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Feasibility of automatically harvested data in asset management

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Name of the report: Feasibility of automatically harvested data in asset management

Key words: use cases

Summary

This report presents results of questionnaire “Development of asset management” focused on electricity distribution system operators (DSOs). The subjects of the questionnaire are related to utilization of measurements in electricity networks, use of already known data in databases and maps, aerial photography and weather forecasts and statistics.

The questionnaire was sent to Finnish DSOs (77), of which 30 responded. The responded DSOs were categorized based on size of company (either “small” or “big”) and environmental circumstance (“rural”, “urban” or “rural and urban”).

The study indicates that there are feasibility in data harvesting. DSOs responded to most of the questions that the feasibility is even “high” or “relatively high”.

CONTENTS

1 Introduction

This report is a part of the national research project called Flexible Energy Systems (Flexe). The purpose of the Flexe-program is to create abilities for the Finnish operators to plan, build, manage and use the future smart and flexible energy system. This program is funded by Tekes – the Finnish Funding Agency for Technology and Innovation.

This document describes the views of Finnish distribution system operators (DSOs) to exploit the automatically harvested data in asset management. The main responsible of the report has been Lappeenranta University of Technology and the co-operators in the study has been Elenia Oy.

The report presents the results of the survey, which target group were Finnish distribution system operators. In the survey, we determined the views of DSOs to use data and develop the processes of asset management. The response rate in the survey was 39 % so that 30 DSOs from the 77 DSOs responded.

