Demand Controlled Ventilation (DCV)
Theory and practise

What is DCV.
Why DCV?
An example of DCV in use.
Future wish list.

Abbreviations

Standard terms:

- CAV = Constant Air Volume

- VAV = Variable Air Volume

  - Timer or predefined setting.
- DCV = Demand Controlled Ventilation

  - automatic regulation of airflow from sensor(s) representing the occupied space.

Why DCV?

- Majority of European building stock is here.
- How many are suitable for large lower pressure ducting system? How many new buidings?
- Use technology to solve an existing problem.
- Efficient use of energy: YES
- Compromise on IAQ? NO

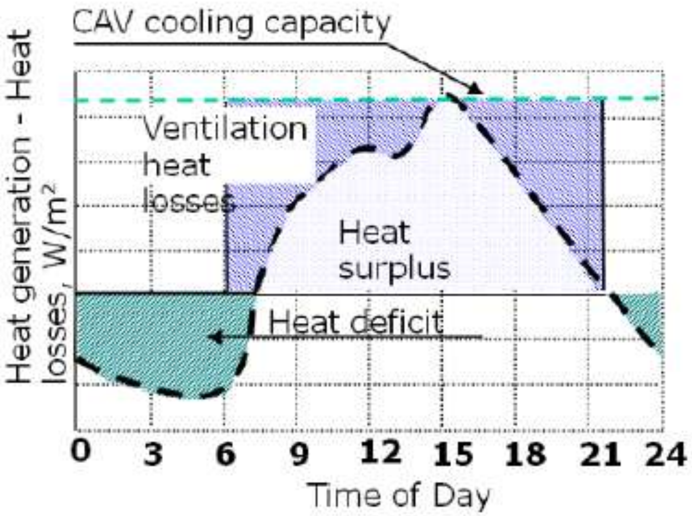
Why DCV?
Sweden today.

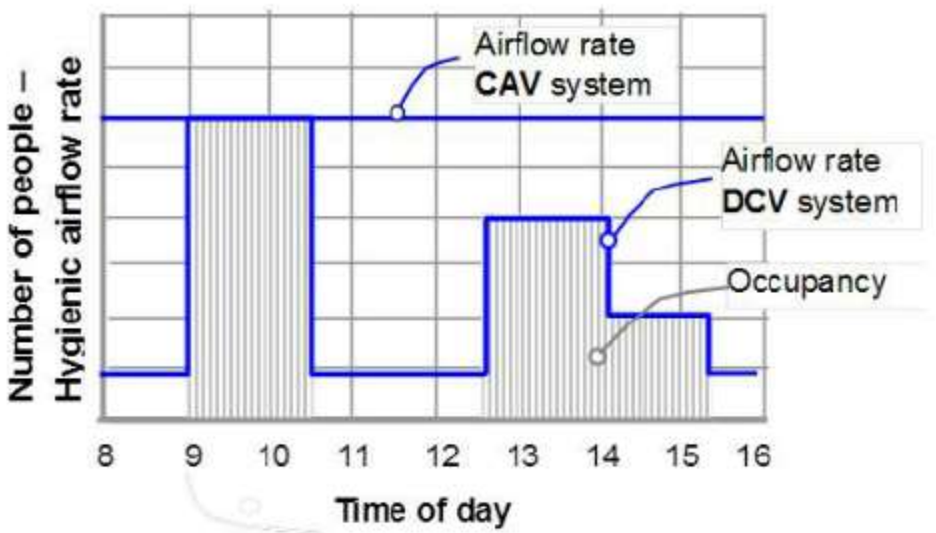
40% of school buildings do not pass the compulsory ventilation inspection.
Source: Dept. of Energy and Board of housing.
.
Allergies due to ineffective ventilation and cleaning.
Source: Swedish Dept. of Health & Welfare.

Renovation with DCV with the goal of good IAQ and lowest energy use.

