

SRC – the societal and economic impacts of the consortium project

THE THIRD OBJECTIVE

The name and abbreviation of the project: Cloud computing as an enabler of large scale variable distributed energy solutions: Bright Clouds – Dark Clouds (BCDC)

The consortium leader: Rauli Svento

1. The impact objective

PROMOTING FLEXIBILITY AND COMMUNALITY IN CHANGING ELECTRICITY MARKETS

(consortium level objective)

The traditional electricity market is not two-sided. Users and buyers of electricity are only out takers from the grid. However, technological development is changing this picture as the network is turning from dumb grids to smart grids. This development, already well under way, enables the change of electricity markets to two-sided markets. The big turn is that the smart grids allow each participant to be simultaneously a consumer and producer, that is a prosumer. The objectives (O) for interaction related to this development as outlined in our Interaction plan are as follows: Establishing a BC-DC Community (O1), and Engaging citizens as active partners in the activities of the BC-DC Community (O2).

2. What program questions (A, B, C, or D) does this objective address?

B: In order to make the best possible use of a particular disruptive technology, what changes are required in human activity, institutions and operational methods?

Flexible and changing roles of existing market participants are necessitated. Consumers become active players in the two-sided energy market. New market participants enter and the roles of these and incumbents mix. The traditional energy institutions need to change their roles into flexible and adaptive market participants. A necessary condition is to create a sense of community in order to involve users into the new market contexts. Consumption patterns need to change so that the new market based equilibriums can be reached. The third objective relates to the markets at the level of community including the perspective of prosumers, that is, consumers as users and producers of energy.

3. Means

Aligned with our Interaction plan is that through enhanced communication and interaction, we aim to form the BCDC Energy Community with well-grounded, shared practices among its members and beyond.. To increase transparency of research including knowledge creating processes we have established a publishing schedule for participation in Twitter and experts' blogs supported by Kaskas Media's training. This practice secures multidisciplinary science communication as the WPs follow monthly and weekly 'Blog&Tweet -turns'. Empowering of researchers to public communication includes ongoing training as editorial help, checking and discussing informally, which help gaining a new researcher's role and responsibility with the Community. (see http://www.tietojohtaminen.com/sites/default/files/tietoasiantuntija_05_2017_low.pdf (s. 22-23)). The perceptions of the researchers and communication professionals on science communication are being investigated in a doctoral thesis of BCDC's Communication specialist Kaisu Innanen, who presented her preliminary findings in an international science communication conference in New Zealand in 2018. Her research supports planning BCDC's communication activities (<http://www.bcdcenergia.fi/blogi-ja-uutiset-science-communication-just-do-it/>).

BCDC Newsletter was launched as a response to the AB members' request. For mapping our knowledge-base to enhance interdisciplinary new conceptions, a Clean Energy Research (CER) terminology has been compiled in the Bank of Finnish Terminology in Arts and Sciences (http://tieteentermipankki.fi/wiki/Clean_Energy_Research) and negotiations are underway for including it in the national ontology FINTO of the National Library.

Our Interaction plan states that, the external communication is implemented in collaboration with the communications' units of the home organizations, the strategic partners and partly of the AB firms. We have succeeded with utilizing these resources of our multi-organizational structure. With the communication specialists of the disciplines involved a stronger competence is in the BCDC Community's reach. Our communication network, initiated by face-to-face meetings with Director and/or Communication managers/specialists from the Finnish Clean Energy Association, CNMF, VATT, FMI

and the Univ. of Helsinki, Dept. of Computer Science with participation from Kaskas Media agency, also functions as a meeting point for highly esteemed professionals and colleagues. At this point, these relations are well-established and embedded into the tasks of Planning officer. In 2016 BCDC started collaboration with the staff that takes part in communications (managing web sites and social media streams), connecting the Faculty of Humanities, of Information Technology and Electrical Engineering, and Oulu Business School with the University of Oulu's Communications. This active collaboration has secured BCDC with professional support on media monitoring of our website (WebnewsMonitor/M-Brain) and publishing on the University's main website. In a joint meeting the staff of these faculties shared knowledge and best practices together at the University of Oulu for the first time in 2016. A follow-up from these discussions is the Oulu University Profile four suggestion GenZ which was highly ranked by the Finnish Academy (3/13).

