- Alex Jones (CNS)

02:22Okay i'd like to good afternoon i'd like to welcome everyone to this webinar discussing the recently released dear colleague letter nsf to to dash 060 designed for sustainability and computing.

- 02:36My name is Alex Jones and i'm pleased to be with you to discuss the CCL but before we get started i'd like to introduce nsf assistant director and director of the science director Margaret martino's he just say a few words.
- 

Margaret Martonosi

02:51Thanks Alex Hello everyone and welcome my name is Margaret Martin oC and I leave the computer and information science and engineering or science director here at nsf.

- 03:00on behalf of all of sighs I wanted to welcome you here, and I really want to thank you for your interest in this webinar and in this incredibly important topic.
- 03:09As you know, because you tuned in for this webinar computing plays an important and unique role.
- 03:16In the world's climate and sustainability future overall so on one hand, computer systems and techniques can help us model future climate change.
- 03:25can help us plan future energy efficient logistics can help us save foot carbon footprint by communicating virtually instead of via carbon intensive travel to face to face meetings.
- 03:36On the other hand, computing itself contributes to the world's carbon footprint and the world sustainability impacts, so the best opportunities.
- 03:45For us rest on improving the sustainability of computing itself in parallel with using computing on the broader climate issues.
- 03:54So, sustainability and computer design is not just energy efficient computing if you know me, you know I love to think about energy efficient competing.
- 04:02That many folks that you can see in the zoom have persuaded me and many folks in the Community have persuaded me to think much more broadly.
- 04:10It pertains to the much bigger set of issues around the materials and the resources required in the full lifecycle of computing equipment.
- 04:19And so, this CCL is about inviting your attention on that broadest set of issues, so the main thing I want to do.
- 04:27In my time during the seminar is to say some Thank you so I want to thank the nsf verse you've contributed to the CCL into the webinar about it.
- 04:36That includes Nina on law and India banerji or brown band Linda bushnell on the Dana just COPA.
- 04:45Dan costly Alex Jones generally Sylvia spangler and goalie on many, many of those folks are here in the zoom ready to answer your questions and so with that i'm going to stop now and turn the meeting back over to Alex thanks very much.
- 

Alex Jones (CNS)

05:02Thank you, Margaret and i'd like to encourage everyone as questions arise as we go through these slides to please feel free to type your questions into the question and answer.

- 05:13portion of zoom as we'll be able to respond to some of these in real time and then we'll answer some of them at the conclusion of the formal part of the presentation.
- 05:27So as Margaret.
- 05:30explained energy efficiency has long been a topic of interest in modern computing.
- 05:36and energy efficiently efficiency has had significant impact on the development of computing so, for example, it's arguable that energy became our first order metric when the power thermal barrier became.
- 05:48An important concern to continue scaling to new silicon seema semiconductor technology nodes.
- 05:54Additionally, energy as a first order concern of mobile computing starting with laptops but also expanding to smartphones and including iot and cyber physical systems, among the many types of mobile computers.
- 06:07Naturally, energy consumption of information and communications technology, in particular from electrical generation using fossil fuels, like whole natural gas that generate a significant amount of carbon dioxide.
- 06:21became recognized as a significant forced order sustainability concern does this what we call operational energy consumption.
- 06:29formed a form of energy efficiency allowed a somewhat narrow definition of sustainability, to become generally adopted do two and part it's alignment.
- 06:38With these other desirable factors of reduce thermal concerns and battery longevity of computing However, the environmental impacts from computing far exceed this narrow definition, for example.
- 06:50Recent life cycle assessment or an assessment of the carbon emissions of a product, through its lifetime.
- 06:56Of a Dell server classes and concluded that carbon emissions from manufacturing the system, also known as embodied carbon.
- 07:03were nearly equal to the carbon emissions from operating the system for for your lifetime, that the typical deployment lifetime in a data Center.
- 07:12This even split may be due to the relatively high utilization factor of a cloud server and in reports from apple computer tablets and mobile phones can have more than 80%.
- 07:24of their lifetime carbon footprint footprint from embodied carbon making embodied carbon more than four times higher than operational carbon emissions.
- 07:32And for some highly energy optimized compact computing systems and body carbon can exceed 90% of that systems carbon footprint.
- 07:40The conclusion is that a more complete definition of sustainability in terms of environmental impacts is really necessary to truly advanced the field of sustainable computing.
- 07:52As we discussed in that previous example and likely in part due to the tremendous advances of energy efficient computing we're calling things like on dells law of improving.
- 08:01The highest contributor of system level carbon improving and body carbon impacts may be, as are more important than operational energy efficiency, or at least until they come back into balance.
- 08:15But this is just one example, many other factors remain of important, including the limited resource of rare earth elements used in computing and particularly in mobile devices.
- 08:24Additionally, planned obsolescence of computing systems could also be considered a corollary to dennard scaling and moore's law, which has led to considerable amounts of E waste.