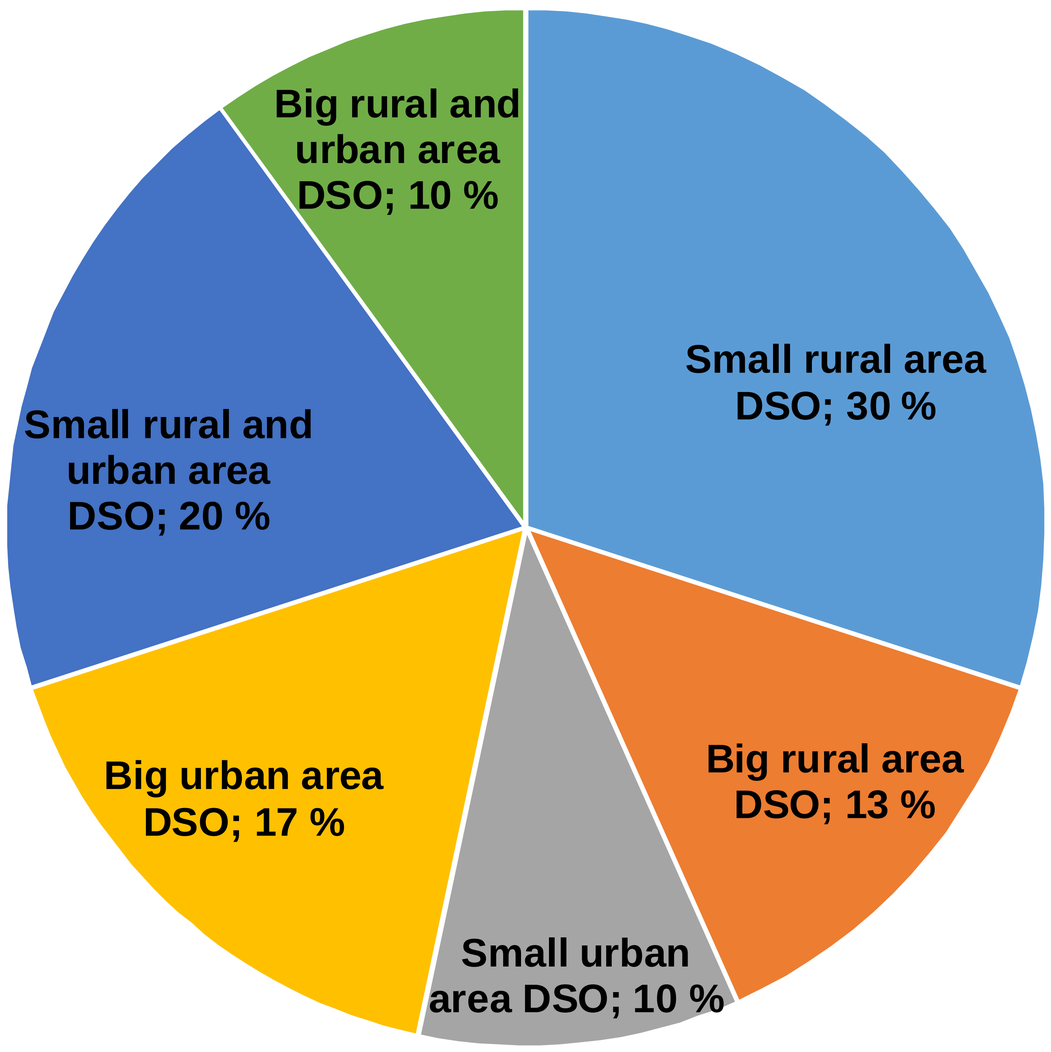

Figure 1. Distribution of respondent DSOs to classes divided according to size and operational environment. DSOs response rate was 39% (30/77).

2 Views of DSOs to utilize automatically harvested data in asset management

Views of DSOs were clarified with a questionnaire concerning development of asset management using automatically harvested data. The questionnaire asked, for instance, general views of the feasibility, present utilization rate, future development potential and future feasibility of the data in asset management. Figure 2 shows the responses of DSOs to a statement "Automatically harvested data have potential to improve asset management process of electricity distribution networks". The result indicates that there are potential in the data processing to develop asset management process, which has yet not been realized. Over 90% of the DSOs responded that they agree with the statement.

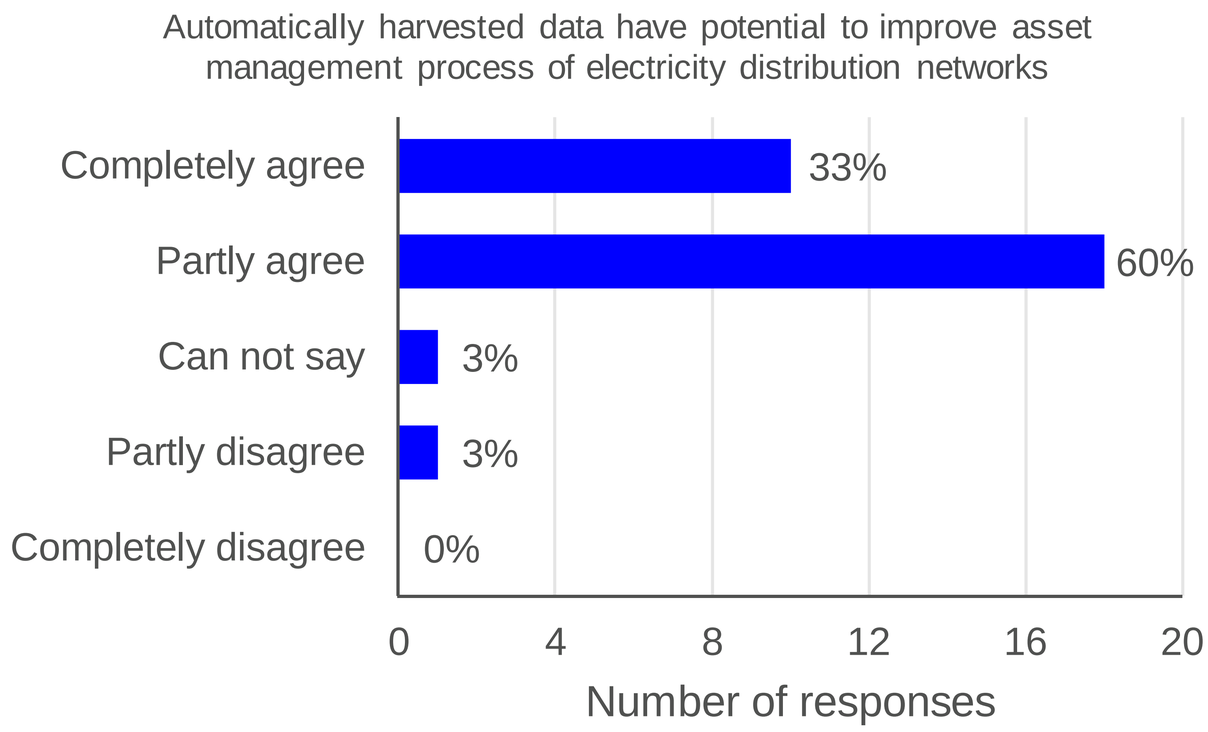

Figure 2. DSOs views of potential of automatically harvested data in asset management. Number of responded DSOs is 30.