The communication network allows sharing BCDC research press releases through the highly esteemed organizations' media connections along with their strong insight (see [http://www.syke.fi/fi-FI/Tutkimus_kehittaminen/Ilmastomuutoksen_hillinta_ja_muutoksiin_sopeutuminen/Kotitaloudet_pitav_at_tarkeana_sahkonkulu\(41887\)](http://www.syke.fi/fi-FI/Tutkimus_kehittaminen/Ilmastomuutoksen_hillinta_ja_muutoksiin_sopeutuminen/Kotitaloudet_pitav_at_tarkeana_sahkonkulu(41887))). It ensures continuous visibility for BCDC related news and blogs online at the University of Oulu, FMI, the Finnish Clean Energy Association, and e.g. Fingrid Magazine (online) and their related social media streams

As flexibility is essential to enable change towards two-sided electricity markets, it should be the objective at all levels, including the demand response from small-scale consumers and producers. To achieve this, a nation-wide population-based survey on residential homeowner attitudes regarding innovative hybrid home heating systems (HHHS) was conducted to gain information about the attitudes of the public and their readiness to adopt new, adaptive electricity consumption methods. The invitations to take part in the survey were popularized together with the researchers and circulated through our partners' channels. The results will be used to develop mechanisms that offer right kind of incentives for consumers and producers of electricity. Most importantly, the survey allows gaining flexibility information. Another broad survey related to flexibility, new types of contracts and home automation has been conducted and the preliminary results are very interesting and promising. These results shall be presented in several highly esteemed conferences during the summer 2018 (IAEE, Ulvön, WCERE). Energy information literacy (EIL) has become a new theme in the project. Doctoral student Teija Keränen conducted a survey on EIL among university students and presented the results in the European Conference on Information Literacy, ECIL, in France, in 2017 (see section 6). The survey is among the first to investigate people's energy information literacy. An EIL survey to households will be conducted in collaboration with the project 'Iisisti Energinen Ii' funded by The Finnish Innovation Fund Sitra, Ii municipality, Micropolis, and Iin Energia. Research collaboration has been initiated with energy literacy research group at the University of Vaasa in workshops in 2017 and 2018 (see <http://www.bcdcenergia.fi/blogi-ja-uutiset-demand-flexibility-so-what/>).

4. Observations on concrete effects

"BCDC Coffee" meetings have taken place since March 2016, including Skype-coffees with our WPs in Helsinki. The BCDC research community posts around 200 messages per week on average on Slack, and hundreds of files/messages are shared in Basecamp. By May 2018 altogether 102 blog-posts or news have been written and published by the BCDC researchers on the BCDC website. The BCDC PI has published 11 Story-posts and BCDC has tweeted/shared 1 021 tweets and re-tweets. BCDC has 340 followers. The new hashtags of #energiasää and #energiasääennuste are established. Finnish and English are publicly equally used. The BCDC Energy sites have been viewed 58 183 times, and time spent on site is 2 min 40 sec in average. Energiasää has been viewed 14 051 times. On BCDC YouTube channel there are altogether 12 videos (incl. Keep On Talking podcasts). These BCDC videos are seen 1 009 times (18.6.2018). The consortium's communication network has published several posts that have been produced and shared with BCDC. Of these for example our BCDC related 12 blogs on Finnish Clean Energy Association site BCDC gathered 909 viewers. We also have published our partners's blogs; by Finnish Clean Energy Association, Fortum Ltd., Finnet and VaGe Project. The communication collaboration has led to strong mutual trust: BCDC has been granted direct access on the University of Oulu home page on the basis of our own self-assessment of the content to be shared.

We have published 32 times on Univ. of Oulu's BCDC Energiablogi site. BCDC Newsletter is published in every two/three months.

In T&T magazine BCDC-articles have been read over 5 000 times by May 2018.

As a result of communications collaboration BCDC has reached impressive numbers in mediamonitoring. The top news from our research group was the launching of Energy weather forecast on June 13th 2016, which was widely published in June and again in October in Finnish media.

Altogether 120 news about Energy weather or BCDC were published in 2016 media, online or print and other news-sites and television (see <http://areena.yle.fi/1-3512978>). In FMI's mediamonitoring report from June 2016, Energy weather was highlighted as one of the most significant news stories.

One particular effect was The Institute for the Languages of Finland picked Energiasääennuste as a new word in their Finnish words database (see

[https://www.kotus.fi/sanakirjat/kielitoimiston_sanakirja/uudet_sanat/vuoden_sanapoinnint_oja_2016](https://www.kotus.fi/sanakirjat/kielitoimiston_sanakirja/uudet_sanat/vuoden_sanapoinnot/sanapoinnint_oja_2016)). Moreover, the news release (see [http://www.syke.fi/fi-FI/Ajankohtaista/Tiedotteet/Kotitaloudet_pitavat_tarkeana_sahkonkulu\(41887\)](http://www.syke.fi/fi-FI/Ajankohtaista/Tiedotteet/Kotitaloudet_pitavat_tarkeana_sahkonkulu(41887))) led to requests to

present the research at the Energy Authority in Finland and to place BCDC on the

Energiatohokkuudesta kilpailukykyä maaseudulla -service (see

<http://energiatohokkaasti.fi/content/hankkeet-ja-kehittajat>).

