"How eager we are to learn about sustainable energy, but a 16 page syllabus. Is this sustainable for TREES, if you print it out? Is Collins going too detailed?" TRUST ME!
NO all you need to know for 465 is herein
Spring 20209 from TUES. 21 Jan to Thur7 May

Schedule and Grading **ECE 465**

Realistic Sustainable Electrical Generation Technologies:
3 Credits
SEE http://www.calendar.colostate.edu/

Class Time: Tuesday and Thursday 12:30- 1:45.in room B103

NO CLASS Thur. 12 March before spring break due to anticipated additional class time overruns during critique talks

Grading Summary:

1. **HW Assignments: 20%**
2. **Talk / Paper # 1: 20 %**
3. **Talk / Paper #2: 40%**
5. **Pop Quizzes: 20%**

THIS TOTALS 100%

Individual extra credit opportunity described later, due on or before 11 May

Up to date in class announcements always supersede this preliminary guide.

The goal of this memo is to let students know in detail and in a clear, plain and intelligible manner what is expected in 465 as regards grading, due dates and the importance of the two GROUP talks. It takes pages. **Goal of the course is to move beyond the sterile defense or touting of any ONE energy source over others with only one metric.**

Keep in mind throughout the course the need to meet three key energy goals:

a. **Home grown energy for security**
b. **Low cost energy for maintaining USA world competitiveness**
c. **Environmentally safe energy sources with low emissions to minimize climate change**

This will lead us all based on data to employ in the future a mix of low cost and low-emission hydrocarbons, nuclear and renewables. ALL ARE NEEDED.

Please contact myself or the grader if the grading is not accomplished in a timely manner. Below I guide you to topics of interest to you.

465 GRADING SUMMARY is on page 3

Goals of the 465, More Grade details and Expectations for Talks are described on pages 4-9

ADVICE FOR SUCCESS IN 465 is on page 9-13

Synopsis of Weekly HW Questions and Weekly Topics are on pages 13-14

Table form of weekly schedule and Due Dates is on pages 14-15

Note students in both 466 and 465 may use very similar talk # 2 in both classes but with slightly different emphasis—see both syllabi.

One website to put the 465 course in economic perspective: See for example countries poor and sick versus rich and healthy over time which is all related to energy use:http://dmarron.com/2010/12/02/200-countries-200-years-4-minutes/

Class Time: Tuesday and Thursday 12:30 to 1:45 in Room 103

- Instructor: Prof. George Collins, Email: gcollins@engr.colostate.edu
- Submit all the assignments in PDF or PPT slides formats in CANVAS
- GRADER: Grader: TBD
- Instructor Philosophy
- **ECE Students are the most important people at CSU.**
- **Not dependent on faculty.**
- **Faculty is dependent on them.**
- **Not an interruption of our work.**
- **They are the purpose of being at CSU.**
- **Students are doing us a favor when they come to our office.**
- **We are not doing them a favor by serving them.**
- **Students are part of our business, not outsiders.**
- **Not just a CSU ID number.**
- **They are flesh and blood human beings with feelings and emotions.**
- **Students come to us with their needs and wants.**
- **It is our job to address them with courteous and attentive treatment.**
- **Students are the life blood of this and every university.**
- **Without them we would close our doors.**
- **DON'T EVER FORGET THIS!**

I seek to help students think and speak for themselves, not telling you all what to think and what to say in your two group talks and in class participation. Let's all be respectful of differing views of energy solutions.

- Here are few guidelines regarding HW and POP QUIZ submissions to the grader and postings on CANVAS-

GRADER: TBD

1) Preferably write your solutions in MS PowerPoint or WORD. Number of slides may vary depending upon the solution, then Please convert it to PDF.
2) Please use the file name format as- "ECE 465_HW/POP QUIZ#_Group#".
3) Only group leader will submit the final PPT of HW/POPQUIZ.
4) Please submit that on CANVAS unless you have a difficulty doing so.

NOTE Talks PPT and WORD are submitted to George Collins directly not to CANVAS

Decide your group members and leader of the group among yourselves. Elected group leaders will send the list of confirmed group members. Also please try to maintain equal number of members in each group before sending the list of confirmed group members.

- FREE Text Book: "Without the Hot air" from Cambridge Univ. UK. The course text is available free on

the web: www.withouthotair.com

- Class website: 1200 pages of my notes are found at http://www.engr.colostate.edu/ECE465

Some folks think they are so right, that their opinions are facts and are above debate. This insight will help us all from charter membership in the flat earth society way of thinking. Please try to make my candle of certainty about negative aspects of solar energies, climate change ambiguity (earth temperatures go up and down over geologic time) or my favoring nuclear energy most of all to reduce CO_2 emissions. Each of my certainties might with your help FLICKER and even go out by your data based enlightening comments in class and ALL group assignments. For example, folks argue about facts using different temperature data of the terrestrial earth versus the ocean covered earth. See the June 2015 National Oceanic and atmospheric Administration (NOAH is located in Boulder Colo.) peer reviewed paper found on the NOAH website discussing these disparate facts versus numerical climate model predictions. A second example is listing the relative advantages of for example solar energy versus nuclear energy for 24/7/365 delivery of energy in the long term.

Scientific certainty has never been unquestionable. Indeed it is often useful. At one time scientists all agreed the solar system revolved around earth, they argued about the data and changed their concepts to the correct view that the planets revolved around the sun and the sun revolved around the black hole in the Milky Way.

I do feel obliged to alert students with passions about solar energy, one way temperature always rising climate change and fear and loathing of nuclear energy that my class presentations may challenge your own certainties. In other words this is a trigger warning. I therefore declare ECE 465 for those passionate and sensitive students an “unsafe place”. In short the earth does not revolve around any of us.

