Impact-based warning information for ice-throw risk: A Norwegian survey

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About ice-throw risks in wind turbine parks

What is the challenge?

- Ice & snow accumulation on wind turbines occurs under specific atmospheric circumstances during winter, posing a risk for turbine maintenance personnel, local users and potential visitors
- Little is known about risk perceptions and warning response in the context of ice-throw risks

What did we want to learn and how?

1. How can the application of online information channels for ice-throw/fall risk be improved, as to optimally communicate risk information (CAP warnings, impacts, behavioural advice), facilitate wind park operators in their communication with potential visitors to the park and give 'actionable' risk information to users?
2. Which measures can enhance the communication of primary risk information (CAP warnings, impacts, behavioural advice), such that it helps people to build skills and awareness to minimize risk of injury when entering Norwegian wind turbine parks?

Category	Safety measures	Remark
Awareness of residents	Communication strategy	Independent from the calculated risk, these measures should be taken to inform the residents and – as a long term strategy – change their behaviour.
	Regular education to change behaviour of people.	

IEA WIND TCP TASK 19 - Qualitative safety measures

- Quantitative survey: N=1377 48%f M =44y, 52%m M=47y
- Three themes:
  - ➢ 1. Familiarity with wind turbine parks
  - ➢ 2. Information seeking & risk perceptions
  - ➢ 3. Warning scenarios
- Data collection: May-July 2021 (IPSOS panel)
- Data analysis: August-September 2021 (MET Norway)

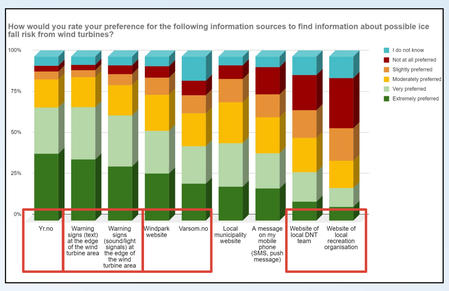
1. Familiarity with wind turbine parks

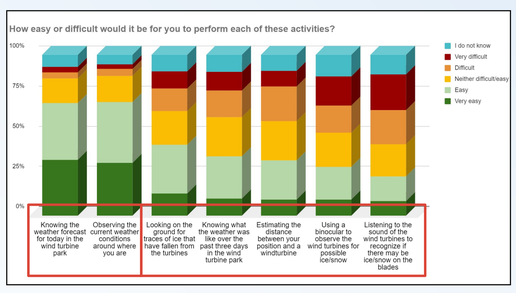
- A small group of people tends to visit wind turbine parks in Norway every now and then
- Wind turbine parks that are relatively nearby people's place of residence are more likely to be visited
- It is likely that wind turbine parks may be visited in some weather conditions that are favourable for ice-throw/fall



2. Information seeking & risk perceptions

- Weather information seeking
  - Most resp. update themselves on daily weather & warnings
  - Many think it is important to be familiar with the risks, and look for information to protect themselves…
  - …but do not primarily consider talking local experts (cf. maintenance personnel)





- Ice-throw/fall information preferences
  - People are not perceiving the risk of ice-throw as higher than other similar risks
  - Preferences for risk communication channels are guided by familiarity (physical signs, park website, Yr.no (!))
  - Observation skills can be an important risk mitigation tool in addition to warnings…but are seen as difficult to perform

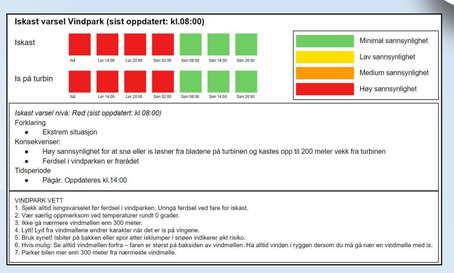
3. Warning scenarios

- Respondents received the following activity & warning scenario (red/yellow level):

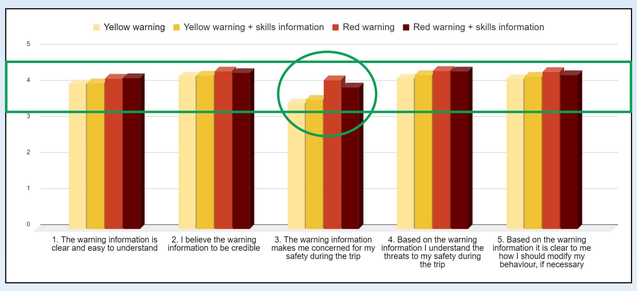
Activity
It is a Saturday morning in February. You plan to go for a hike or ski tour, starting at 09.30h until 14.30h. The distance of the trip is within your physical ability.

Weather information
After a week of variable weather, with snow showers and temperatures just below freezing, the forecast for both Saturday and Sunday is sunny with some clouds, wind northwest 5m/s and a maximum temperature of -1 degrees Celsius.
There is snow on the ground, but it is easily possible to both walk and ski.

Route information
The route of your trip will go through an area where various wind turbines are located. The following information about the windpark is available to you:



- Overall, CAP warning information appears understandable and actionable
- Risk for information overload with too much text





- Colours are appreciated (esp. red colour stands out)
  - People likely to follow clear advice: cancel/ postpone visit
  - Yellow colour/warning is ambivalent (safe vs not safe)
- Distance to turbines
  - Challenging to assess
  - Distance advice is noticed by those who consider visit, while turbines are avoided regardless by those who do not want to visit
- Skills
  - Unclear effect of skills information (Vindpark Vett)
  - Prefer own observations to mitigate on-site risk (but don't know how)



4. Lessons & Recommendations

- Apply standardised information formats
  - Use consistent CAP format for ice throw/fall warnings, potentially tailored to local windfarm context, with colours as central ingredient
  - Layer warning information according to information density/priority to avoid information overload
    - ➢ Include impact information and behavioural advice, include distance advice
    - ➢ Include background information on ice-throw events as second information layer
  - Tailor warnings mainly for 'non-expert' users
  - Distinguish between 'no risk' vs. 'low risk'

- Enhance risk information accessibility
  - Use consistent and interconnected (QR/urls) portfolios of online and offline (physical signs) communication channels, which combine risk and forecast information
  - Framing ice-throw as a weather hazard, as opposed to a technical hazard, may improve understanding/uptake

- Build actionable knowledge: a long-term perspective
  - Educate observation skills and risk awareness,, together with local stakeholders tailored for specific user groups (recreation, reindeer herding)
  - Monitor and evaluate warning communication across windparks, incl. perceptions and behavioural aspects