The PI Svento has been profiled and interviewed of BCDC related topics in publications like Ekonomi

(<http://www.ekonomilehti.fi/taloustiede-raivaa-tieta-uusiutuvalle-energialle/>) and Kauppa-lehti (2017). In

the Bank of Finnish Terminology in Arts and Sciences 202 pages of Clean Energy Research lexicon are compiled and a blog, published on request from the Bank of Finnish Terminology in Arts and Sciences

(<http://blogs.helsinki.fi/tieteentermipankki/>), appeared also on BCDC's and Finnish Clean Energy

Association's web-sites.

The courses Smart Grids 1, 2 and 3 including learning materials by WP1 and WP2 at the University of

Oulu, Centre of Wireless Communications (see <http://www oulu.fi/energy/node/41323>) have been taught

with good success.

5. Intentional impacts

The interaction objective related to this Impact Narrative 2 is 'Establishing a BCDC Community' (O1). We have created the consortium without earlier connections between the participants. In the beginning the importance of formal and informal face-to-face interaction was and still is evident for sharing ideas; discussing for defining the joint goals; learning to know and each other and motivation for collaboration.

We continue organising workshops, weekly coffee meetings, and the WPs meet in smaller groups. We continue engaging with our partners by co-creating and interacting with them, thus far we've organized 12 workshops. Implementing our Interaction plan has supported building our Community. We started

public blogging soon after the first Kick-offs, and in the process of creating the representation of the BCDC, the researchers have agreed on the joint goals and one's role for gaining them. The participatory

and engaging model of science communication has motivated, supported and increased the capability of the researchers with excellent outcomes. With embedded routines the researchers' participation in

science communication is established and ongoing. Before joining the BCDC Community, many of the researchers had never written an expert blog or tweeted. The monthly blogging led to joint appearance

in 2017 on respected science communication site (see <http://www.skolar.fi/>). Researchers' have started participating in authoring interdisciplinary popularized expert texts (see

https://ilmansuojeluyhdistys.files.wordpress.com/2017/01/is_4_web.pdf, p. 11 – 16) and some have advanced in debating in Twitter. There clearly is a BCDC communication model evolving that has

reformed the science communication culture in the shape of a project, and may be adapted elsewhere. The PI's BCDC Story updates, acknowledged by SRC, resulted in demanding a public research

narrative from all the SRC consortia according to the SRC's feedback email in 2017. The competencies in science communication also have the goal of preparing the researchers to support an even more

widespread sense of community, as the other objective related to this Impact Narrative 2 is 'Engaging citizens as active partners in the activities of the BCDC Community' (O2). Towards this, we strive also by

building the networked impact professionally with the network of the communications' units. This enables us to communicate, reach and interact with the energy interested publics: citizens and consumers, civic

organizations, firms and municipalities. The communication network in itself is a novel alliance: instead of competition, the idea is based on sharing the content as well as the credits and impact indicators. We are not aware of other research projects creating an alliance like BCDC. This was expressed in the meeting with three faculties' and the University of Oulu's Communications unit's Communication specialists in 2016. The Interaction teams (WP5) work was appreciated further when the persons responsible for SRC's interaction had a meeting in which BCDC's Communication specialist was invited to present the BCDC communication model to other SRC consortia in 2016.

Creating the impact on political decision making is supported by the communication network. Many of communication units are well experienced in creating policy impact as e.g. policy briefs, and therefore BCDC has strong experience available in our own community – when the research has reached the state when policy implications are evident. BCDC agreed with the Hinku-municipalities in 2016 to jointly communicate and organize events with the municipal stakeholders and decision makers about future virtual utility and energy technology disruption timed with the progress of research and testing of VU.