Definition of DCV

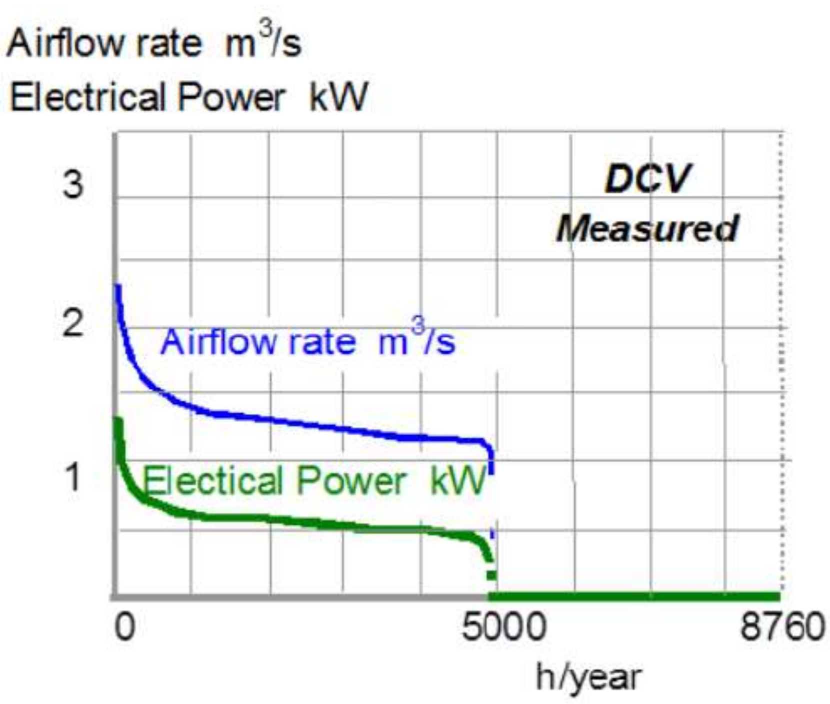
Provide the exact amount of clean air at the required temperature at the right time in the right place.