GRADE SUMMARY 465 out of 100

Talk#1: 20% (15 points PPT slides and talk and 5 points for WORD paper). Topic for all is mini-nuclear power in detail . The format is to have a critique PPT talk first, where I point out short comings, and then week later send the final PPT and word to me directly by email attachment. Do not send to CANVAS or to the grader. In both talks for 465 the role of grants, legal mandates, feed-in tariffs, tax breaks, loans, subsidies should also be mentioned to help explain government’s role in fostering sustainable energy development and picking winners and losers of receiving the tax dollars of all of us.

Talk#2: 40% (35 points for PPT talk and 5 for WORD paper) Topic is up to the group and individual student as long as its energy/ transport related. The format is to have a critique talk first, where I point out short comings, and then week later send the final PPT and word to me directly by email attachment. Do not send to CANVAS or to the grader. In both talks for 465 the role of grants, legal mandates, feed-in tariffs, tax breaks, loans, subsidies should also be mentioned to help explain government’s role in fostering sustainable energy development and picking winners and losers of receiving the tax dollars of all of us.

In summary TWO GROUP TALKS ACCOUNT FOR 60% of grade

5 Group Pop Quizzes: 20%

5 Group HW assignments: 20%

Total 100 %

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Don't be a potted plant in class. Challenge the instructor on things said you disagree with and can offer justification and thereby earn extra points for class participation up to 3 % of final grade.

An **additional individual up to 7% extra credit** can be earned by sending me on or before 11 MAY a PPT presentation on variable frequency motor drives (VFMD), a form of a DC to AC inverter which can save 20-30 % over prior motor drives. Be sure to separate VFMD for both DC versus induction motors. The induction motors are used in electrical vehicles as they can dynamically break using the induction motor and during that electrical braking GENERATE electricity to recharge the electric car battery

CSU ACADEMIC INTEGRITY Policy: http://catalog.colostate.edu/general-catalog/policies/students-responsibilities/#academic-integrity

SEE two free Coursera courses on climate change for lecture 1 preparation:

https://www.coursera.org/course/sids

https://www.coursera.org/learn/sustainabledevelopment1/outline

Climate change is a fact of earth's life from the beginning of its creation. Noah's Arc story tells of rising sea levels, no doubt due to higher earth temperatures. In the other direction of cooling Europe's little ice age in the 1640's is a matter of record. Cooling occurred due to both LOW solar radiation and volcanoes erupting. Cold wet weather ruined harvests but was blamed on divine wrath instead of CO_2 levels deceasing. Today it's the wrath of man's CO_2 emissions. Nowadays we blame this warming on man even though 97% of CO_2 in the atmosphere is due to natural causes. If one denies that man is causing climate change you are guided to a dark room and told to lie down. This is despite the fact that, the error bar on earth's temperature measurements is 5 times the measured value. SEE Berkley Earth a known publication. What about melting ice caps—ask NASA- http://phys.org/news/2015-10-mass-gains-antarctic-ice-sheet.html

HERE IS THE CONTRARIAN SCIENCE
The oversimplified Fox news article:
https://www.foxnews.com/science/explosion-antarctic-sea-ice-ice-age

Below is the Nature Geoscience Abstract of the scientific article on which it is based:

5

nature geoscience

ARTICLES

https://doi.org/10.1038/s41561-019-0466-8

Global cooling linked to increased glacial carbon storage via changes in Antarctic sea ice

Alice Marzocchi[1*] and Malte F. Jansen[2]

Palaeo-oceanographic reconstructions indicate that the distribution of global ocean water masses has undergone major glacial–interglacial rearrangements over the past ~2.5 million years. Given that the ocean is the largest carbon reservoir, such circulation changes were probably key in driving the variations in atmospheric CO_2 concentrations observed in the ice-core record. However, we still lack a mechanistic understanding of the ocean's role in regulating CO_2 on these timescales. Here, we show that glacial ocean–sea ice numerical simulations with a single-basin general circulation model, forced solely by atmospheric cooling, can predict ocean circulation patterns associated with increased atmospheric carbon sequestration in the deep ocean. Under such conditions, Antarctic bottom water becomes more isolated from the sea surface as a result of two connected factors: reduced air–sea gas exchange under sea ice around Antarctica and weaker mixing with North Atlantic Deep Water due to a shallower interface between southern- and northern-sourced water masses. These physical changes alone are sufficient to explain ~40 ppm atmospheric CO_2 drawdown—about half of the glacial–interglacial variation. Our results highlight that atmospheric cooling could have directly caused the reorganization of deep ocean water masses and, thus, glacial CO_2 drawdown. This provides an important step towards a consistent picture of glacial climates.

1.

I love questions from the class. You are paying to be taught and I am being paid to teach, so ask lots of questions. Do not act like a potted plant in the classroom.

Up to date in class announcements always supersede this preliminary guide.

GUIDE to getting maximum value from class lectures:

1. Listen and take minimal notes in class – but interrupt the lecture flow often with cogent questions. Be shameless; never be like a zombie during lectures. Use lectures to get a wider angle view of Sustainable Energy ISSUES.
2. Enjoy the wonder and possibilities of sustainable energy ISSUES.
3. 465 lecture notes are found at http://www.engr.colostate.edu/ECE465

A-F with plus minus 465 GRADING SUMMARY

Letter grades for ECE 465 are on an F to A scale with plus minus fine tuning on all letter grades.

A-F GRADING SUMMARY with plus minus fine tuning for 465

Letter grades for ECE 461 are on an F to A scale with plus minus fine tuning on all letter grades.

