effect distillation plant.

Description of the work:

- Task 1.1 Selecting Research Topic
  - Reading to select area of research.
  - Attend seminars and meet faculty.
  - Talk to potential advisers about possible research projects.
- Task 1.2 Coursework
  - Complete three core courses in semester 1.
  - Complete 1 core course and 1 elective in semester 2.
  - Complete 1 elective in semester 5.
- Task 1.3 Research Plan and Qualification Exam
  - Finalize adviser selection by end of semester 2.
  - Discuss with adviser about research topic and objectives.
  - Finish the draft literature review by end of summer of 1st year.
  - Prepare report for qualification exam in semester 3.
- Task 1.4 Candidacy Exam
  - Prepare chapters 1-4 in thesis by semester 5.
  - Prepare to take the candidacy exam by end of semester 5.
- Task 1.5 Dissertation Defense
  - Complete chapters 5 and 6 in dissertation by semester 7.

- Prepare for the final dissertation defense by semester 8.

List of the deliverables:

- D 1.1 Selected adviser and research advisory committee.
- D 1.2 Completed all coursework requirements with the minimum required CGPA.
- D 1.3 Complete and detailed research plan.
- D 1.4 Passed candidacy exam.
- D 1.5 Complete PhD dissertation and peer reviewed publications.

Mohamed Atta Elmanan Bakhit Alhaj (210003978)
Doctor of Philosophy in Sustainable Energy

Work package number:	2 out of 7	**Start Date**	Oct, 2015	**End Date**	Jul, 2017
Work package title:	A review of Qatar's water resources				

Participant:	Mohamed Alhaj	Dr. Sami Al-Ghamdi	Dr. Mohamed Darwish
Role:	PhD Student	Main-Advisor	Co-Author 1
Institution:	HBKU	HBKU	QEERI

Participant:	Sayeed Mohammed	Dr. Ashraf Hassan
Role:	Co-Author 2	Co-Author 3
Institution:	QEERI	QEERI

Objectives of this work package (WP):

This WP is an extensive review of Qatar's renewable and non-renewable water resources and the consumption by different sectors in Qatar. The aim of this review is to highlight the problem of water scarcity in Qatar in details and also propose policy recommendations.

The main objectives are:

1. Present an overview of Qatar's renewable and non-renewable water resources.
2. Present data on consumption patterns by various sectors.
3. Highlight the heavy dependence on virtual water as a result of freshwater scarcity.
4. Propose policy recommendations on water resources management.

Description of the work:

- Task 2.1 Water Resources
  - Data on rainfall, groundwater, desalted water and treated sewage water.
- Task 2.2 Water Withdrawals
  - Data on withdrawals from all water resources and future forecast.
- Task 2.3 Virtual Water Trade
  - Calculating water footprint in Qatar.
- Task 2.4 Policy Recommendations and Water Conservation
  - Proposing polices to manage water resources.

List of the deliverables:

- Journal paper: M. Alhaj, S. Mohammed, M. Darwish, A. Hassan and Sami G. Al-Ghamdi, A Review of Qatar's Water Resources, Consumption and Virtual Water Trade, Desal. Wat. Treat. 21246 (2017) 1–16.
- Qatar Sustainability Award 2017 (at the Qatar Green Buildings Council Conference) in the category: Green Research.

Mohamed Atta Elmanan Bakhit Alhaj (210003978)
Doctor of Philosophy in Sustainable Energy

Work package number:	3 out of 7	**Start Date**	Jun, 2016	**End Date**	Aug, 2017
Work package title:	A techno-economic review of solar-driven multi-effect distillation				

Participant:	Mohamed Alhaj	Dr. Sami Al-Ghamdi	Dr. Ashraf Hassan
Role:	PhD Student	Main-Advisor	Co-author 1
Institution:	HBKU	HBKU	QEERI

Participant:	Dr. Mohamed Darwish
Role:	Co-Author 2
Institution:	QEERI

Objectives of this work package (WP):

This WP is a critical review of the literature on solar-driven multi-effect distillation.

The main objectives are:

1. Describe the MED process and its advantages.
2. Explain integration strategies of MED with solar collectors.
3. Investigate research gaps in the literature in details such as: thermal storage, plant configurations and modelling limitations.
4. Review economic analysis of solar-driven MED systems.

Description of the work:

- Task 3.1 Introduction to Thermal Desalination
  - Overview of thermal desalination and why the MED process is important.
- Task 3.2 Coupling Solar Collectors with MED Systems
  - Thermal storage.
  - Plant configurations.
  - Adapting solar collectors to the requirements of MED.
- Task 3.3 Modelling Studies
  - Assumptions and limitations.
- Task 3.4 Economic Analysis
  - Main findings in the literature and gaps in the analysis.

