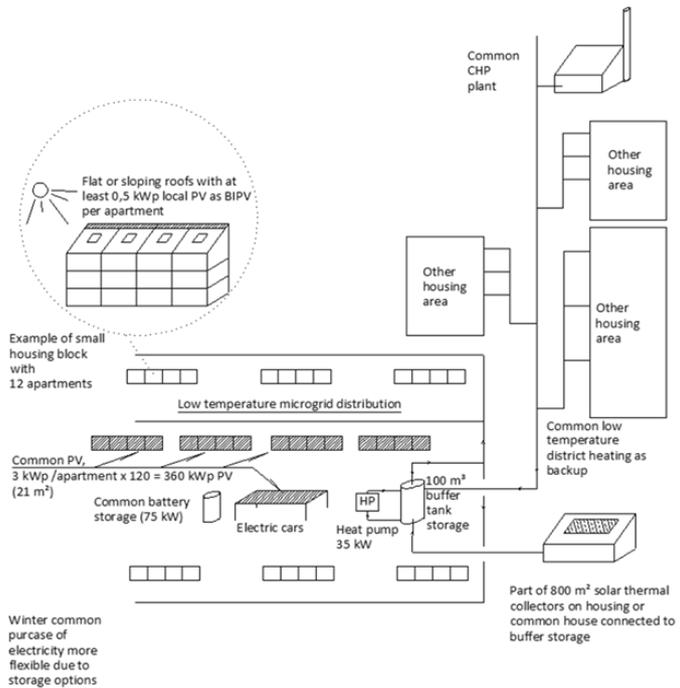
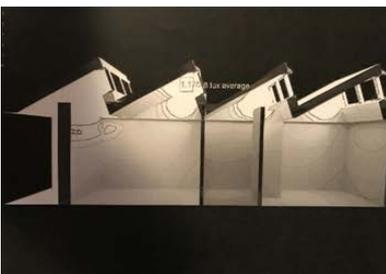


Bilag

BIPV and the development of Smart Energy CO₂ neutral Active House city areas.



Winter common purchase of electricity more flexible due to storage options



The Valby PV plan was launched in year 2000 inspired from recent PV implementation in the Netherlands, Switzerland and also Germany, where a 1.000 roofs programme had been finalised and a new feed in tariff system was recently launched. The aim of the initiative was to work with the idea of planning PV electricity in a whole city area with important input from architects and city planners. With the launching of the Solar City Copenhagen organisation in 2004, a good support for the development of PV in cities had been created, and together with that, a co-operation, which has lasted all the way to 2017. During this period, many initiatives to introduce PV in cities have taken place, also with a view to good design.

Many qualified actors including local PV producers like Racell, Gaia Solar, SolarLab, Phønix Energy and VELUX, which all have contributed to the actual integration of PV in the build environment.

If you look into an update of Danish BIPV technologies there are quite convincing examples, which have been created by the unique co-operation between lots of actors in the Danish market over the years.

At the same time as the cost of PV panels and related technologies is still clearly reduced every year, ongoing work is still taking place in Denmark to develop new low cost mounting and integration systems for both roofs and facades, here with focus on ultimate solutions where PV panels can actually substitute normal building materials, so use of nice architecturally integrated BIPV solutions in many cases can be realised at very competitive costs even based on the new legislation for use of PV in Denmark.

In the ongoing ForskVE projects, BIPV Quality Cities and PV Active Roofs and Facades, Gate 21, Cenergia and Kuben Management, and other partners like Technological Institute, AAU, Eniig, Solar City Denmark and FBBB is working respectively with cities and housing associations to support the development of good BIPV solutions. Also with a view to use of a so-called "Solar Watch" system to secure principles for detailed monitoring, follow up and quality control. And a number of workshops are here organised with the involved stake holders to support practical implementation work and full understanding of the new PV rules in Denmark, and how you can still realise cost effective PV projects if you base the design on more limited size projects where most of the PV electricity can be used in the hour it is produced in.

In connection to this it has been clear that when you deal with new build and deep renovation projects of the future, then quite small PV systems can actually play an important role not only in securing that f. ex. the new low energy class 2020 can be met in practice, but even with a possibility to reach a zero energy or even plus energy building standard. It has now been possible to identify a number of housing associations and cities who is interested to be involved in a dedicated campaign concerning this together with agreements concerning "Performance Documentation", so it is possible to secure a good energy balance in practice both with respect to the actual energy consumption/ solar PV production and the total economy for the users. And when the results are being disseminated through the national data base for sustainable and energy efficient building in Denmark, which is administrated by the Danish Association of Sustainable Cities and Buildings, FBBB(www.fbbb.dk) at www.baeredygtigebygninger.dk, these projects can have a strong impact concerning integration of BIPV which will actually be a benefit to the society.