Score (X)	Letter Grade
X > 100	A+
X > 96	A
X > 93	A-
X > 91	B+
X > 86	B
X > 83	B-
X > 81	C+
X > ~~76~~59	C
X < 59	F

No C minus grades allowed

If you are experiencing difficult situations that are affecting, or could potentially affect, your academic success, please contact Student Case Management as soon as possible (http://www.studentcasemanagement.colostate.edu/ E203 Newsom Hall, 970-491-8051). Difficult situations can include issues such as medical, mental health, personal or family crisis, illness, or injury. If students request extensions or considerations due to difficult situations, I typically require documentation from Student Case Management. In addition, I urge students to contact me in advance of deadlines about such issues.

For making referrals, their contact information is:
Student Case Management
E203 Newsom Hall
970-491-8051
vpsa_student_case_management@colostate.edu
http://www.studentcasemanagement.colostate.edu/

AIMS/Goals of the 465 Course

This course will instruct undergraduates from all areas of study, about sustainable and green but intermittent energy sources of energy as compared to traditional fossil fuel, hydro and nuclear energy sources which operate 24/7/365. It will also cover transportation energies. An increasing energy need is related to the world's population and economic growth. This brings associated energy and environmental needs as well as issues of sustainability and climate concerns with fossil fuels which are now the predominant energy source. To grasp why fossil fuels are king for transportation, consider a single Kg of diesel fuel which equals >13 kW –hr (.3 GJ of energy) of energy. This is about 300 times the energy storage density of lead acid batteries, which incidentally must be charged by some other energy source, likely hydrocarbon driven power plants. One megawatt of emergency electricity can be delivered by a single trailer mounted greasy diesel generator, which can run maintenance free for weeks. A megawatt of wind would require a remote area of 100 football fields' area and only operate on average for 1/6 of the time on average at best. These proffered proposed realities from me are subject to your critical analysis during the course to affirm or deny in weekly Pop quizzes.

In short in the discussion of energy sources as well as energy savings, who is right and who is wrong is too

simple. Each side is right in some sense but how do you parse that. Again pop quizzes attempt to give you practice doing just that.

You will learn in this course to use hard numbers, “metrics” with “units”, such as energy cost in $/Watt or $/Joule as well as detail the land area and water volume needed to generate a GW of power from wind, solar, hydro, tides, waves ,nuclear, and fossil fuels. This way, quantitative comparisons may be made between various energy pathways that we can pursue to be more sustainable. For fossil fuels the hidden costs of pollution and the remediation costs to reduce pollution will be covered in detail. There is no free lunch. Again the effort is to inform you, the future energy policy makers, of the visionary possibilities, the practical realities and the costs of different energy balance pathways forward.

“Cost” is a four letter word that makes visionary dreams face reality. is that which you ignore does not go away. I will conclude in class notes as does our text author, that sustainable renewable/green energy claims beyond 30 % total energy generation are starting to be more “pixie dust” than reality because of COST and grid integration considerations of intermittent energy sources. In addition the inability of alternative energies to meet base load requirements reliably and lack of grid scale energy storage are a big unsolved problems. In addition, total costs may lead to “green energy economic suicide”. But you and your group make your own determination in your TALKS, especially talk # 2. After listening to me and reading our text you do your own research and decide for yourself. You will be rewarded if you disagree with me and the author and use a cogent rational explanation why you disagree.

Sustainability is the art of balancing all engineering and scientific possibilities including ECONOMIC COST, a four letter word, which we learn from economics and double entry accounting. I believe that we do NOT have an energy crisis; we have a crisis as regards the cost of energy and the BEST economic choices to address climate warming. I judge nuclear energy to be the best long term solution. If you disagree with anything I present, tell me why in a cogent manner and earn extra credit points. Energy, CO_2 and nuclear energy are three parts of a multi-part issue called Climate Change—to see Bill Gates opinion on Nuclear Power go to: http://www.ted.com/talks/bill_gates.html

A major aspect of the course is INCREASED energy efficiency in units of “Negawatts”, “kill-a Watts”, or energy saved. Energy saved is energy that need not be generated. This concept is especially useful in discussing new technologies with increased efficiencies such as: transportation of people and freight, variable frequency power electronic motor drives and heat pipes employed in home and building HVAC, as well as LED lighting of buildings. Just increasing lighting or transformer efficiency by 3 % would save energy costs, reduce greenhouse gas and CO_2 emissions, and reduce the need to build new power plants.

Another focus in the course is on BIG energy savings and not little energy savings; unless the little saving is multiplied by say 1-3 billion such devices (e.g. charging inefficiencies for the wall warts for cell phones). But again the TOTAL energy saving must be substantial to be considered in the course. Therefore lighting is one example where energy savings are emerging as is variable frequency motor drives.

I hope by the end of 465 or even sooner, all students appreciate the old saw “to read without reflecting is like eating without digesting”. Or for the simple fools like me the shorter version is the difference between “knowing the facts versus knowing the truth”. More energy use correlates with higher GDP in every country. Hence the increased energy use in the third world as it grows economically. If we just use less energy we will live less well—better to target energy inefficiencies

The class notes are password protected
Username: Student
Password: Power!

I will send out weekly emails to remind you of what is due. If the email is different from the syllabus schedule let me know as I may have changed assignments. Weekly memos trump the syllabus. We will cover in our text the listed chapters and my web notes the following topics in the weeks listed.