The questionnaire has been divided to five subjects considering different data sources, which are:

- Network measurements
- Utilization of open maps
- Utilization of open databases
- Benefits of aerial photography
- Utilization of weather data

2.1 Benefits of distribution network measurements

Measurements in electricity distribution system provide important information of the operation of the system. In the present system, the measurements are typically carried out in the substation level and partially in the customer-end. The system between these points are often not so well measured.

Substation online measurements provide significant amount of data consisting for instance current and voltage measurements, which are the basis for the system protection. A great improvement in the network measurements has been achieved by installation of automatic meter reading (AMR) system. For instance, in Finland all the households have AMR meters providing one-hour resolution of their energy consumption, which is used in balance settlement of electricity trade. However, at present the role of AMR in the asset management is not significant that could be changed in the future.

In addition to AMR measurements, new type of condition monitoring in the electricity network such as measurements in secondary substations could provide data for more accurate network analysis. This aspect was approached in the questionnaire with a statement “It would be profitable to do more measurements in distribution network”. Figure 3 shows that 73% of the DSOs indicated that they agree with the statement, 20% responded that they can not say and less than 10% disagreed the statement.

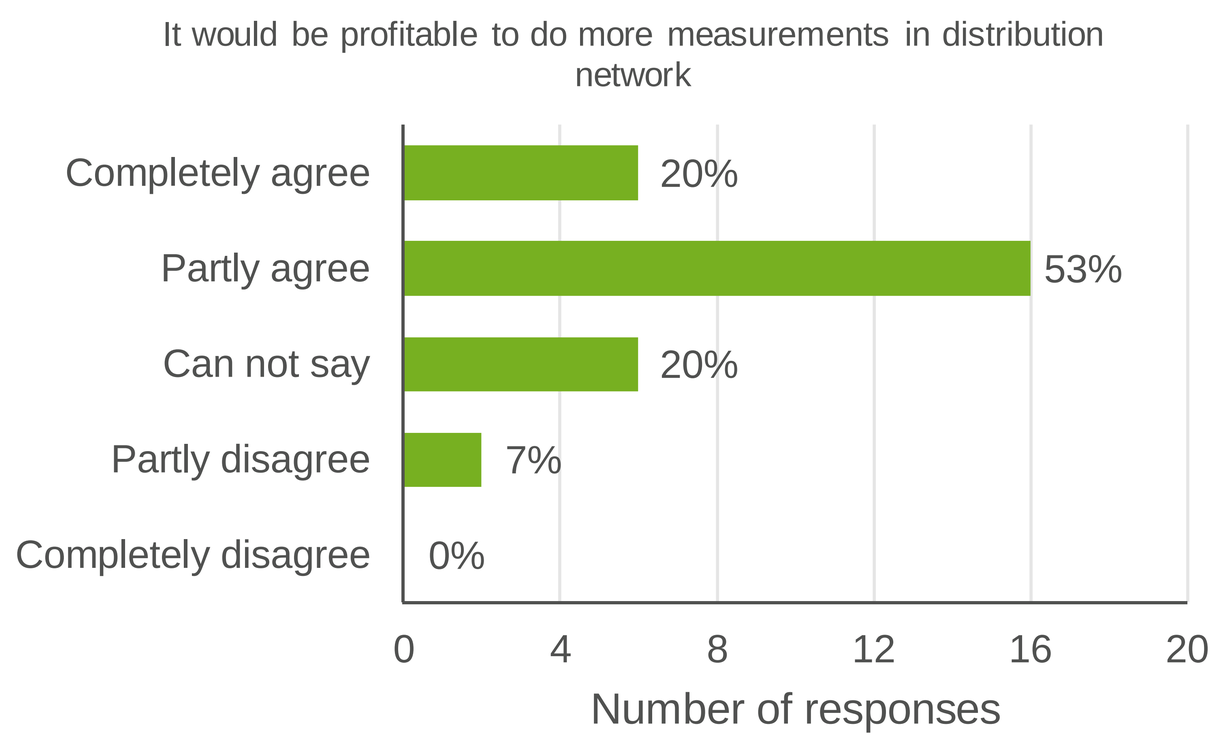

Figure 3. DSOs views to take the benefits of measurements of the grid. Number of responded DSOs is 30.

