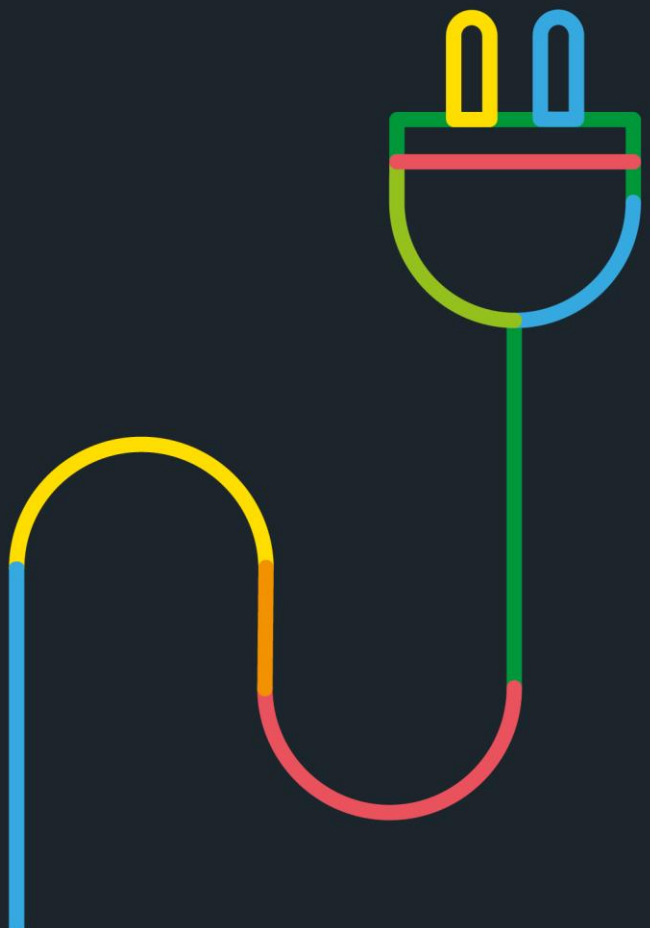

Addressing health and well-being (WP4)

ALDREN ALliance for Deep RENovation in buildings

DTU

CSTB le futur en construction

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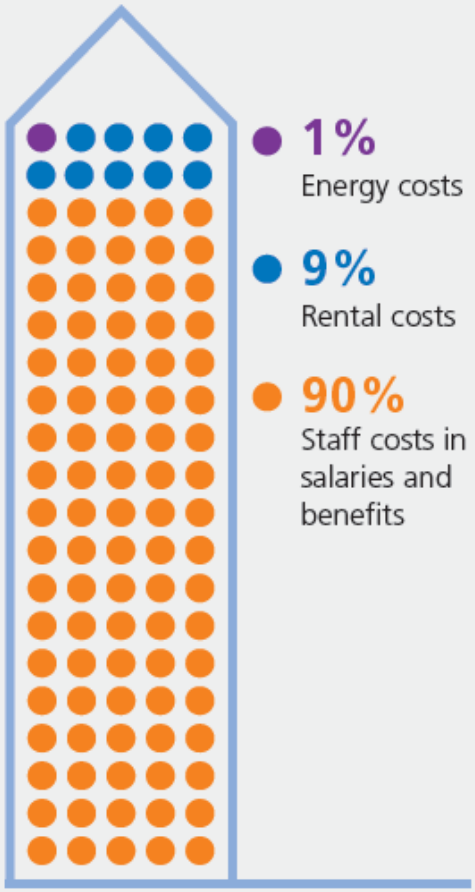
Background

- Intensify the rate of energy retrofits of buildings in Europe by creating additional incentives.
- Integrate, beyond the assessment of energy performance, indoor air quality, comfort and health as priorities in the scope of deep renovation.
- Include IAQ/IEQ indicators in the building passport.
- Use IAQ/IEQ indicators to assess economic benefit (to perform the financial valuation) of improved IAQ/IEQ resulting from the building energy retrofit.

Why?