The indicators in Section 3 indicate that by the means represented in Section 2 BCDC has reached a reasonable public. The fact that The Institute for the Languages of Finland picked Energiasääennuste as a new word in their Finnish words database, indicates that launching of Energiasää was a significant occurrence and a new concept in Finland in 2016 related to the disruption of the energy markets. We have recognized that many people are aware of Energiasää. This is one step in engaging citizens in the activities in BCDC community (O2). The phenomena is evident also online as Energiasää keeps spreading - without any effort from WP5 - to a variety of sites (see

<http://www.finsolar.net/aurinkoenergia/aurinkoatlas/>

<https://www.sahkonkilpailutus.fi/blogi/katso-taalta-paikkakuntakohtainen-energiasaaennuste/>

http://www.lounaistieto.fi/ymparistonyt/ymparisto_ohjelma/resurssiviisaus/energian-tuotanto/

<http://www.energiatalous.fi/?p=1076>)

6. Nonintentional impacts

One unexpected result stem from early experience within BCDC that shaped our Interaction plan. The multidisciplinary and multi-organizational challenges that emerged are related to regular updating the social media and blogs. As a lesson learned, we know now that communication efforts of a multidisciplinary research project cannot be implemented by outsourcing the task for an independent work package of the project as was outlined in our Interaction plan. What was done instead was that the Interaction team (WP5) and its Communication specialist enhanced active collaboration with every WP's researchers. This is a precondition for successful interaction, and has resulted in the profound process of empowering researchers with communication means. Consequently, the researchers have learnt to communicate about their studies by blogging on the BCDC Energy web-site, and tweeting, both are done regularly in turns, with increasing success. An open minded approach, clear organization of tasks, shared workload and easily approachable support provided first by Communication specialist's and then Planning officers close work with the researchers have been a prerequisite for effective and fruitful science communication.

The quality of collaboration of the consortium's communications was put on a test by a sudden media situation in 2016. BCDC Energy was involved in Sitra's Ratkaisu 100 –vote. Sitra recognized an increase in voting rates (see <http://www.bcdcenergia.fi/energia-haaste-ratkaisu-100-haastekilpailun-karkikaksikossa/>).

7. Background research

The research results of the a nation-wide population-based survey on residential homeowner attitudes regarding innovative hybrid home heating systems (HHHS) conducted, reveal that ground heating and district heating are favored over other studied main heating alternatives. District heating is a common source of space heating for detached houses in Finland. However, the most popular heating technology is the ground heat pump. Also other heat pump technologies (e.g. exhaust air heat pumps) have gained a stable status in residential heating market. There are several possible reasons explaining the popularity of the district heat and heat pump technologies. Our results indicate that both comfort of use

and environmental friendliness are perceived as important factors when choosing these systems. However, the results show that district heat is relatively sensitive for increases in its operating costs whereas ground heat is relatively sensitive for increases in its investment costs. Additionally, the perceived reliability of these technologies has probably been enhanced due to learning effects among households. Overall, the surveys conducted give a signal that there is not enough valid information available about the HHSs and the energy market disruption related topics. This quest for information dissemination opens a big challenge for BCDC Energy project second term.

A number of policy implications can be derived from the conducted research. It would be beneficial for the policy makers to subsidize especially solar based heating because it is perceived as the most favored supplementary heating alternative. The overall taxation and subsidy planning should take into consideration the finding that the investigated heating alternatives are very different what comes to direct and cross marginal effects with respect to investment and operating costs. It seems that policies targeting the operating costs might be more effective as households are more sensitive for changes in operating costs than for changes in investment costs. However, as subsidizing investment cost is probably easier than subsidizing or taxing operating costs, our findings suggest that subsidizing the investment cost of heat pump technologies and district heat is probably effective.

Taking into account the environmental aspects of the heating systems should be one of the main focus areas in the policy planning, and furthermore used as an argument when implementing these policies and marketing the heating systems. Our empirical analyses demonstrate the importance of careful policy targeting, because socio-demographic characteristics have clear impact on households' heating system decisions.

Lastly, the results indicate that there is positive perceptions toward HHSs among households as the respondents prefer having supplementary heating alternatives alongside the main heating system. From a policy perspective this means that the potential of the innovative HHSs has to be taken carefully into account because higher utilization of the HHSs will increase the overall energy efficiency of the residential heating sector and make households more self-sufficient heating-wise. An important factor in realizing this potential is to provide information of HHSs. Technology awareness has a significant effect on the adoption probability of the innovative technologies indicating the need of effective information sharing and education.

The system model presented in Impact Narrative 1 will allow us understand the dynamics that are created in the interaction of price sensitive consumers, the spot market and the balancing market. Which in turn allows to design a virtual utility concept that makes optimal use of the flexibility of consumers and distributed consumption inside the given market environment. For example, if consumers see high prices on the spot market they might change their consumption pattern to consume less during the high price period. However, these changes will mean less consumption as anticipated from the market, resulting in higher balancing costs. The job of the virtual utility is then to make sure the savings due to avoiding the high prices are not eaten up by the higher balancing costs.

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