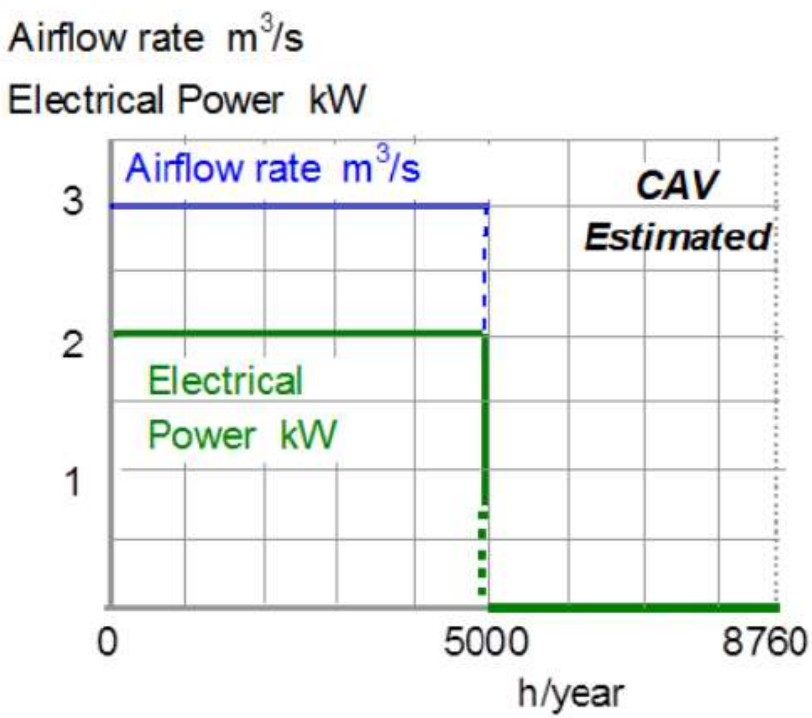




Source:Maripuu, Chalmers

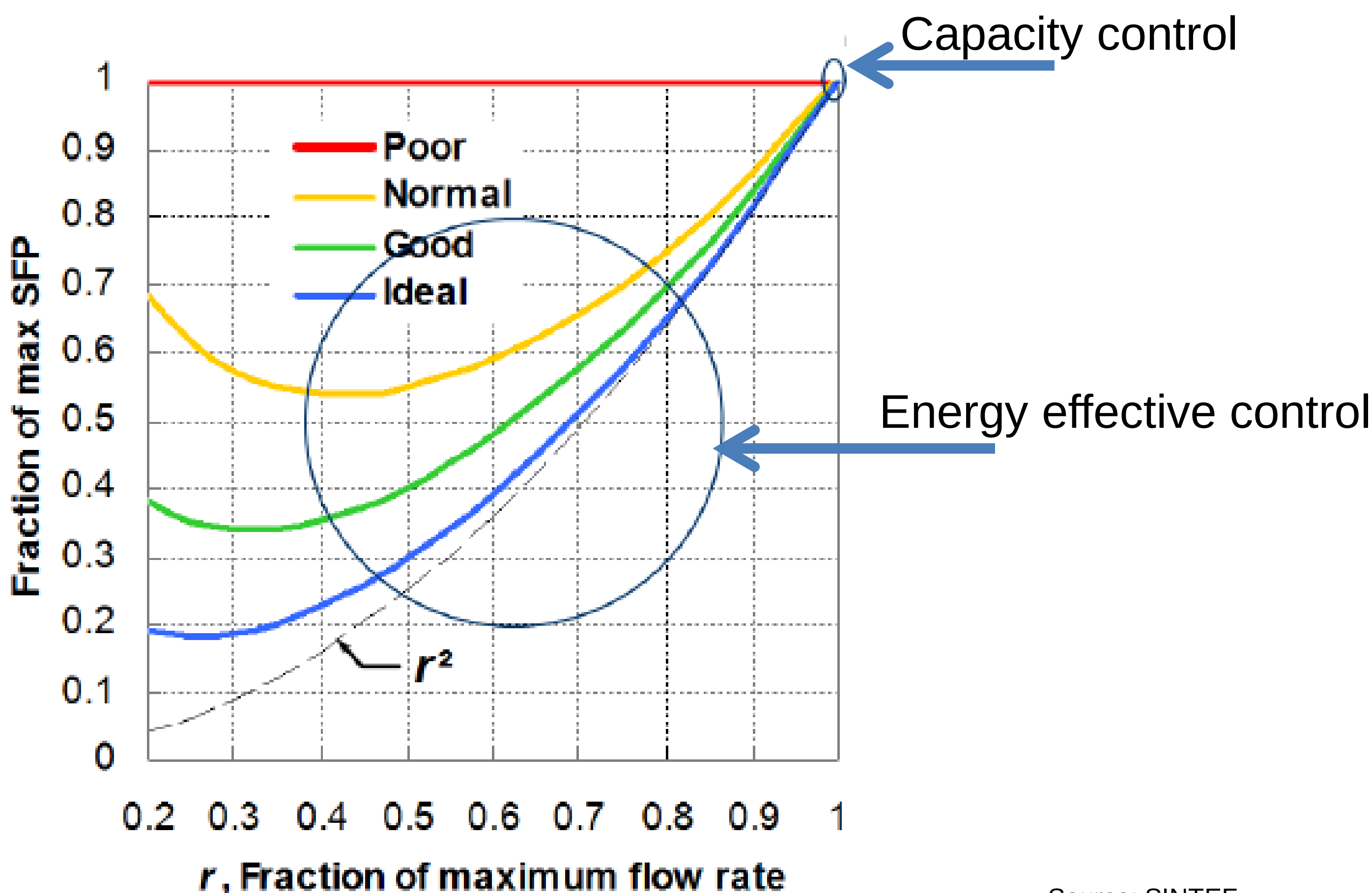
Field measurements





Source:Maripuu, Chalmers

Characteristics of SFP against airflow



Source: SINTEF

Sensor types

Regulating parameter	Sensortype	Benefits	Drawbacks
Clock	No sensor required. Possible to have time-control through the system or the BMS	Affordable	Not possible to control according to occupancy
Presence	Motion sensor (IR-sensor)	Low cost Long life span	Limited possibility for gradual control according to actual occupancy, *e.g.* in meeting rooms, open space office etc.
CO_2-concentration	CO_2-sensor	Gradual demand-control according to actual occupancy in classrooms, meeting rooms, open space office etc.	Can require calibration to ensure precise measurements. Measurements uncertainty.
Temperature (in combination with one of the previous parameters)	Temperature sensor	Low cost Long life span	Soiling of the sensor can induce measurement errors. Only demand-control according to heat loads
VOC-concentration	VOC-sensor	Give the possibility to control according to the measured VOC concentration. The latter can be used to predict the CO_2 level and thus replace a CO_2-sensor.	Unclear/little use of requirements for VOC related to ventilation control. Inaccurate as CO_2 predictor. Cannot be controlled or calibrated.