- **1%** Energy costs
- **9%** Rental costs
- **90%** Staff costs in salaries and benefits

10% Variation

A 10% variation applied equally to each cost has a far from equal impact

+/– 0.1%
Energy costs

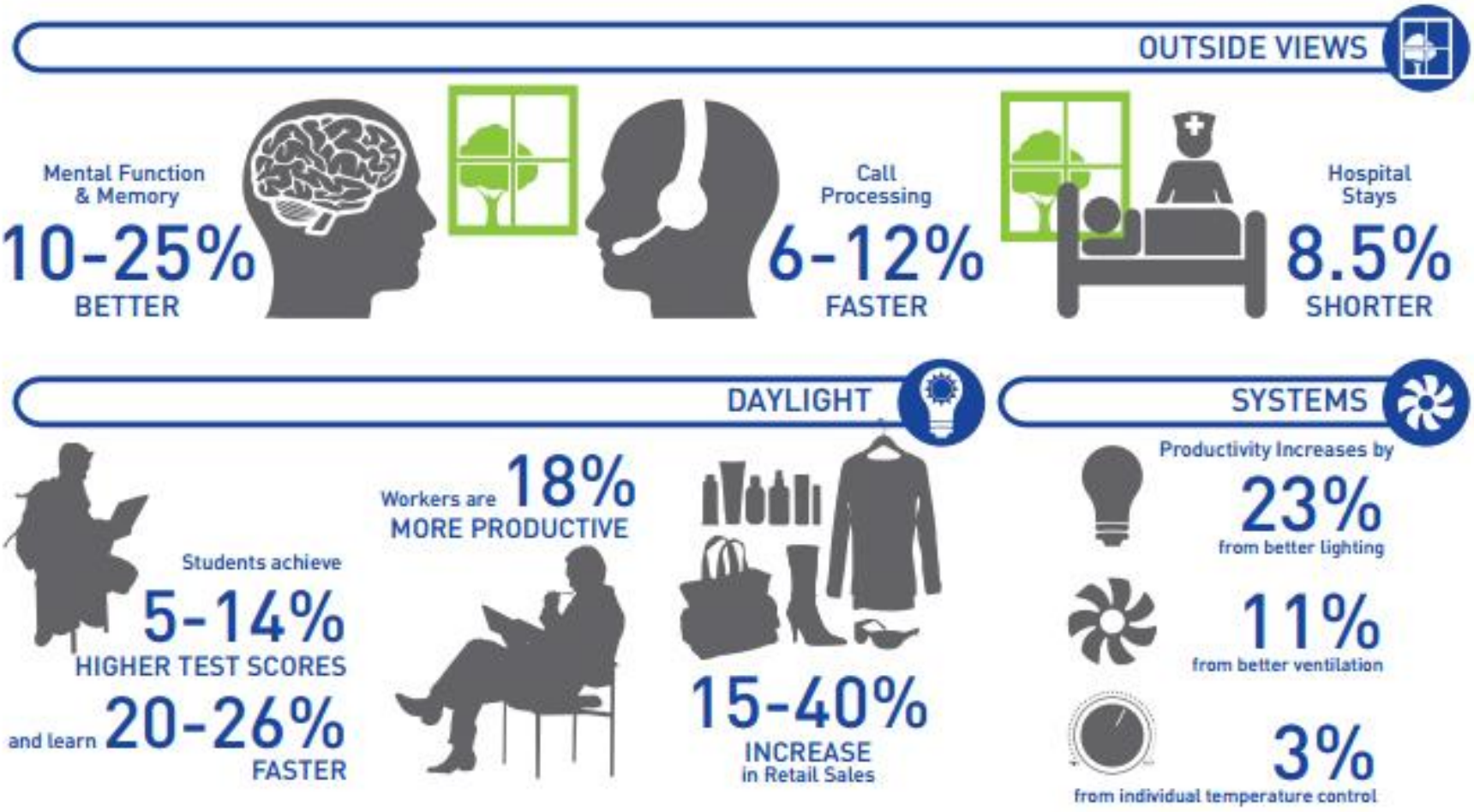
+/– 0.9%
Rental costs

+/– 9.0%
Staff costs

Based on a typical split of business operating costs, modest gains in staff health and wellbeing can deliver significant financial savings.

Source: World Green Building Council (2014)

Why?