- 08:34Further, furthermore, as applications expand their computational requirements enabled by computational advances compute and storage intensive applications, whose non exhaustive list traverses blockchain and crypto fun.
- 08:48and artificial intelligence machine learning also contribute to sustainability challenges in computing.
- 08:56The purpose of this CCL is to encourage the submission of novel and high impact proposals to provide substantive.
- 09:03and potentially disruptive research in the design for sustainability in computing to address these understudied challenges in sustainability of information and communications technologies.
- 09:15These proposals should focus broadly on sustainability, including mitigating carbon and other greenhouse gas emissions harmful emissions from volatile organic compounds, also known as vcs.
- 09:28And carcinogens wastewater generation eutrophication, such as algae blooms and the many other potential impacts, the CCL encourages sustainability across the full computing spectrum and across the full computing life lifecycle.
- 09:45Hopefully attending this webinar today will help solidify the intent behind the DC well.
- 09:50As with all of our solicitations and dear colleague letters we encourage you to read the written information closely.
- 09:57As many questions may be answered by detailed scrutiny of those materials our We certainly realized that there may be many questions not directly addressed, and we encourage you to write.
- 10:06Those questions in the Q amp a box, as I mentioned earlier, and we will attempt to answer these questions during the Q amp a part of the webinar.
- 10:14If we are unable to get to your question, or you have questions after the conclusion of the webinar you may send email to.
- 10:20dsc hyphen D cl@nsf.gov or dsc stands for design for sustainability.
- 10:27It is important to note that this detail is not a new program but rather encourages submissions on the topic of design for sustainability, to the sys ccf see CNS and is core programs.
- 10:40Currently, the ccf CNS and is small program has no deadline so you may submit a response to this DC our in a way.
- 10:49It is also allowed to submit it a medium project in response to the CCL However, you must comply with medium deadlines specified in the core programs call nsf two one dash 616.
- 11:02Moreover, responses to the CCL must also follow all the rules specified for the size core programs in 21 6164 interested in P eyes, you may wish to reach out to one of the program officers, that is part of this program.
- 11:20that's also a panelist on this call, or the program officer that you must currently work with with a one page summary of your proposal idea to get feedback on whether their proposal would be responsive.
- 11:33To both core programs into this detail and the next few slides will provide certainly a non existent list of topics that are generally of interest to this D Co.
- 11:45Given that sustainable computing has been narrowed recent relatively narrowly defined.
- 11:50As similar to energy efficient computing to better address a larger perspective on sustainability may require new models and metrics that better capture holistic sustainability.

- 12:02And the broad field of computing these models and metrics may be necessary to evaluate trade offs among sustainability performance reliability security cost, among many other relevant concerns.
- 12:16Like the size core programs that seek to advanced computing communication algorithms networking intelligent systems.
- 12:24etc broadly this CCL envisions that sustainability and computing requires advances similarly broadly throughout the computing research areas.
- 12:34Last data movement storage operating precision are potentially important considerations judicious use of computing from lightweight to resource intensive techniques.
- 12:45may be relevant to state and sustainability goals, however, the research should state the goals which quantifiable sustainability metrics are used, while seeking to advance compute capabilities.
- 13:00designed for sustainability is meant to be not just a name but also meaningful thrust advances that consider re usability principles throughout the computing stack.
- 13:10techniques that avoid obsolescence and enabled device longevity such as graceful degradation, particularly for sectors, with particularly fast turnover like smartphones are encouraged.
- 13:22Some techniques that have been effective in other areas that could apply to competing are modular design common products parts and standards retrofitting obsolete devices for other important PR purposes and effective means of recycling.
- 13:40While the earlier example focused on a hardware example of embodying carbon we envisioned sustainability aspects throughout the stack starting with software systems.
- 13:50that's new software system abstractions design methodologies programming languages middleware compilers and software hardware co design techniques that target sustainability metrics while consider considering other first order metrics of computing are encouraged.
- 14:07New and novel computing architectures from traditional approaches such as systems on a chip, including processors with accelerators.
- 14:16To non traditional non violent women approximate computing and other approaches are of interest appropriate advances in memory storage fault tolerance that addressed holistic sustainability are also in scope.
- 14:33Like in the traditional energy efficient data Center scope this DCS also encourages novel cloud technologies that advanced sustainability and metrics from SL a's to desegregated computing techniques.
- 14:47integration of renewable energy sources novel cooling etc are still in scope, but techniques to advance operational energy efficient alone are generally not in scope for this D Co.
- 15:00novel sustainable computing hardware, such as improvements and CAD to achieve similar performance and operational energy from legacy technology node compared to today's deep scaling our interest.
- 15:13more sustainable CMOs or CMOs hybrid or replacement technologies, including things like CMOs plus x sustainable hardware intellectual property are all potentially of interest.
- 15:29The previous examples are far from exhaustive, as I mentioned before, the goal is to make disruptive improvements to this more broad holistic view of sustainability for computing.
- 15:40techniques are soft that improve or reduce the environmental impacts of computing technologies beyond traditional operating energy efficiency.

- 15:49Low power computing operational energy efficiency alone, while a lot of polls and still within the scope of the core programs are not directly responsive to this DCM.
- 16:00Additionally, new advances in information and communications technology designed to advance the sustainability and other domains.
- 16:08While again laudable and potentially of interest to size core programs and other programs in science and an nsf wide are not directly in scope of this D Co.
- 16:18Also, again, please note that submissions to the CCL must comply with other aspects of the sys ccf CNS and I asked core programs, including their particular their particular requirements that might differ between the three areas.
- 16:34For small projects these may be submitted at any time and media projects must adhere to the deadline stated in nsf to two dash 616 or its successor.
- 16:46Well, oh, I see a while I always see is represented in this working group group currently OTC small projects are not solicited as part of this detail.
- 16:58At this point we will move to the question and answer portion of the webinar.