Group Class Talk # 1, **Tues**. **18- Thur. 27 Feb.,** and associated WORD paper (20 points total 15 points PPT slides and talk and 5 points for WORD paper). **The format is to have a critique PPT talk first, where I point out short comings, and then week later send the final PPT and word to me directly by email attachment. Do not send to CANVAS or to the grader.** gcollins@engr.colostate.edu

.Paper and revised PPT slides are due ONE WEEK after the group critique talk. Send both revised PPT slides and WORD paper to me only

Do NOT send via CANVAS

Topics of Talk #1 is Micro Style Nuclear Energy. Emphasize in your talks fail safe micro nuclear power plants from Westinghouse /Toshiba and Hyperion out of Denver.

Grouptalk # 1 will give students a chance to discern and make judgements about truth versus facts in the case NEW nuclear power. Send to me both the PPT and WORD paper one week after the critique presentations:

Individual Talk # 1 PPT Presentation grading is out of 15 is as follows:

1. TECHNICAL ACCURACY 9/15
2. PPT Slide ORGANIZATION 3/5
3. CLARITY OF MATERIAL-SHORT LIST OF TOPICS IN DEPTH COVERAGE BETTER THAN MANY TOPICS VERY SHALLOW DOVERAGE 1/15
4. PROPER SPELLING GRAMMAR REFERENCES 1/15
5. FOLLOWING THE MEMOS ON TOPICS TO BE COVERED 1/15

GROUP WORD PAPER GRADE OUT OF 5 is based AS FOLLOWS:
1. TECHNICAL ACCURACY 2/5
2. PAPER ORGANIZATION 1/5
3. CLARITY OF MATERIAL-SHORT LIST OF TOPICS IN DEPTH COVERAGE BETTER THAN MANY TOPICS VERY SHALLOW DOVERAGE 1/5
4. PROPER SPELLING GRAMMAR REFERENCES .5/5
5. FOLLOWING THE MEMOS ON TOPICS TO BE COVERED .5/5

Again I repeat: Group TALK # 1: Tues. Feb 18 – Thur.27 Feb will integrate all learning to date and drill deep into a common comparative topic: Specifically, Micro Nuclear Energy for ALL groups.

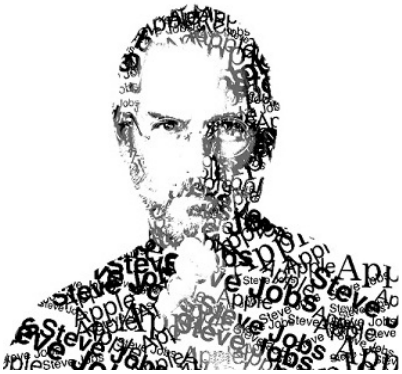
Talk # 1 emphasis in MICRO NUCLEAR
Goal of Talk # 1 is to improve communication skills by exploring nuclear energy. It will spot problems early in both presentations and papers and fix them, so you do not repeat mistakes in talk # 2. Again you get a group grade on the paper with individual grades for PPT presentations. Written portion must be in Word format and oral presentation slides in PowerPoint Format. Talk # 1 and paper # 1 has a common theme for all groups, so your group can hear other groups cover the same materials and learn by positive or negative example of how to present materials.

BEST Presentations Steve Jobs Style

When you give a presentation, you face at least two hurdles.

First, you need to sell yourself as a credible spokesperson on your topic. Audiences need to believe in you-and that's hard enough.

Second, you need to sell your ideas so that people come away inspired, persuaded and enlightened.



Steve Jobs did both-with incredible skill. Widely considered one of the most gifted presenters ever, Jobs understood how to deliver memorable speeches in a seemingly effortless, engaging manner. His conversational tone, simple yet compelling word choice and masterful use of slides and other props helped reinforce his message in winning ways.

You'll learn how to develop key skills, including how to:

- Integrate Aristotle's "Big Three"-logos/ethos/pathos-to win over audiences. Learn how to blend logic, credibility and emotion to enliven your remarks.
- Convey big ideas or central themes via multiple channels. From audience giveaways to props to slides, apply the Steve Jobs approach and align all available tools to drive home key points so that people cannot help but remember them-and buy into them.
- Think in threes. To explain complex processes (from chemical reactions to financial formulas), learn to cluster your main points in threes. Your audiences will thank you.
- Use bluntness and directness. Rather than drop hints or dance around controversial positions, follow Steve Jobs' example and state your case boldly and succinctly.
- Embrace simple language. If you need to explain complex ideas, you must speak in complex terms. Right? Well, Steve Jobs was a master at communicating complicated concepts in unmistakably clear words. Develop tools to translate your speech into plain English that's compelling and hard for anyone-of any background or educational level-to ignore.
- Start staff meetings with an edge. Steve Jobs did not begin staff meetings with touchy-feely happy talk. Instead, he often provoked people or expressed disappointment in some aspect of the team's performance. But by the end of the meeting, everyone left in a positive frame of mind-inspired and validated. Find out how Jobs pulled that off.

1. Ten total weekly Pop Quizzes: Eight required and two optional for extra credit (30 points total).

Ten take home or in class pop quizzes (3 points each) based on material given in class presentations, summarized on the web notes for 465 and text as well as Google Scholar searches. At minimum the pop quizzes are tailored to both keep you current with my web notes and prepare you for Talks # 1 and #2.
This is a chance to “drill deep” into a topic I assign with your group team dividing the work. Use my class notes, the text and articles from the web. Pop Quiz solutions are assigned a week in advance and are due the following

week on Thur. Pop Quizzes are to be done as a group effort not as an individual effort. Split up the work among your group members and put all answers in PPT format with cogent and to the point bullets not windy paragraphs with large font sizes in say Ariel black.