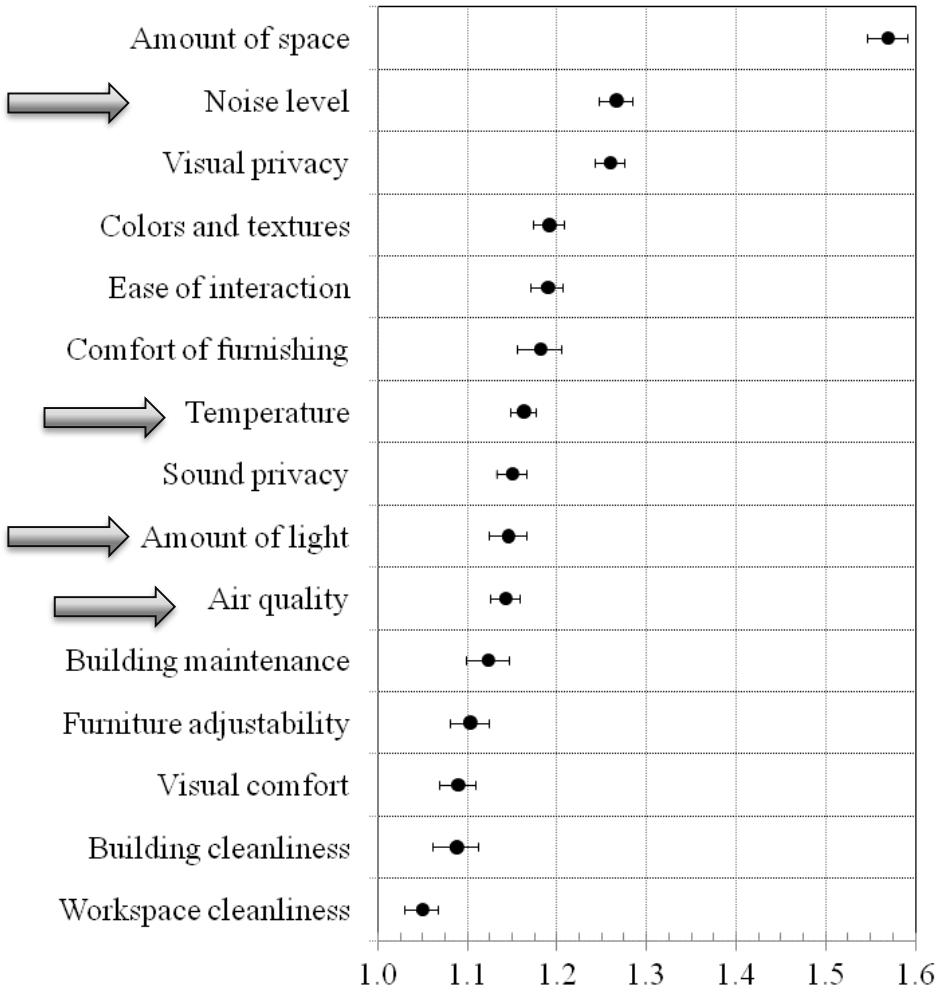


Source: World Green Building Council (2014)

Why?

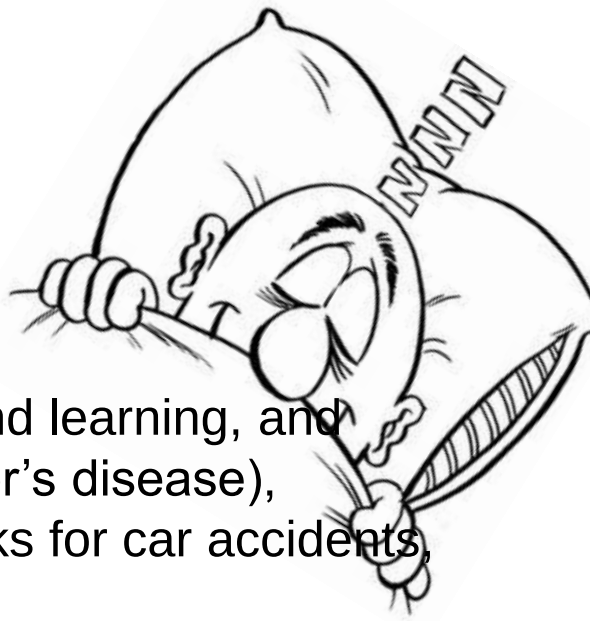
- Costs of IAQ are estimated to be >2 mil. DALYs (premature death or morbidity)
- The estimates are comparable with DALYs lost due to road traffic injuries in European region yielding 3.6 million DALYs in 2002.
- Assuming that one DALY is worth US$125k, the economic consequences are comparable with a GDP of a Cyprus.
- For example, a recent French estimation shows that socio-economic consequences in France due to indoor air pollution amount €20 billion.

Why?



Source: Frontczak et al. (2011)