List of the deliverables:

- Journal paper: M. Alhaj, A. Hassan, M. Darwish, and Sami G. Al-Ghamdi, A Techno-Economic Review of Solar-Driven Multi-Effect Distillation, Desal. Wat. Treat. 21297 (2017) 1–13.

Mohamed Atta Elmanan Bakhit Alhaj (210003978)
Doctor of Philosophy in Sustainable Energy

Work package number:	4 out of 7	**Start Date**	November, 2017	**End Date**	March, 2018
Work package title:	Reducing electric energy consumption in linear Fresnel collector solar fields coupled to thermal desalination plants by optimal mirror defocusing				

Participant:	Mohamed Alhaj	Dr. Sami Al-Ghamdi
Role:	PhD Student	Main-Advisor
Institution:	HBKU	HBKU

Objectives of this work package (WP):

This WP present a control method for reducing electrical pumping energy requirements in the solar field. This problem occurs when the solar intensity is very high and mass flow rate of the heat transfer fluid has to be increased to main constant outlet temperature. This control strategy also shows the advantages of using the linear Fresnel collector.

The main objectives are:

1. Present overview of solar-driven thermal desalination.
2. Describe the solar collector.
3. Develop mathematical model and correlations for solar intensity.
4. Show how collector defocusing can reduce pumping energy requirements.

Description of the work:

- Task 4.1 Overview of Solar-Driven Thermal Desalination
  - Brief literature review.
- Task 4.2 The Solar Collector
  - Describe the linear Fresnel collector in the solar test facility.
  - Formulate mathematical model.
  - Correlations for solar intensity.
- Task 4.3 Simulation In the engineering equation solver (EES)
  - Results of the model.
  - Compare pumping energy with and without the proposed control strategy.

List of the deliverables:

- Journal paper: M. Alhaj, S.G. Al-Ghamdi, Reducing electric energy consumption in linear Fresnel collector solar fields coupled to thermal desalination plants by optimal mirror defocusing, Heliyon. 4 (2018) e00813. doi:10.1016/j.heliyon.2018.e00813.

Mohamed Atta Elmanan Bakhit Alhaj (210003978)
Doctor of Philosophy in Sustainable Energy

Work package number:	5 out of 7	**Start Date**	November, 2017	**End Date**	May, 2018
Work package title:	Energy efficient multi-effect distillation powered by a solar linear Fresnel collector				

Participant:	Mohamed Alhaj	Dr. Sami Al-Ghamdi	Dr. Abdelnasser Mabrouk
Role:	PhD Student	Main-Advisor	Co-Author 1
Institution:	HBKU	HBKU	QEERI

Objectives of this work package (WP):

This WP presents the technical analysis on solar-driven multi-effect distillation. The aim of the technical analysis is to model the performance of a solar-driven MED plant, investigate ways to minimize the plant's energy consumption, investigate the optimal plant design based on equivalent mechanical energy, assess the most suitable storage system, and examine the feasibility of incorporating an air-cooled condenser

The main objectives are:

1. Develop and validate a steady-state model for a 10-effect solar-driven MED plant.
2. Propose an optimized plant configuration based on equivalent mechanical energy.
3. Investigate the impact of several storage systems on the total plant capital expenditure
4. Investigate the technical feasibility and limitations of integrating an air-cooled condenser.

Description of the work:

- Task 5.1 Overview of Solar-Driven Thermal Desalination
  - Brief critical literature review.
- Task 5.2 EES Model
  - Develop and validate a complete model for the entire plant (solar + desalination blocks)
- Task 5.3 Investigation of equivalent mechanical energy
  - Analyze the effect of latent heat recovery and number of effects on the equivalent energy consumed
- Task 5.4 Investigation of storage system selection
  - Compare sensible heat, latent heat, and water storage systems in terms of total system cost.
- Task 5.5 Air-cooled condenser Integration
  - Investigate the feasibility and sensitivity of incorporating an air-cooled condenser.
- Task 5.6 Conclusion
  - Highlight key findings and propose future work.

List of the deliverables:

- Journal paper: M. Alhaj, A. Mabrouk, S.G. Al-Ghamdi, Energy efficient multi-effect distillation powered by a solar linear Fresnel collector, Energy Convers. Manag. 171 (2018) 576–586. doi:10.1016/j.enconman.2018.05.082.

- Tarsheed Award 2018 – "Best Green Sustainable Initiative", by the National Program for Conservation and Energy Efficiency, Kahramaa, Ministry of Energy and Industry.