2. Group Class Talk # 2: "**Energy Topics of group choice**", **Tues. 14 April- Thur. 23 April.**
   For example the limited Internet of Light (IoL) to control a lighting system, from city street lights to a large office building lighting, with sensors (SCADA Data) and software like GE's Predix..
   Address the claim that LED lighting devices alone without IoT can save more energy at lower cost than solar energy generation can provide to date. This is overlapping with ECE 465—you can give same talk in both 465 and 466 courses.

   Again **the format is to have a critique PPT talk first, where I point out short comings, and then week later send the final PPT and word to me directly by email attachment. Do not send to CANVAS or to the grader.**

   Instructor: Prof. George Collins, Email: gcollins@engr.colostate.edu

Talk # 2 Individual PPT Presentations are graded out of 40 is as follows:35 for PPT and 5 for WORD

1. TECHNICAL ACCURACY 25/ 25
2. PPT Slide ORGANIZATION 5/25
3. CLARITY OF MATERIAL-SHORT LIST OF TOPICS IN DEPTH COVERAGE BETTER THAN MANY TOPICS VERY SHALLOW DOVERAGE 1/15
4. PROPER SPELLING GRAMMAR REFERENCES 1/15
5. FOLLOWING THE MEMOS ON TOPICS TO BE COVERED 3/15

GROUP WORD PAPER GRADE OUT OF 5 is based AS FOLLOWS:
1. TECHNICAL ACCURACY 2/5
2. PAPER ORGANIZATION 1/5
3. CLARITY OF MATERIAL-SHORT LIST OF TOPICS IN DEPTH COVERAGE BETTER THAN MANY TOPICS VERY SHALLOW DOVERAGE 1/5
4. PROPER SPELLING GRAMMAR REFERENCES .5/5
5. FOLLOWING THE MEMOS ON TOPICS TO BE COVERED .5/5

TALK #2 should be entirely student group and individual student choice. One exception is the same talk # 2 can be given in BOTH ECE 466 and ECE 465 if students are enrolled in both courses but the emphasis is different—see syllabi details. I will talk on an overview of LED lighting DEVICES for ENERGY SAVING of NEGAWATTS in both classes.

The format is to have a critique PPT talk first, where I point out short comings, and then week later send the final PPT and word to me directly by email attachment. Do not send to CANVAS or to the grader. gcollins@engr.colostate.edu

Group Talk # 2 topic example might be perhaps "How IoT meld IoT (sensors) OT(operational technology) and IT (analytics/algorithms) for "**Energy Saving LED Lighting Systems for City street lights and office building lighting systems**". SCADA Data from light sensors and the software from GE Predix to command and control for optimum performance. Just a suggestion or example of a talk topic

Practice makes perfect
Kaizen is a Japanese word for" continual improvement and is common in manufacturing as pioneered by Toyota.

GROUP and individual EFFORTS in ECE465 are the key to your success and also teach many soft skills needed in your future job where group efforts are the rule.

I love questions from the class. You are paying to be taught and I am being paid to teach, so ask lots of questions. Do not act like a potted plant in the classroom.

TWO GROUP TALKS/Papers count 60% of the grade so keep that in mind:

> In both talks t**he format is to have a critique PPT talk first, where I point out short comings, and then week later send the final PPT and word to me directly by email attachment. Do not send to CANVAS or to the grader.** gcollins@engr.colostate.edu

Both talks/papers are done as group efforts to simulate your future environment in the workplace. Group/team efforts are required to get students familiar with the team efforts that they will encounter in the workplace and so they better understand the dynamics of team work. For group efforts Microsoft has versions of Word and Power Point that reside on servers at Microsoft Office Live —moreover this allows MULTIPLE users to log on and work on the SAME document together. I strongly recommend Microsoft SkyDrive for student cooperative projects/talks/papers that many students in a group can share edits as they occur. It is deeply integrated with Microsoft Office on both Windows and Mac's and is free.

See a remarkable way to "see" data and try to use gapfinder.com in your talks
http://www.youtube.com/watch?v=hVimVzgtD6w

I encourage campus students to form HW/pop quiz/presentation groups ASAP to reduce your work load in 465 by dividing the work and handing in a single group effort.

SECOND Disclaimer Notice:

Up to date in class announcements always supersede this preliminary guide.

If you have further questions ask me in class so everybody benefits.

Please forgive this windy 16 page syllabus. It has both a time line schedule and grading breakdown as well as details on the two required GROUP presentations/Papers. In addition to keep it all clear and fresh, I will send out a weekly memo reminding you of: last week's material, this week's materials and next week's material. This effort is for better detailing, I hope clearly three points:

1. What prior assignment is due that week (e.g. Pop Quiz, Chapter HW, upcoming talks etc). In general the weekly Pop Quiz is due the following week it was assigned and on Thurs. The HW is assigned as we cover materials and not weekly, it is due the following week it is assigned on Tues.
2. I highlight newly assigned material for that coming week and future due dates for all new assignments within a month's interval. This is to better help students guide their time, as I know you have other courses. Due dates for ALL pop quizzes and HW are given below in the syllabus.
3. Finally this course is lots of work in the beginning of the semester but much less work in the final

. In short, all items in this memo are subject to change by Prof. Collins in LATER weekly class announcements and

General Advice on Materials to be Included in THE TWO TALKS

The format is to have a critique PPT talk first, where I point out short comings, and then week later send the final PPT and word to me directly by email attachment. Do not send to CANVAS or to the grader.
gcollins@engr.colostate.edu

In both talks for 465 the role of grants, legal mandates, feed-in tariffs, tax breaks, loans, subsidies should also be mentioned to help explain government's role in fostering sustainable energy development and picking winners and losers of receiving the tax dollars of all of us. The two biggest energy generation and consumption countries

are the US (1200 GW or 26% of world energy use) and China (1000 GW). To be economically competitive in the future each country has to MINIMIZE energy costs, as innumerable studies show that low cost energy drives Gross Domestic Product (GDP). Moreover slow global warming is a reality and most proposed energy saving or energy generation solutions to the problem, can have seemingly worse adverse economic effects than the warming itself might pose. Compromises need to be made on a realistic basis and this is open for your group to discuss, where 3-6 students each present a portion of the talk.