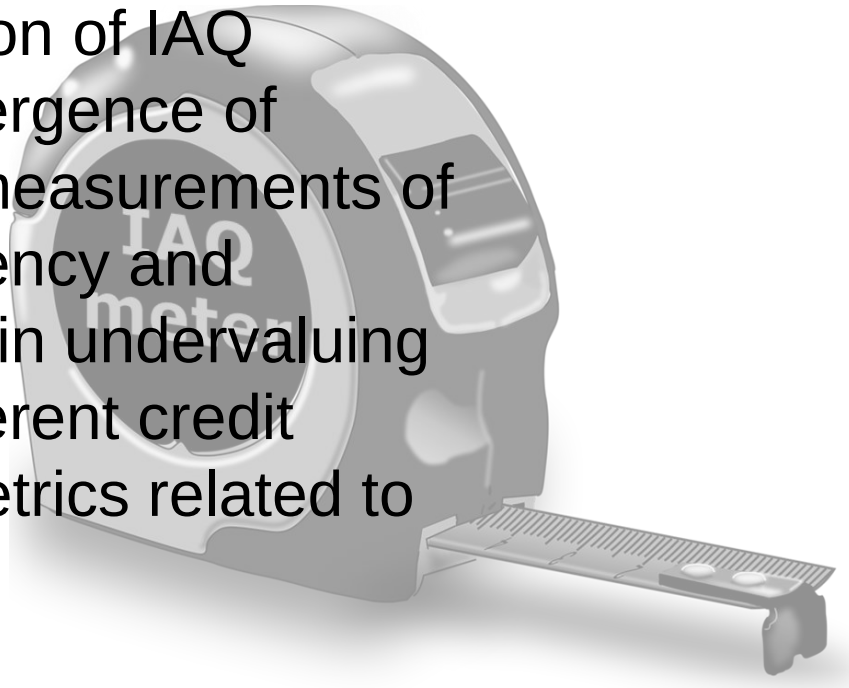
Why?



- People sleep over 20 years during their life time
- High quality sleep is vital for humans
- Sleep improves cognitive performance (memory and learning, and creativity), reduce health risks (dementia, Alzheimer's disease), regulates hunger and fullness (obesity), reduce risks for car accidents, improves concentration and next-day performance
- People are getting more and more deprived of sleep, length (<7,5 hrs) and quality
- Both sleep quality and next-day performance were negatively affected when the outdoor air supply rate to the bedroom was reduced
- It is difficult to fall asleep and to stay asleep when the bedroom is too cold or too hot
- Sleep quality seems to be enhanced when bedroom temperatures are warm when falling asleep and when waking but cool in between

Bottom-line

- Lack of IAQ metric or disagreement what should constitute IAQ metric is a significant barrier holding back innovation of IAQ conducive technologies, emergence of undocumented methods of measurements of IEQ claiming their high efficiency and authenticity, this all resulting in undervaluing the importance of IAQ in different credit schemes and compliance metrics related to built environment



Source: Steinemann et al. (2016)

The course of action (ALDREN)

- Development of a framework for IAQ/IEQ metric addressing health and well-being
- Review of a literature with respect to indicators and methodologies for measuring health, comfort (well-being) and productivity
- Definition of a minimum number of indicators of health, comfort (well-being) and productivity
- Integration of indicators with EVCS through point/grading system
- Monetizing IAQ/IEQ improvements
- Development of protocol for assessing health and comfort (well-being)

A certification framework for indoor environmental quality (in offices and hotels) (1)

- Minimum (passive attribute): Indoor environment **should not compromise** basic human requirements by decreasing the quality of life, i.e. reducing well-being, increasing health risks and negatively impacting physical and mental activity and rest.
- Desirable (active adaptation and opportunity): Indoor environment **should promote** conditions conducive for well-being, health, cognitive performance and rest.

A certification framework for indoor environmental quality (in offices and hotels) (2)

- **COMFORT & well-being: parameters of indoor environment defining IEQ and ergonomic aspects** such as personal control that secure comfort (or absence of discomfort), optimal well-being and high level of satisfaction (following definitions of comfort), as well as rest and sleep quality.
  NB. Increase in comfort is difficult to monetize. Perhaps incremental property value, premiums, tenant loyalty, rental time, etc. can be used or data/models/simulations from the real-estate market?

- **HEALTH: Air contaminants impacting quality of air** in and around a building at levels below known toxic effects, i.e. at level with no increased risk for health (following the definition of indoor air quality and health)
  NB. The effects can be monetized, but only globally.

- **WORK performance: Conditions optimal for work performance** (no particular definition and difficult to measure)
  NB. Can be monetized

Components of certification framework for indoor environmental quality

- Conform with the relevant building codes and standards describing IEQ conditions in buildings
- Tangible (quantifiable) by credible measuring/observation methods
- Describing parameters of indoor environment (not human responses), which is under certification and its control:
  - Measured parameters (measurements), e.g. physical, chemical, biological
  - Identified installed components, materials, and/or systems (assets) by e.g. observations
- Health, comfort, performance and rest (the outcomes or human responses) should rather not become the part of certification (i.e. they should not be directly certified); they should be addressed through proxies. They are the result of the certification process, while the process of certification refers to the properties of a building.
  - Optionally: subjective evaluations through questionnaires, psychological tests, objectively measured sleep quality, physiological indicators.

To be contd…..

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