Sustainability and energy demand project topics
Designing Solar-powered Websites

• **Supervisor:** This project would be supervised by Mike Hazas, or another member of the "Solar Internet" project (funded by Energimyndigheten). If Mike is not the supervisor, then he will be directly involved as the subject reviewer.

• **Background:** The vast majority of websites and services are designed for always-on and high bandwidth connectivity. As a result, they use a lot of data, which in turn can use a lot of energy, which is in turn bad for the environment. At the same time high data demand can lead to bloated and slow user experiences. This project will build on examples of the solar internet, to prototype and test interaction techniques and design for the constraints of using solar-powered webservers, such as https://solar.lawtechmagazine.com/. The research will develop alongside the Solar Internet research project, funded by the Swedish Energy Agency to ask: How do we communicate the constraints of solar powered internet while maintaining or even extending the user experience?

• **Project/Task:** The project will involve the prototyping of interactions for websites and testing those with a small user group. The prototyping will require some preliminary research, brainstorming design, use of either low- or high fidelity prototyping tools, and design of user tests. User testing will be necessary to ensure successful design strategies are deployed.

• **Research Method:** The project will follow a research-through-design process, where the design of web interactions generates knowledge on constraints-based computing for sustainability. The method can follow standard design processes, likely with an emphasis on showcases multiple interactions, rather than one finished product. User testing should follow procedures for usability testing and could make use of the department’s usability lab.
Visualising Solar Power

• **Supervisor:** This project would be supervised by Mike Hazas, or another member of the "Solar Internet" project (funded by Energimyndigheten). If Mike is not the supervisor, then he will be directly involved as the subject reviewer.

• **Background:** Solar power is a key renewable energy source for supporting environmental sustainability. This project will explore means to visualize solar power within the Swedish energy context – for instance, considering how much sunshine falls on each day, how much space is needed for solar cells, the cost in hours of sunshine of an activity like watching a TV show, and so on. For instance, the KiloWhat?? Website (http://kilowh.at/) demonstrate the equivalence of various energy practices and sources, where 1 square meter of solar paneling produces enough energy over a year to charge 26055 mobile phones.

• **Project/Task:** The project will involve the prototyping of visualisations for the web or other technologies (e.g. physical computing). The prototyping will require some preliminary research on solar energy production, visualization techniques and cognitive and information science, brainstorming design, use of either low- or high-fidelity prototyping tools, and final design of a visualization tool.

• **Method:** This would follow a standard design process, with critical reflection, and should include some user testing, as for example the following:

Energy and environmental impact of games in Sweden

• **Supervisor:** Mike Hazas

• **Background:** In Sweden, gaming currently accounts for perhaps 0.3% of electricity demand; and a conservative estimate is that this will rise to about 1.2% by 2030. Or, 2.5% if 4K-capable cloud gaming services take off. As gaming continues to grow, we must shape this growth in sustainable ways.

• This is a broad and challenging topic, involving a variety of participants, stakeholders, and data. As such, a project could take any number of approaches, for example:
  • interviewing people that play games about what, when, and how they play;
  • talking to games companies and developers to understand how energy, resources and sustainability fit in (or not) to their system designs;
  • analysis of existing media or datasets to find out more about gaming’s impacts (e.g. game-related content livestreamed or posted on YouTube and Twitch);
  • performing network and power measurements of games devices to better understand their potential impacts.

• There is a small amount of work on this topic (and one master’s thesis ongoing), so any further project would need to be carefully scoped to have a non-overlapping contribution.

• **Diversity and inclusion:** Gaming has a broad following. And yet parts of the games industry, and online discourse about games, have gained a poor reputation for diversity and inclusion, particularly in their treatment of women and those identifying as LGBTQ. The master's thesis would need to specifically situate itself with respect to this problem, and if appropriate account for it through the empirical work (e.g. participants recruited, interview design, qualitative/quantitative analysis)
Building the Internet Microscope

- **Supervisor:** Mike Hazas

- **Background:** How can we better investigate home Internet service demand, and how that ties with everyday practices? One way is to look at what Internet services are being relied upon in the home, and at the same time, how people report spending their time. This would require a network monitoring device installed in the home, and something akin to a time-use diary.

- **Project:** Design, evaluate with participants in homes, and redesign a time-use diary app that could be deployed at scale (potentially thousands of homes). There are established methods for studies of time-use, and a recent study of domestic electricity in the UK (link below) may provide a starting point for your app.

- **References:**
  The METER Study (University of Oxford): https://www.energy-use.org/data/
Thermal comfort at home

- **Supervisor:** Miriam Börjesson Rivera
- **Subject reviewer:** Mike Hazas

**Background:** Indoor heating (and cooling) of housing constitutes a fairly large part of the energy consumption of households. The smart grid is seen as an integral part of the energy transition in Sweden, together with the electrification of e.g. the transport system. The smart grid will facilitate for prosumers and a larger part of renewable, intermittent energy sources such as wind, solar, and hydro power. However, there is fear that there will be a capacity deficiency when society is electrified. One proposed way to balance this deficiency is to be able to shift electricity consumption from peak hours. Here, the heating of homes comes in as an interesting source for flexibility in the smart grid. The norms for what an acceptable indoor temperature has changed over time, co-evolving with the technological development of heating systems. Challenging the norms and ways of keeping warm indoors could also be part of how this project is framed.

- **Project/Task:** The project will involve the prototyping of interactions for thermostat interfaces testing those with a small user group. The prototyping will require some preliminary research, brainstorming design, use of either low- or high fidelity prototyping tools, and design of user tests. User testing will be necessary to ensure successful design strategies are deployed.

- **Research Method:** The project will follow a research-through-design process, where the design of thermostat interfaces generates knowledge on constraints-based computing for sustainability. The method can follow standard design processes, likely with an emphasis on showcases multiple interactions, rather than one finished product. User testing should follow procedures for usability testing and could make use of the department’s usability lab.
Rural broadband in Sweden

Supervisor:  Miriam Börjesson Rivera
Subject reviewer:  Mike Hazas

70 % of Swedish households have fibre to the premises (gigabit capable). But there is still a fairly large amount of households that still has no possibility to have broadband in their homes. This project would look into this topic and focus specifically on the possible implications for sustainability and social justice. This project could either have a desk-based research approach, looking into the government vision and analysing the the policies. It could also have a more ‘empirical’ approach including interviewing and (qual or quant) observation in rural households that have no access to broadband in their homes.