In addition to the statement related to profitability of measurement of the grid, the questionnaire asked the DSOs to assess present utilization, future potential and economic feasibility of certain measurement or statistics. An example of the DSOs responses is presented in Figure 4 that shows the evaluation of condition monitoring. For instance, the present use is seen relatively low (80% of the responses), but the potential is “high” or “relatively high” (96% of the responses) as well as the economic feasibility (80% of the responses).

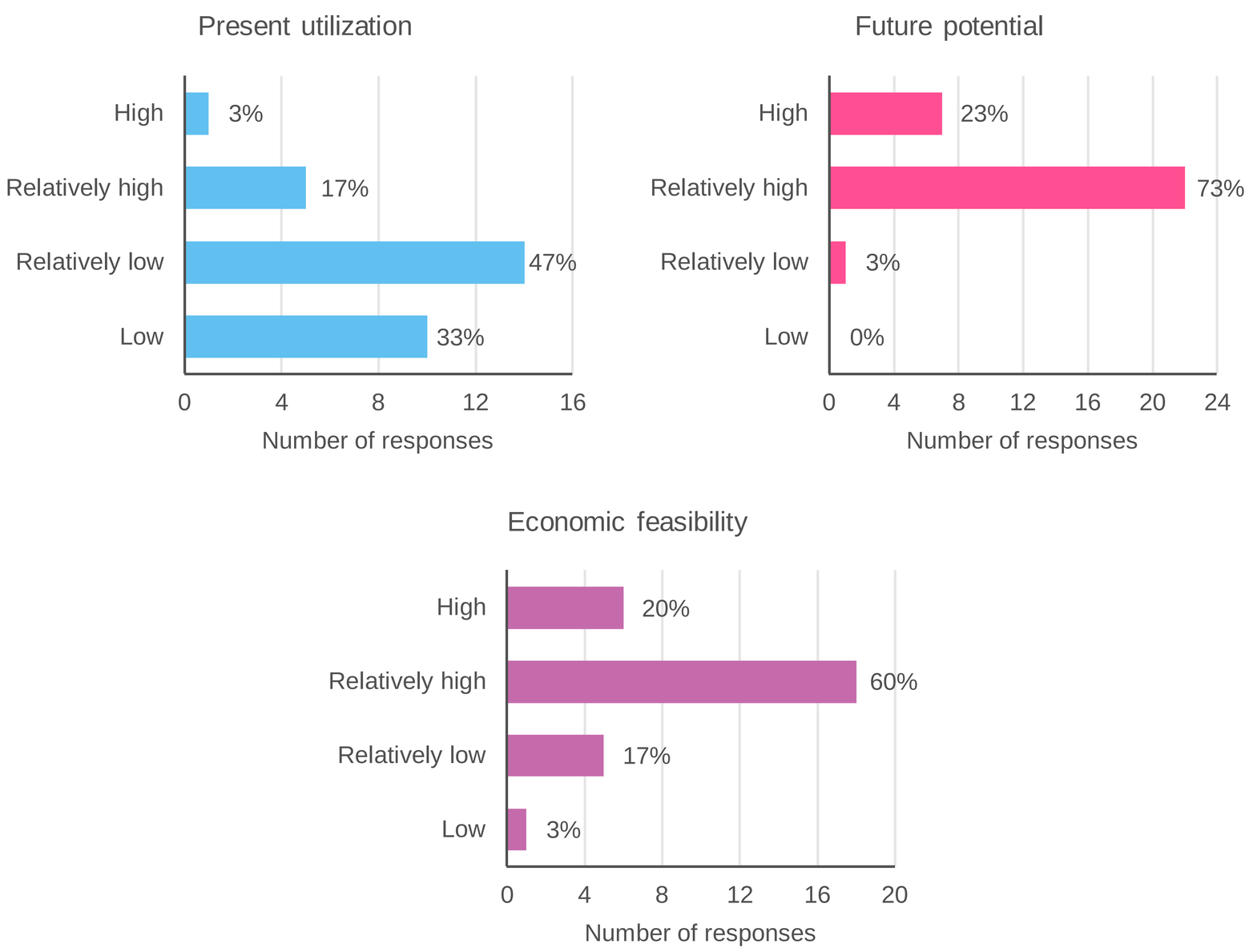

Figure 4. DSOs views of electricity network condition monitoring as part of asset management. Present utilization rate, future potential and economic feasibility in asset management. Number of responded DSOs is 30.