Source: SINTEF

Types of DCV

- **Constant pressure control**.
- The fan speed drive is controlled by the pressure sensor in the main ventilation duct.

- **Pressure-optimised DCV.**
- The fan capacity is controlled by a pressure sensor in the main duct, but the pressure set point is regulated by the controller so that at least one of the DCV dampers is fully opened.

- **Damper-optimised DCV.**
- Airflow control rate in the main duct according to the position of the dampers, so that at least one of the dampers is fully opened.

Extreme DCV Building

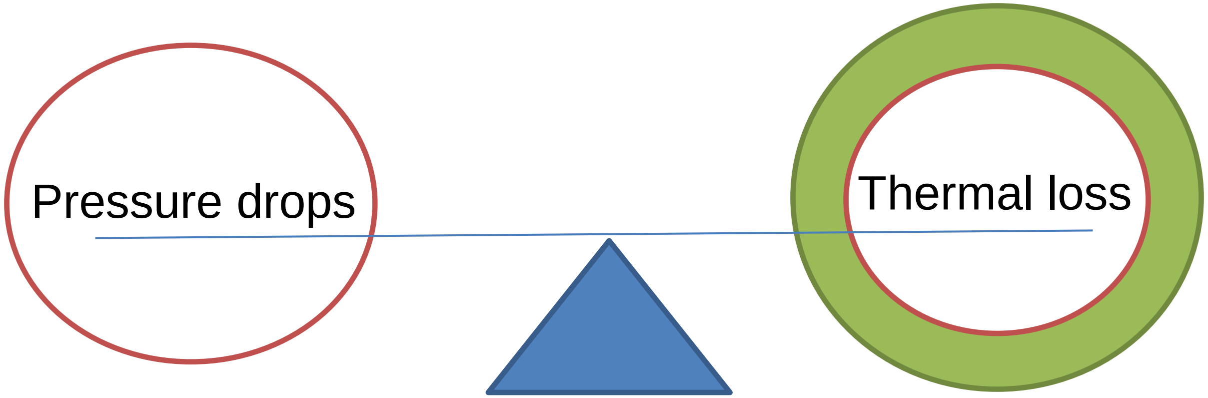
Extreme DCV building

Phenomena that we emerged during BDAB construction.

Size of vertical shafts

- Pressure drops in ducts
- Thermal loss in ducting

Low air speed = large extra need for isolation



Extreme DCV building

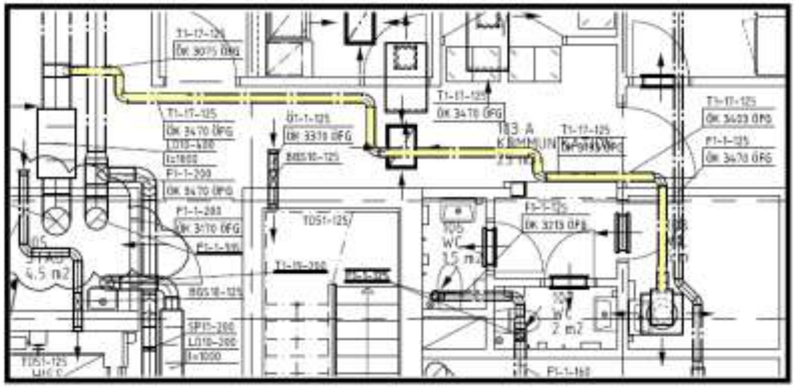
Must understand how airflow and pressure works.

Technical room on the 1st floor was missed in construction so the ventilation contractor was asked to connect a duct to bring in 50l/s to that room,

An 15m long duct size 125 was mounted.

After starting up system this zone pressure end up to 80Pa, al the rest of the building only needed 35Pa on the same level.