In connection to this, a Danish Smart Active House demonstration project has been suggested for a new build housing area linked to an existing district heating network, here utilising the international Active House standard. (www.activehouse.info)

It is here suggested to combine a local low temperature microgrid distribution network for the houses in combination with a solar heated buffer tank and a local heat pump, which secures very low return temperatures to the district heating system. Besides there is 0,5 kWp local building integrated PV for the houses combined with selected roofs near the common house, where the whole roofs are BIPV, and connected to a local battery system also charging the heat pump and local electrical cars.

As part of the Active House design is used an integrated and web based local performance documentation system incl. comfort.

As mentioned Kuben Management has been involved in RTD work concerning PV technologies since 1998 often in cooperation with the company Cenergia, which is now a part of Kuben Management. Cenergias involvement in the PV area dates back to 1991, where the first EU funded PV project was obtained (see also enclosed list of the long-term involvement in building integrated PV and work on dissemination and developing BIPV solutions in practice, both in connection to a number of EU supported projects as well as the ForskVE and the EUDP programme.

The situation today is that there actually exist a quite strong technology base for use and production of BIPV solutions in Denmark despite a PV market, which have had many barriers.

This is also supported by the global development, where PV costs have been reduced very considerably and by the Danish electricity market with quite high electricity costs especially for private users.

The fact is that there exists good business cases for several BIPV solutions, both for roofs and for facades, especially when we are creating BIPV and building designs, where the PV panels can substitute the normal building materials in roofs and facades.

In /1/ there is a presentation of a number of best practice BIPV solutions, which exists in the Danish market.

For Kuben Management and also its owner NRGi, there is a clear interest to work in the area of Smart Energy solutions, Smart Buildings and Smart Cities, and it can be mentioned, that NRGi together with Gate21 organise the yearly large "Smart City – Smart Strategy Conferences The latest: Bæredygtig udvikling i hele landet" conference in Copenhagen in January 2017.

It is now the idea to work on a city area level with leading cities and housing associations to combine almost CO₂ neutral low energy building standards like 2020 by use of the recently launched international Active House labelling (www.activehouse.info) including online performance documentation and Smart Energy solutions. Here utilising low temperature district heating together with heat pumps, BIPV and different types of storage solutions incl. flow batteries.

At the same time there is suggested a very interesting vision for use of BIPV (building integrated PV) for the future.

The idea, is to create the background to let energy companies organise the financing of the PV part of future facades and roofs, which at the same time is equipped with very durable and almost maintenance free, glazed surfaces to the outside in the areas, where the PV modules are integrated. And at the same time demonstrate BIPV solutions, which actually substitutes normal facade or roof building materials, so the total economy for the users are improved considerably.

And to utilise the very professional social housing sector as basis for demonstrating, these types of BIPV solutions, together with Smart Energy and system integration policies including smart metering and use of local storage options together with heat pump based communal heating. And at the same time prepare for virtual accounting, which secures more optimised BIPV use in practice.

/1/ Eksempler på bygningsindpassede solceller BIPV, Cenergia / Kuben Management 2017

In relation to ongoing work on Smart City development with a special focus on BIPV, there has also been a cooperation with Solar City Malmø and Solar City Skåne, and e.g. work on the European project SECURE with Malmø City as the lead.

In the Green Solar Cities EU-Concerto project, Lund University was a partner and in the ongoing Nordic Built project Active Roofs and Facades in Sustainable Renovation, WSP Malmø has together with the private housing company Trianon been involved as partners.

It is suggested to established new cooperative actions on BIPV development in a Smart Energy context, which is involving both the Copenhagen region and Region Skåne. An important initiative here could be to realise BIPV Demosite in both regions, together with CO₂ neutral Active House test houses. A 3 year programme here could be realised. Ideas from the enclosed 2016 porposal for Nordic Innovation, which did not obtain funding, could also be utilised.

Flat or sloping roofs with at least 0,5 kWp local PV as BIPV per apartment

Example of small housing block with 12 apartments

Low temperature microgrid distribution

Common PV, 3 kWp /apartment x 120 = 360 kWp PV (21 m²)

Common battery storage (75 kW)

Electric cars

Heat pump 35 kW

100 m³ buffer tank storage

Common CHP plant

Other housing area

Other housing area

Other housing area

Common low temperature district heating as backup

Part of 800 m² solar thermal collectors on housing or common house connected to buffer storage

Winter common purchase of electricity more flexible due to storage options

Here is illustrated an example of a city area based Smart Energy CO₂ neutral Active House design, together with recent examples of Danish produced BIPV solutions, which at the same time can support a good score, when using the recently launched Active House standard.

Overview of Cenergia and Kuben Management projects in the BIPV area.

Sammenhæng med andre projekter.