2.2 Utilization of open maps

Planning of energy system utilizes considerably existing maps that have been integrated in network planning systems. Traditionally maps are important part of general planning of the system providing the first view of the systems line routes. However, the maps could be used more extensively providing information also for the computer-based analyses having, for instance, the first indication of forest rate of the existing line routes. The perspective of the potential of existing maps was clarified with a statement “Existing maps can be used efficiently in network planning”. Figure 5 presents the responds of the DSOs showing that 80% of the respondents agreed with the statement that there are potential in existing maps.

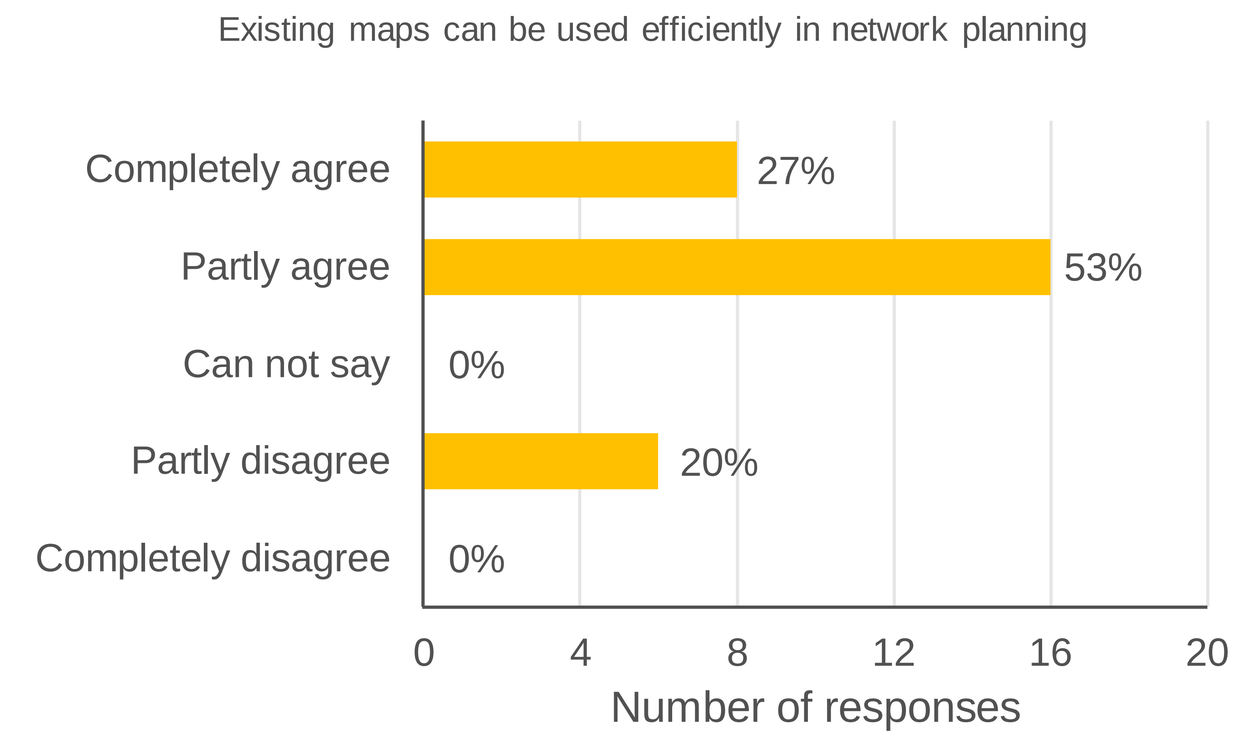

Figure 5. DSOs views to use maps as part of network planning process. Number of responded DSOs is 30.