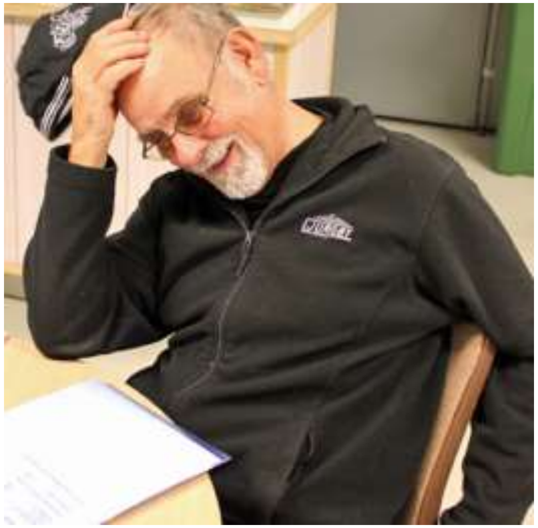
After remodelling:
changing from duct size 125 to 200
also this zone end up on 35 Pa.



Documentation

Ventilation principal drawing must contain:

- All levels of airflows;
  unoccupied – minimum occupied – maximum occupied
  (for example 10 - 50 - 200 l/s).
- Pressure sensor placement.
- Every room has to be added.
- Individual marking to each components.
- Function of zone dampers.



DCV tips

- Start DCV planning from the first step.
- Which room shall have balanced supply and extract air, or supply and transfer air?
- Which room shall have DCV or CAV?
- How shall we solve the main ducting / shafts (vertical and horizontal)?
- Dimensioning of system and air handling unit(s)

Wish list

- More smart functions as self-optimisation, for both temperature and pressure.
- Weather-control system for energy-optimised buildings.
- Technological boost in the design software as:

  CAD software that can simulate and calculate DCV.
- IAQ indicator?
- Greater focus on simplicity.

Conclusion

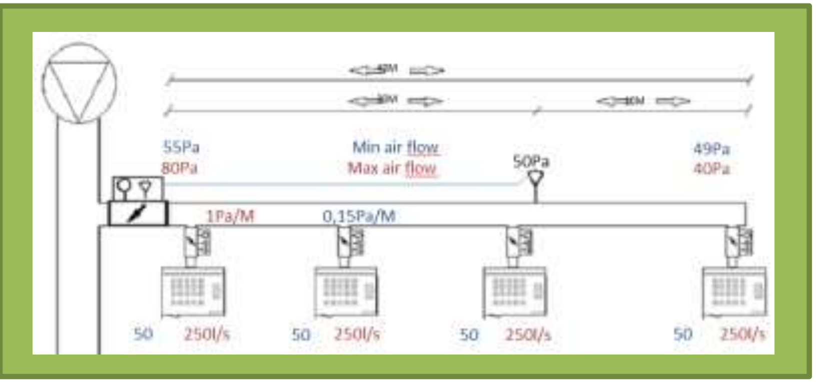
Design for DCV from the beginning.

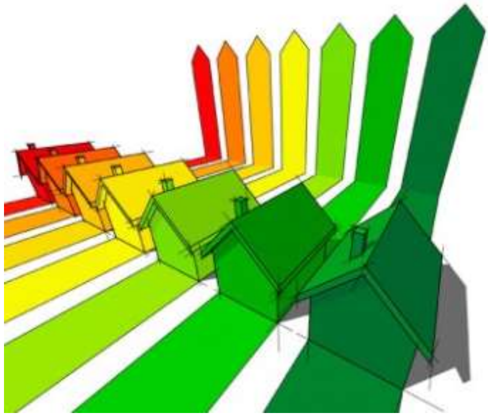
Consider future changes of the system in the building.

A practical understanding of air flow and pressure is needed when making changes in DCV systems.

DCV IS EASY

REDUCES ENERGY USE
WITH
IAQ COMPROMISE





www.swegonairacademy.com

Other DCV presentations from Swegon Air Academy

DCV experience from real projects
Torbjörn Flodén

Clima 2010, 2013 workshop
Chair; John Woollett

DCV for better IAQ and energy efficiency
Mari-Liis Maripuu

Demand Control Ventilation Systems
Michele De Carli

Good indoor air quality and low-energy consumption in buildings
Mads Mysen

http://www.sintef.no/Projectweb/reDuCeVentilation/Publikasjoner/