Mohamed Atta Elmanan Bakhit Alhaj (210003978)
Doctor of Philosophy in Sustainable Energy

Work package number:	6 out of 7	**Start Date**	November, 2017	**End Date**	September, 2018
Work package title:	Environmental life-cycle assessment of solar-driven multi-effect distillation				

Participant:	Mohamed Alhaj	Dr. Sami Al-Ghamdi
Role:	PhD Student	Main-Advisor
Institution:	HBKU	HBKU

Objectives of this work package (WP):

The aim of this WP is to quantify the environmental impacts of solar-driven thermal desalination from cradle-to-grave in a systematic way. This is done using life-cycle assessment (LCA). The main questions that this WP addresses are: a) To what extent can we minimize the life cycle environmental impact of conventional thermal desalination processes through the integration of concentered solar power collectors and how do various collectors compare in this regard? and b) How does the uneven geospatial distribution of solar resources and water-stressed regions globally affect the environmental rating of solar thermal desalination systems?

The main objectives will be:

1. Define the LCA's study scope, system boundary and functional unit.
2. Compile the life cycle inventory for the integrated solar-driven MED plant.
3. Apply the LCIA method (ReCiPe) and analyze results.
4. Compare results with similar works and make recommendations.

Description of the work:

- Task 6.1 Environmental Impacts of Solar-Desalination
  - Literature review on environmental impacts of thermal desalination.
  - Literature review on environmental impacts of solar collectors.
- Task 6.2 LCA Study Design Parameters
  - Based on the study's scope and boundary, describe the system to be analyzed.
  - Decide on the functional unit.
  - Compile LCI and check data for accuracy and consistency.
  - Explain the LCIA method ReCiPe and the selected impact categories.
- Task 6.3 Results and Discussion
  - Discuss the results of the LCA for the optimized solar-driven MED plant.
  - Compare the LFC and the PTC solar collectors in terms of LCA rating.
  - Investigate the impact of variable DNI, seawater conditions, and local grid mix on the LCA results.
  - Highlight study limitations and results uncertainties.

List of the deliverables:

- Extended abstract published in *ARC'18* conference: "Solar power integration with desalination: A systematic assessment of the potential environmental impacts" by Mohamed Alhaj, Sami G. Al-Ghamdi, and Ashraf S. Hassan.
- Conference presentation given at the International Symposium of Sustainable Systems and Technologies (ISSST) June 26-28 2018, Buffalo, N.Y, USA.
- M. Alhaj, S.G. Al-Ghamdi. Environmental assessment of solar-driven thermal desalination. Journal of Cleaner Production. 2019. Under Review.
- M. Alhaj, S.G. Al-Ghamdi. Integrating concentrated solar power with seawater desalination technologies: A multi-regional environmental assessment. Environmental Research Letters. 2019. Under Review.

Mohamed Atta Elmanan Bakhit Alhaj (210003978)
Doctor of Philosophy in Sustainable Energy

Work package number:	7 out of 7	**Start Date**	September, 2018	**End Date**	December, 2018
Work package title:	Economic feasibility of solar-driven multi-effect distillation				

Participant:	Mohamed Alhaj	Dr. Sami Al-Ghamdi
Role:	PhD Student	Main-Advisor
Institution:	HBKU	HBKU

Objectives of this work package (WP):

Solar thermal desalination has the potential to reduce the environmental impacts of desalination and supply freshwater in remote areas, but it still has not been demonstrated in a commercial project. This problem raises concerns about the long-term reliability and economic feasibility of this technology, particularly when implemented at a large scale, which is the niche market for desalination. In this WP, we obtained further insights into the economics of solar thermal desalination based on a representative calculation of the levelized cost of water (LCOW) and cost sensitivity analysis. In addition, we compared our cost estimations with those of previous studies and evaluated the reasons for their significant variation. Moreover, we discuss market commercialization barriers from a policy perspective

The main objectives will be:

1. Conduct a critical literature review on the economic analysis of solar-desalination.
2. Develop an economic model for evaluating the LCOW.
3. Calculate the LCOW for solar-driven MED and compare literature values.
4. Conduct a sensitivity analysis.
5. Discuss technological and regulatory market commercialization barriers.

Description of the work:

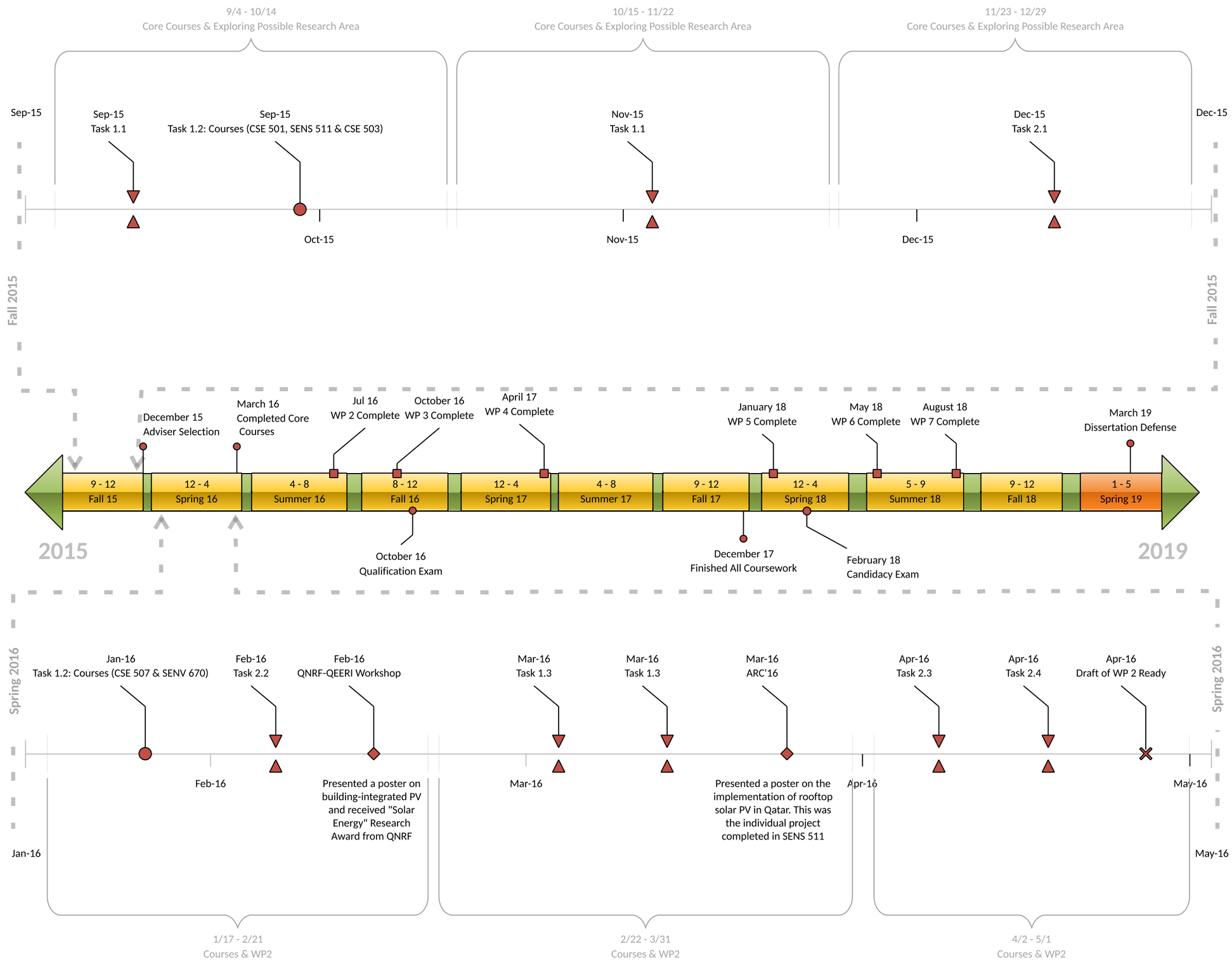
- Task 7.1 Review relations used for calculating the LCOW for solar-desalination systems
- Task 7.2 Compile cost data and derive relations for the specific system cost for LFC solar field
- Task 7.3 Develop a program in the EES for evaluating the LCOW
- Task 7.4 Discuss the EES program's results
- Task 7.5 Critically assess the market commercialization barriers

List of the deliverables:

- Journal paper: M. Alhaj, S.G. Al-Ghamdi. Why is solar thermal desalination expensive? Assessing economic feasibility and market commercialization barriers. Energy Policy. 2019. *Under Review*.