The field of open maps was continued with statements where the DSOs assessed the present usability, potential and feasibility of open maps from the perspective of asset management. The results of responses are presented in Figure 6. It shows that present utilization is seen low (indication of 67% of the DSOs) and potential “high” or “relatively high” (90% of the DSOs). Also the indication of economic feasibility is that there are economic potential (67% of the DSOs).

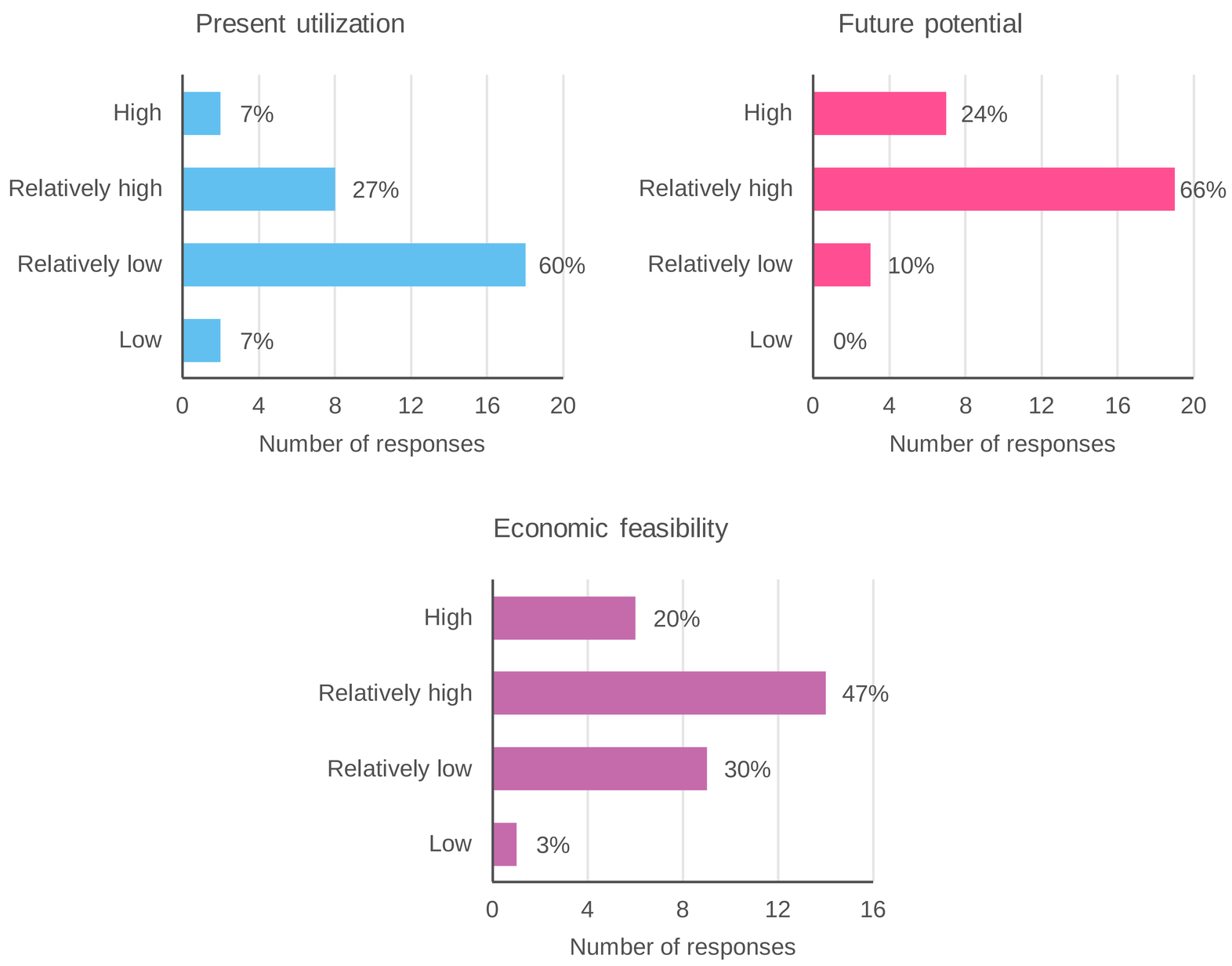

Figure 6. DSOs views to use maps as part of network planning process. Present utilization rate, future potential and economic feasibility in asset management. Number of responded DSOs is 30.