I again repeat guidance of what is expected on both talks as they constitute 60% of the grade.

Talk # 1 Micro nuclear, Four groups talk **Tues. Feb 18 – Thur. 27 Feb,** 20 points total (15 points PPT slides and talk and 5 points for WORD paper). **GROUP TALKS/Papers count 60% of the grade so keep that in mind:**

The format is to have a critique PPT talk first, where I point out short comings, and then week later send the final PPT and word to me directly by email attachment. Do not send to CANVAS or to the grader. gcollins@engr.colostate.edu

Go to the internet to learn about micro nuclear power plants from Westinghouse /Toshibsa to Hyperion out of Denver. Your task is to explore micronuclear as concerns a renewable energy source that operates 24/7/365, unlike solar or wind with a >90 % capacity factor and emits ZERO CO_2.

I suggest five guides for ALL GROUPS (Four GROUPS present each one for one class period to use in discussing geothermal versus nuclear energy: I suggest five guides to use in discussing the topic micro nuclear plants in detail:

1. Affordable Economics in two parts for construction of the energy source and operating costs together with prevailing costs for alternatives help determine breakeven dates.
2. Technical practicality of the energy source is needed, including economic impact of future energy prices.
3. Efficient use of limited and scarce capital for this energy source compared to others like natural gas fired energy and heat. The role of grants, legal mandates, feed-in tariffs, tax breaks, loans, subsidies should also be mentioned to help explain government's role in fostering sustainable energy development.
4. Long term supply security of the need fuel for energy generation say compared to nuclear energy
5. Environmental effects of the energy source include for example "bird and bat kill" from wind generators.

The role of grants, legal mandates, feed-in tariffs, tax breaks, loans, subsidies should also be mentioned to help explain government's role in fostering sustainable energy development. Get your background research on geothermal going now not at the last day or week. At minimum 6 principles should be covered in both the PPT talk and the WORD paper as compared to a natural gas fired power plant employed as a baseline.

NO CLASS Thur. 12 March before spring break.

Week # 9: SPRING BREAK: 16-22 March

TALK # 2 "ANY topic in energy or transportation the group chooses Tues.14 April- Thur. 23 April Your talk's PPT slides should be crystal clear and the reasoning and conclusions sensible. 40 points total 35 PPT and 5 WORD. **GROUP TALKS/Papers count 60% of the grade so keep that in mind:**

The format is to have a critique PPT talk first, where I point out short comings, and then week later send the final PPT and word to me directly by email attachment. Do not send to CANVAS or to the grader. gcollins@engr.colostate.edu

IF your group chooses connected lighting systems, aLL lighting schemes have three major technical issues: electrical to light conversion efficiency, cost of the luminaire and its operating lifetime, required heat sinking to achieve long life LED and electronics drive operating power factor correction requirements and for dimming light intensity using legacy SCR dimmers. Consider costs divided by the operating lifetime of the two luminaires. Estimate in 1 PPT slide with in your talk the total amount of energy or greenhouse gas pollution saved by either fluorescent or LED lighting versus incandescent lighting. Moreover surprising to some, inefficient energy use is becoming ILLEGAL, such as use of incandescent light bulbs in 2012.See for example www.energy.ca.gov/commision/commissioners/rosenfeld_docs/index.html and www.efficientpowersupplies.org/efficiency_news.asp.

If your group chooses lighting it must cover at minimum the following FOUR areas of light sources themselves that you learned in class: LED sources and their color and intensity spectrum, conversion efficiency compared to fluorescent lights, heat removal in LED light fixtures called luminaire's as this effects operating lifetime and power electronics drives that are separate from the LED or on the same IC chip for LED's as this drives luminaire cost. For lighting systems expand you view to include other lighting means such as sunshine inside the building. Electrochromic windows allow outside light in at varying intensities to augment artificial luminaires intensity. I emphasize: Your talk # 2 must focus on combining SCADA Data (IoT) with command and control software from GE called "Predix". Finally compare and contrast the LED lighting energy saving approaches and speculate on if solar energy is a better investment than LED lighting for achieving the largest amount of "Negawatts". Again, the LED lighting system includes: LED device characteristics include: available and variable color spectrum and intensity, heat sink technology and power electronics drives for both power factor correction of the lighting system and light dimming abilities from legacy dimmers via the power electronic drives. All of the power electronics must fit inside the legacy "Edison Screw". Use Chapters 20-24 of our text, the DOE website (DALI initiative is an example) and LED luminaire manufacturers like Cree, Philips and Sylvania to get specific facts to better fathom "LED Lighting Energy Savings". "Discuss and Justify Your Groups Choice of LED Lighting Pathways toward Energy Conservation / Savings that are Both Practical and Cost Effective".

I l lecture on general lighting DEVICES to set the stage for your group # 2 talks **so you can focus on combining lighting sensor SCADA Data aggregated with command and control GE software "Predix" to optimize the lighting system**.