Mohamed Alhaj (210003978), Doctor of Philosophy in Sustainable Energy

Dr. Sami G. Al-Ghamdi's Research Group, Division of Sustainable Development



PhD

12/16/17
Journals Papers

5/12/17
Conferences Activities

20/12/17
Dissertation Milestone

12/10/17
Research Tasks

5/3/16
Degree Milestone

Past Semesters

Current Semester

Forthcoming Semesters

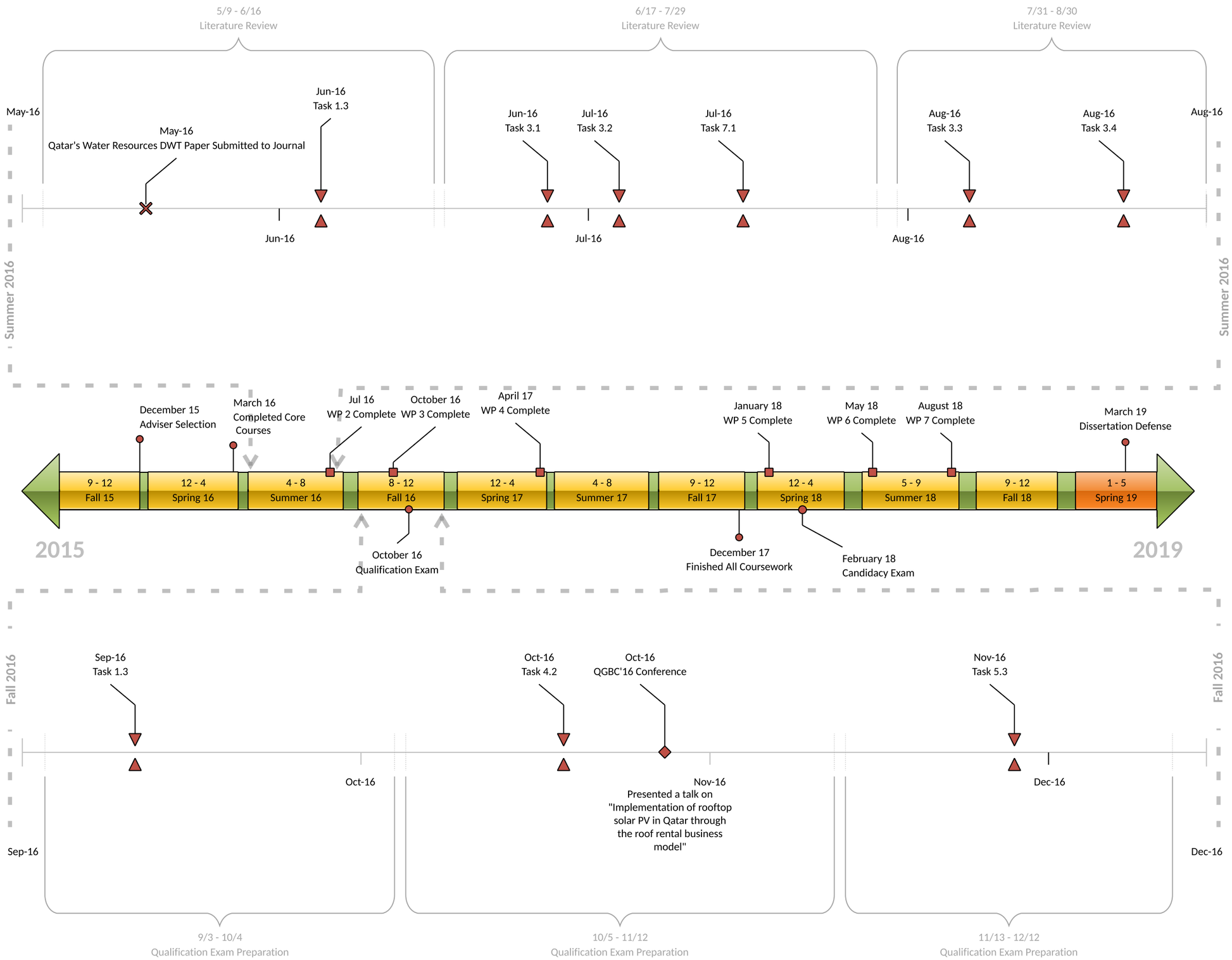
Last Update: Aug 13, 2017

Mohamed Alhaj (210003978), Doctor of Philosophy in Sustainable Energy

Dr. Sami G. Al-Ghamdi's Research Group, Division of Sustainable Development

HAMAD BIN KHALIFA UNIVERSITY
جامعة حمد بن خليفة
عضو في مؤسسة قطر
Member of Qatar Foundation

PhD



7/18/16
Journals Papers

5/12/17
Conferences Activities

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Dissertation Milestone

12/12/17
Research Tasks

11/7/16
Degree Milestone

Past Semesters

Current Semester

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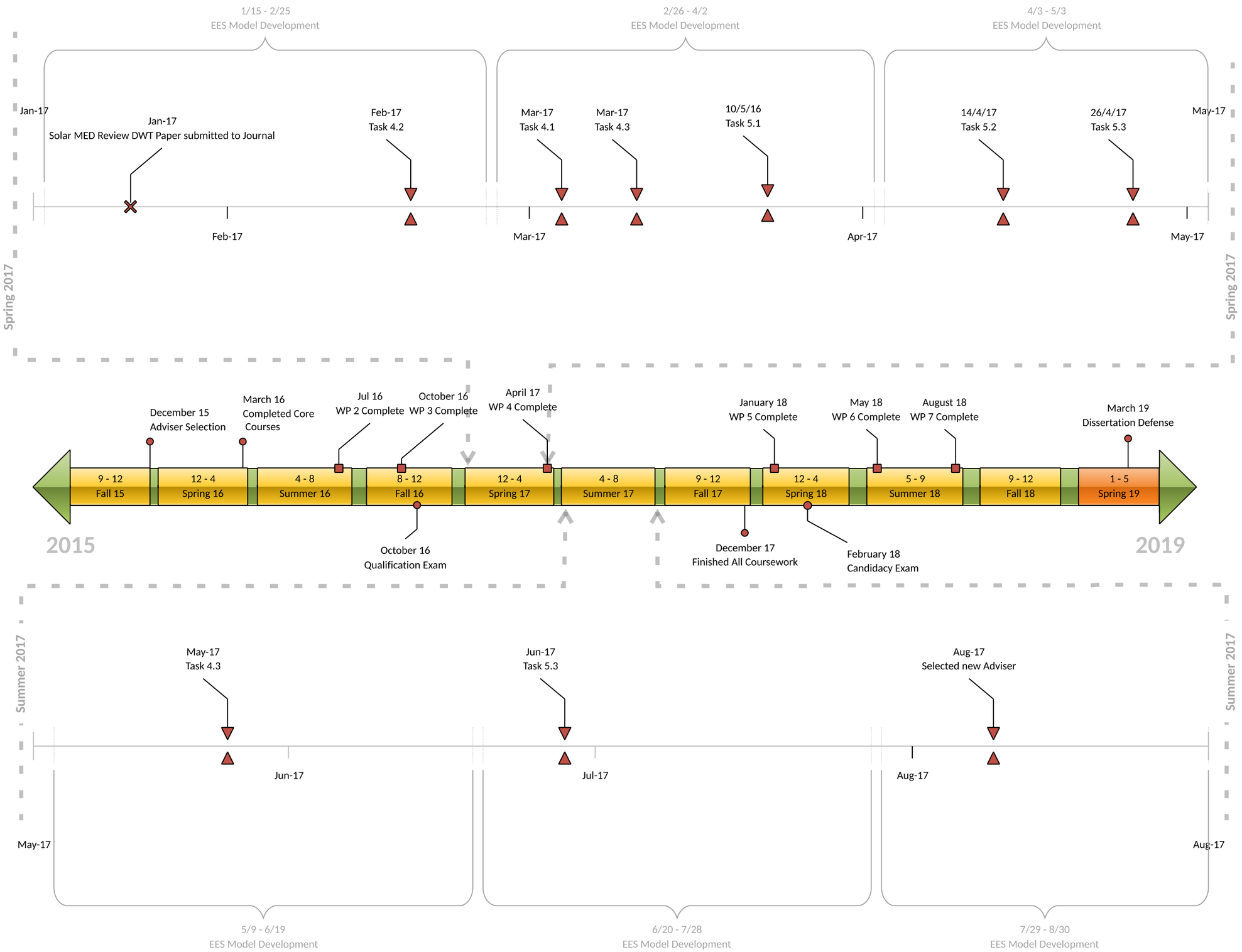

PhD

3/23/17
Journals Papers

5/12/17
Conferences Activities

12/12/17
Dissertation Milestone

12/12/17
Research Tasks

7/19/17
Degree Milestone

Past Semesters

Current Semester

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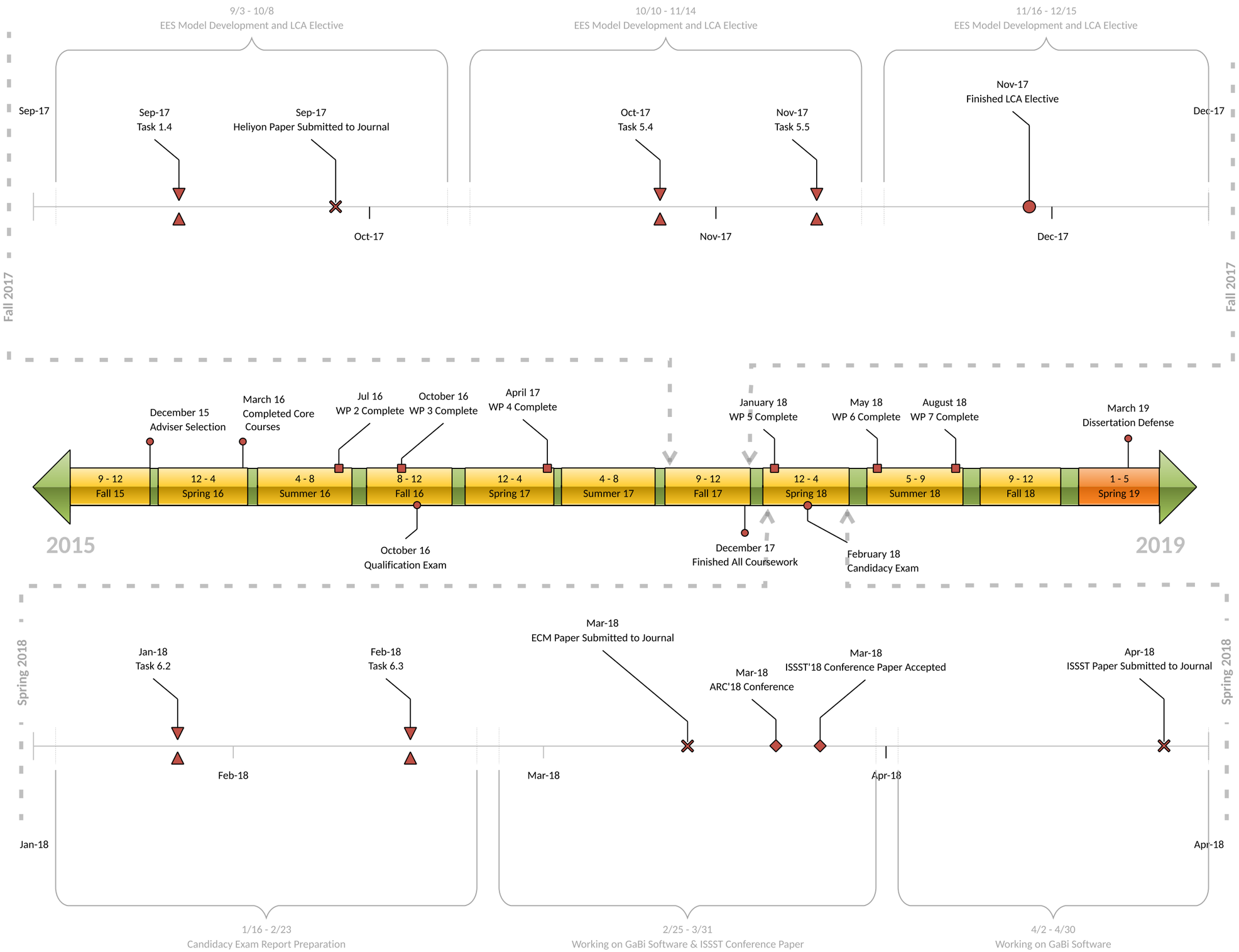