Look at an image of the earth at night to grasp the lighting energy use http://antwrp.gsfc.nasa.gov/apod/image/0011/earthlights_dmsp_big.jpg to better any given evening. Keep this in mind when you tackle Group Talk # 2 "LED LIGHTING SYSTEMS". Group Talk #2 asks your 465 group to tackle energy savings in the units of "Negawatts" for the specific case of "LED Lighting Systems and Luminaires" as opposed to conventional incandescent lighting. Lighting represents 20% of the use of electricity in the USA. A watt saved is a watt not need to be generated or a "kill-a watt". It is the most economical way to attack the emerging energy crisis and emission of greenhouse gases from power plants.

Note students in 466 and 465 may use very similar talk # 2 in both classes but with slightly different emphasis. One on efficiency one on integrated lot lighting —see both syllabi.

1. ***Extra Credit points UP TO 5% of final grade in two parts*** IGNORE ALL weekly Mention of pop Quiz extra credits. Do not do weekly ex credit. **Rather by Mon 11 may send Ten top takeaways from the 465 course for YOUR GROUP and why they are important to you, Five new topics that your group would like included in 465 and of course the main purpose. Your individual 465 Ex Credit topic of your choice should be discussed ONLY in PPT with no WORD PAPER NEEDED is due 11 MAY**

CSU ACADEMIC INTEGRITY Policy

This course will adhere to Academic Integrity Policy of CSU General Catalog and Student Conduct code. It is expected in this course that all students will not give, receive or use any unauthorized or undocumented assistance in their group efforts as well as individual efforts. All appropriate sources need to be referenced and it's best to do in IEEE format for references/sources. Unauthorized audits violate the Student Conduct code.

Accommodation for Students with disabilities:

I will follow CSU policy given at http:rds.colostate.edu or call CSU telephone extension 6385

Synopsis of Eight Weekly HW Question and Answer (Q/ A) assignments

Five text Chapter Questions your group either creates with answers or just answers if I provide the questions that week. The chapter/appendix key point questions is a pathway to see if the group members have read in depth the TEN chapters and appendices listed below as well as digested the facts and understands the major take away points:
The group either poses or answers text chapter and appendix questions, as detailed in the weekly memo you will receive from me, or just answers the questions I ask. I give lots of illustrative starter questions.

HW # 1 Chapter 1(Motivations) and my web notes
HW # 2 Chapter 2 (Balance Sheet concepts for energy sources and energy uses) and my web notes
HW # 3 Chapter 3 (CARS, buses and trucks for highway transport) and appendix A(cars) and my web notes
HW # 4 Chapter 5(planes) and Appendix C(planes, trains, trucks and buses) and my web notes—note we jump to chapter 5 (PLANES for transport and then return to Ch. 4)
HW # 5 Chapter 4(terrestrial) wind) & 10 (Offshore wind) and appendix B(wind II) and my web notes—back to chapter 4 and ahead to Chapter 10
HW # 6 Chapter 6 (Solar) and Appendix D (Solar II) and my web notes
HW # 7 Chapter 7 Chapter 9Heating cooling and ventilation HVAC) and Appendix E (Heating II) and my web notes
HW # 8 Chapter 8 (Hydroelectricity) and Appendix F (Wave Power) and G (Tide Power) and my web notes

No HW on nuclear energy or was it unclear energy? Again talk # 1 covered that area. The HW philosophy is too increasingly throughout the semester, judge the groups grade partially by the "quality and depth of the questions they both ask and answer" and by the answers to questions I ask for the ten chapters and appendices listed above. Again this is to better fathom what the group considers it learned that week and for me too to fathom your progress level.

OUTLINE of Detailed Weekly Topics

Week # 1: Pop Quiz #1 Energy Jargon and motivations for reducing the POSSIBLE MAN MADE climate change path we are presently on and the economic cost to do so to reduce global warming (chapter 1 of our text). We explore numerical metrics to compare all energy use and generation from transportation and electric generation. Electrical use is further broken down into motor drives, HVAC, lighting etc. The double entry balance sheet is introduced to match energy use and generation (Chapters 1 and 2 of our text must be read)

Week # 2: Pop Quiz # 2 Energy Units and Concept of an Energy Balance Sheet with Quantitative Debits and Credits in units of Joules or Watt-hours (Chapter 3 (cars)of our text and appendix A must be read)

Week # 3: Pop Quiz # 3 Transportation of both people and freight energy costs of cars, trucks trains, ocean ships and planes for both people and freight transportation. (Chapter 5 (planes) of our text and appendix C (planes II) must be read)

Week # 4: Pop Quiz # 4 Wind Energy Promise versus wind energy reality (Chapters 4 (terrestrial wind) and 10 (Offshore wind) as well as Appendix B (Wind II)

I lecture will lecture on an OVERVIEW OF BOTH geothermal electric and thermal generation so your student group can focus on micro nuclear for TALK #1 scheduled for

Weeks 5 and 6: TALK #1 Fixed Topic for ALL groups cover micro Nuclear

TALK #1 Fixed Topic for ALL groups micro Nuclear Energy Energy in detail.

Read the nuclear chapter to get you started talk #1. At minimum 5 principles should be covered in both the PPT talk and the WORD paper as compared to a natural gas fired power plant or transportation system of any type employed as a baseline:

1. Affordability or cost per MW-hr to both build and operate geothermal
2. Technical practicality of a GW level geothermal power plant
3. Long term fuel supply security of geothermal energy
4. Environmental issues that geothermal raises
5. Area required for a GW geothermal plant

Identify the "best of the breed commercial geothermal plant" PPT for each with highlights of capabilities.
1
After group Talk # 1 we return to and continue Collins lectures on the topic of Solar POWER. and after that start the topic of HVAC energy use in buildings.