PhD

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Conferences Activities

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Dissertation Milestone

3/22/18
Degree Milestone

3/22/18
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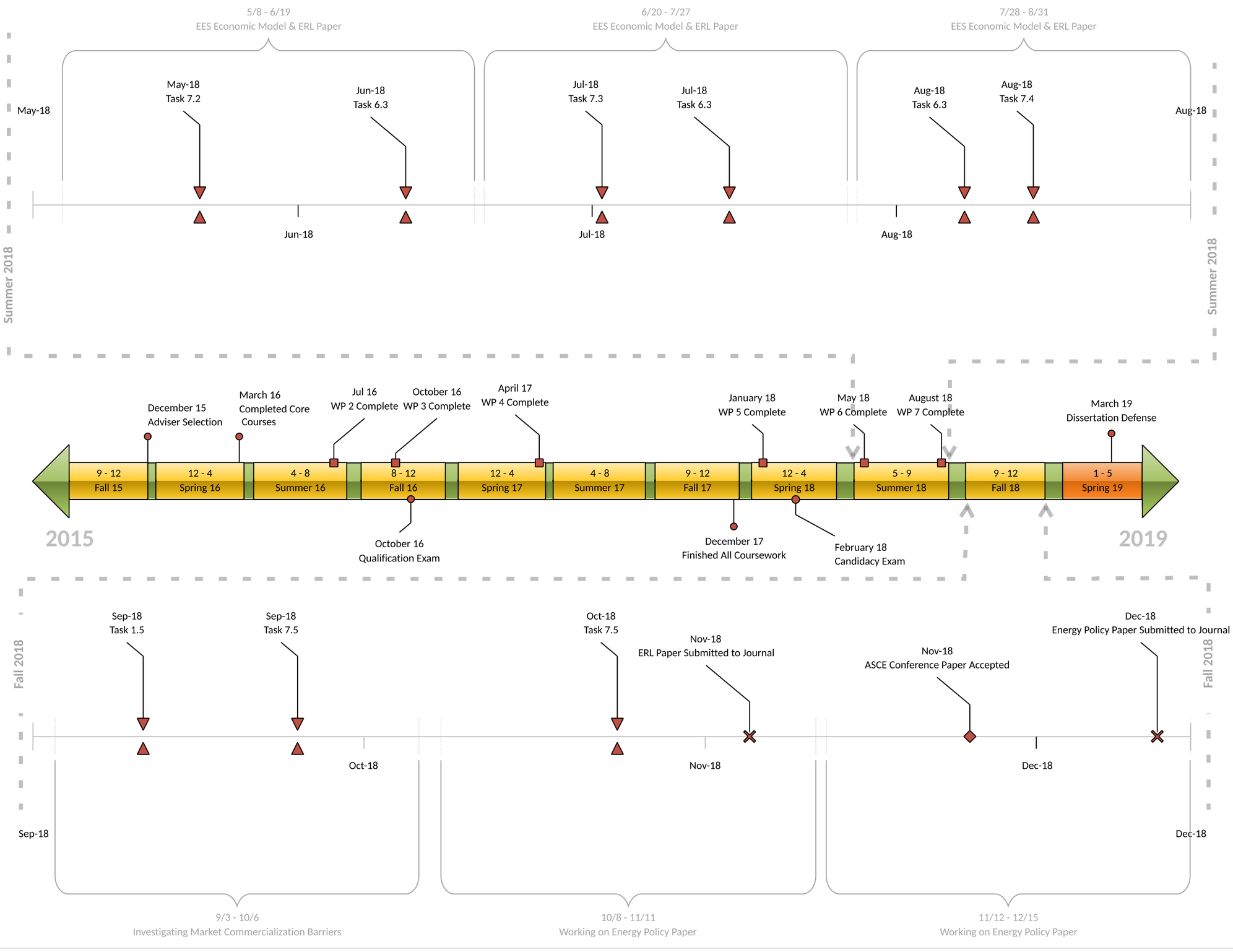

PhD

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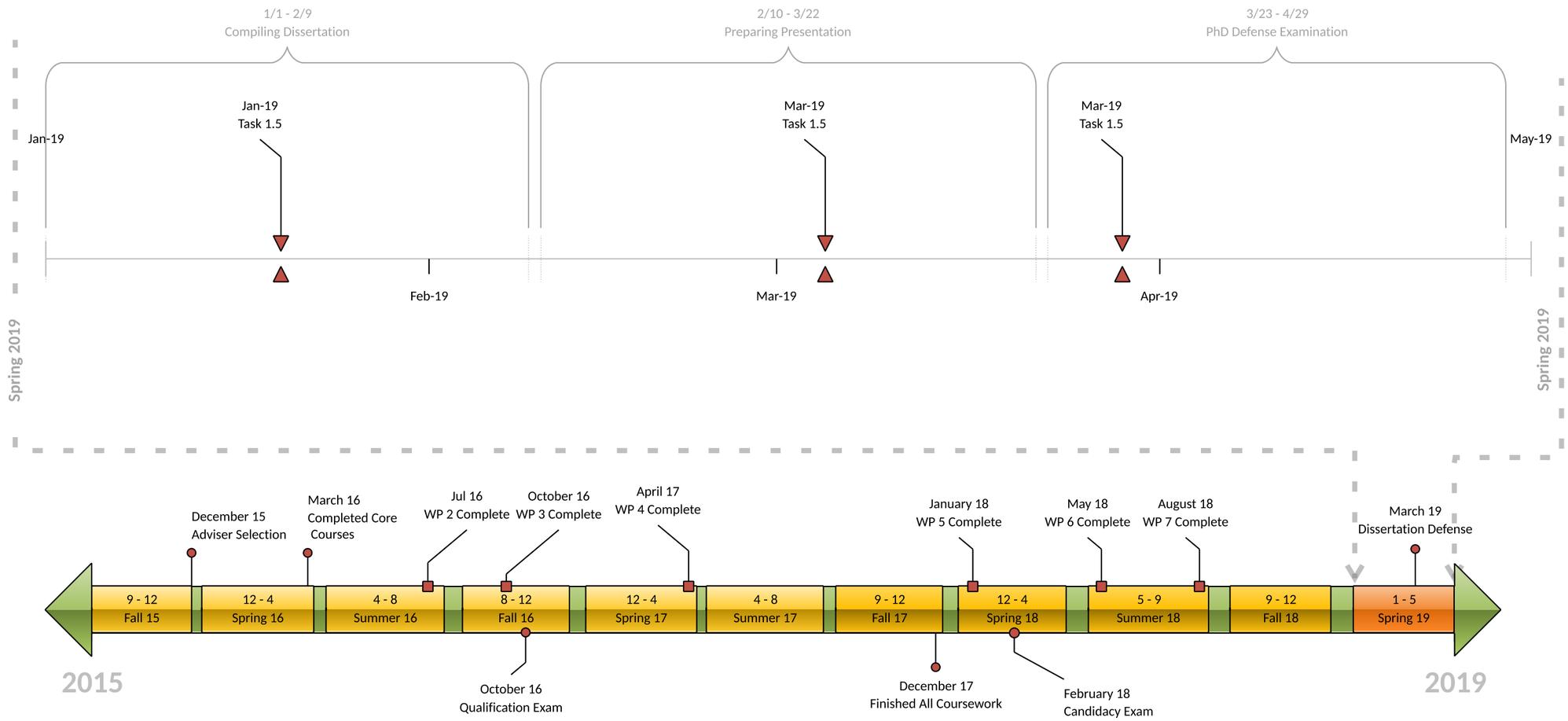

PhD

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5/12/17
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12/12/17
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12/12/17
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11/7/18
Degree Milestone

Past Semesters

Current Semester

Forthcoming Semesters

Last Update: Aug 13, 2017