WEEK # 7 Chapter 6 (Solar) and Appendix D (Solar II) and my web notes. Pop Quiz # 5 and HW #5 assigned. THESE ARE TH LAST POP QUIZZES OF THE SEMESTER. Below I list PQ and HW beyond #5 which are optional on request

Week # 8. ONLY We start the HVAC (heating ventilation and air conditioning) lectures and assign Pop Quiz # 6 and Hw #6

AGAIN NO CLASS THUR 12 March before spring break 16-24 March

Week # 10

We return to Collins lectures and Finish Chapters 7 & 9 Heating cooling and ventilation HVAC) and Appendix E (Heating II) and my web notes. We assign Pop Quiz #7 and HW #7 We start to discuss water power from terrestrial dams as the "best of the breed" renewable energy source available to date at high power, with 24/7/365 reliability and at low cost. Terrestrial hydro also has its unique "pumped water energy storage" capabilities. (Chapter 8: Hydroelectricity). Water Power from tidal barrages and ocean waves is feasible at MW levels as proven in several projects. GW-hr level wave or tidal power presents many intriguing dreams, but little GW-Hr reality has appeared to date. Stay tuned to latest research in class. Appendix F (Wave energy) and G (Tide energy) must be read

Week # 11: Hydrocarbon power plant ISSUES. Week # I give lectures on both coal and natural gas fossil fuel fired power plants pros and cons, Read.Chapter 23 of our text. Beware the trigger warning green energy students.I lecture on general lighting before your groups do so on Energy Saving LED Luminaires.
I cover pollution remediation from hydrocarbon fired power plants (coal, oil and natural gas).I spend special time on the energy game saver for the USA: "abundant and low cost natural gas and liquid hydrocarbons enabled from new "vertical and horizontal well "fracking" technologies developed by the private natural gas sector on private land with minimum government assistance". My web notes and Chapter 23 See Sustainable Fossil Fuels and "fracking" revolution from my class notes

Week #13 and 14 TALK # 2

Tues.14 April- Thur. 23 April., Group Talk # 2 worth 40 points, , is on ANY IN DEPTH TOPIC focused on energy sources or transportation covered to date . The format is to have a critique PPT talk first, where I point out short comings, and then week later send the final PPT and word to me directly by email attachment. Do not send to CANVAS or to the grader.
gcollins@engr.colostate.edu

TALK # 2 is key to the grade so we show details of its grading is repeated here.
Individual Portions of the PPT Presentation for talk # 2 is graded as follows
out of 40 total: 35 PPT and 5 WORD

1. TECHNICAL ACCURACY 20/35
2. PPT Slide ORGANIZATION 7/ 35
3. CLARITY OF MATERIAL-SHORT LIST OF TOPICS IN DEPTH COVERAGE BETTER THAN MANY TOPICS VERY SHALLOW COVERAGE 4/ 35
4. PROPER SPELLING GRAMMAR REFERENCES 2/25
5. FOLLOWING THE MEMOS ON TOPICS TO BE COVERED 2/25

GROUP WORD PAPER FOR Talk # 2 IS GRADED OUT OF 5 AS FOLLOWS:
1. TECHNICAL ACCURACY 2/5
2. PAPER ORGANIZATION 1/5
3. CLARITY OF MATERIAL-SHORT LIST OF TOPICS IN DEPTH COVERAGE BETTER THAN MANY TOPICS VERY SHALLOW DOVERAGE 1/5
4. PROPER SPELLING GRAMMAR REFERENCES .5/5
5. FOLLOWING THE MEMOS ON TOPICS TO BE COVERED 0.5/5

Week #15 and Week #

I cover both fission and fusion "Nuclear" Energy. Note that changing just one letter in nuclear we get, "Unclear" Energy: Long Term Friend or Foe?? Chapter 24 (Nuclear Energy: fission and fusion)) of the text and my web notes must be read. My call as the only long term solution to energy needs, but that might be >100 years from now when natural gas runs out. All of the above topics are addressed in detail in our text. The course text is available free on the web: www.withouthotair.com

CSU CLASSES WILL END 8 MAY

A tentative summary of all due dates for chapter HW assignments and Pop Quizzes for each week of the semester is given below. Remember the HW and Pop Quiz is due the week after we cover the topic in class. The team's tasks also include weekly Pop Quiz assignments. All of these assignments are done as a team. You will get a team grade for all of the above. **Still each student will have their portion highlighted as theirs, as for example when giving class talks EACH member will talk** and in papers, if properly documented, who did what. Individual efforts will also be in POP quizzes and extra credit assignments. In summary, group efforts are encouraged as well as individual efforts. PLEASE FORM a GROUP ASAP in the first week of the semester. In an interdisciplinary class such as this one, students need to form diverse groups.

TENTATIVE DUE DATES as grader will fine tune these dates on CANVAS

Assignments	CANVAS Publish	Due date
HW1	Tues. 21 Jan	Thur. 30 Jan
Pop quiz 1	Tues. 21 Jan	Tues. 28 Jan
HW2	Tues. 28 Jan	Thur. 6 Feb

Pop quiz 2	Tues. 28 Jan	Tues. 4 Feb
HW3	Tues. 4 Feb	Thur. 13 Feb
Pop quiz 3	Tues. 4 Feb	Tues. 11 Feb
HW4	Tues. 11 Feb	Thur. 20 Feb
Pop quiz 4	Tues. 11 Feb	Tues. 18 Feb
HW5	Tues3 March	Tues. 12 March No class but HW due by midnight
Pop quiz 5	Tues. 3 March	Thur. 10 March