2.3 Utilization of open databases

Open databases can be useful part of asset management process. At present lots of data are available and organized in databases where it is in a formal shape facilitating the exploitation of data. An example of open database is so called topographical database that is maintained by National Land Survey of Finland (NLS). The database contains, for instance, the routes of roads, contour lines, existing over head line routes and buildings.

This subject was approached by a statement “Existing databases can be used efficiently in network planning”. Figure 7 provides the responses of the DSOs showing that the responses diverge considerably. If the responses are compared with previous subject “Utilization of open maps”, it can be observed that DSOs are not as convinced of the exploitation of open databases even they may contain the same data or even more as maps. This may be a consequence of lack in the awareness of the data that databases contain or the graphical information of maps are seen much more informative as text or number form in database.

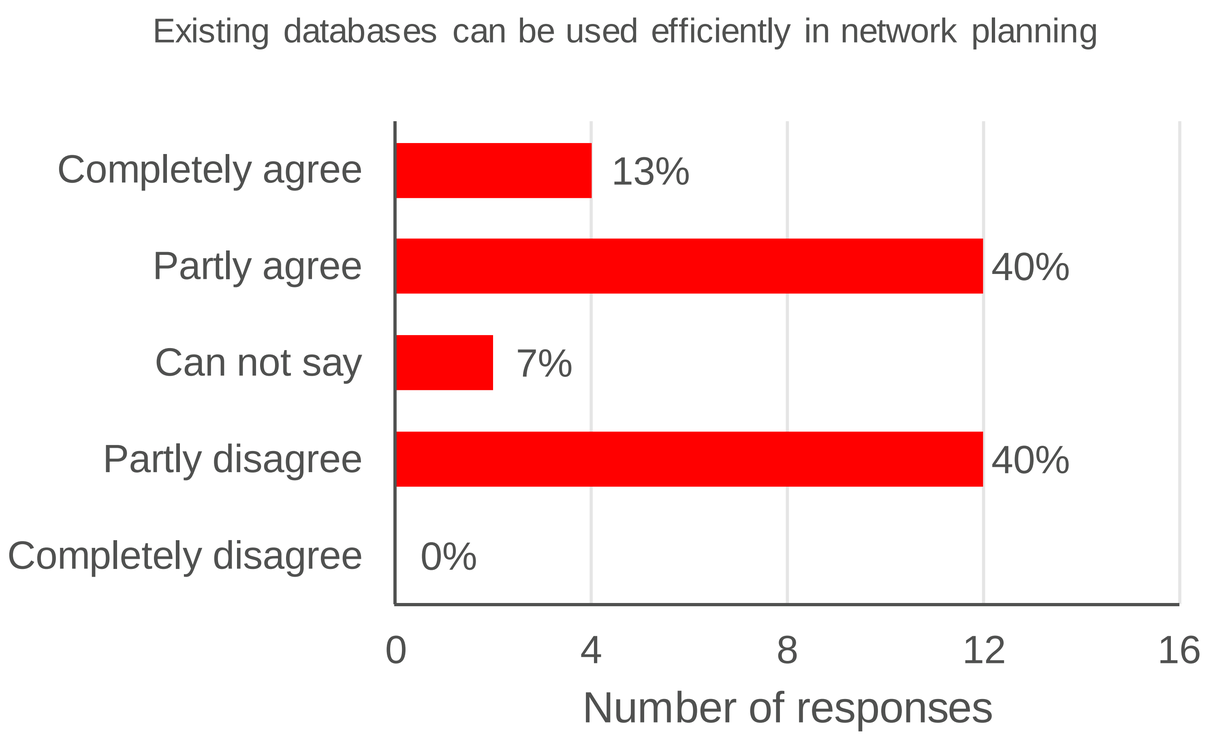

Figure 7. DSOs views of role of open databases in network planning. Number of responded DSOs is 30.

Figure 8 presents the DSOs responses of the present utilization, future potential and economic feasibility of open databases in asset management. The responses are almost similar compared again with the previous subject “Open maps”. The present utilization is low, but potential is high. Economic feasibility has divided the DSOs opinions sot that 60% of the DSOs responded “high” or “relatively high” and 40% “low” or “relatively low”.

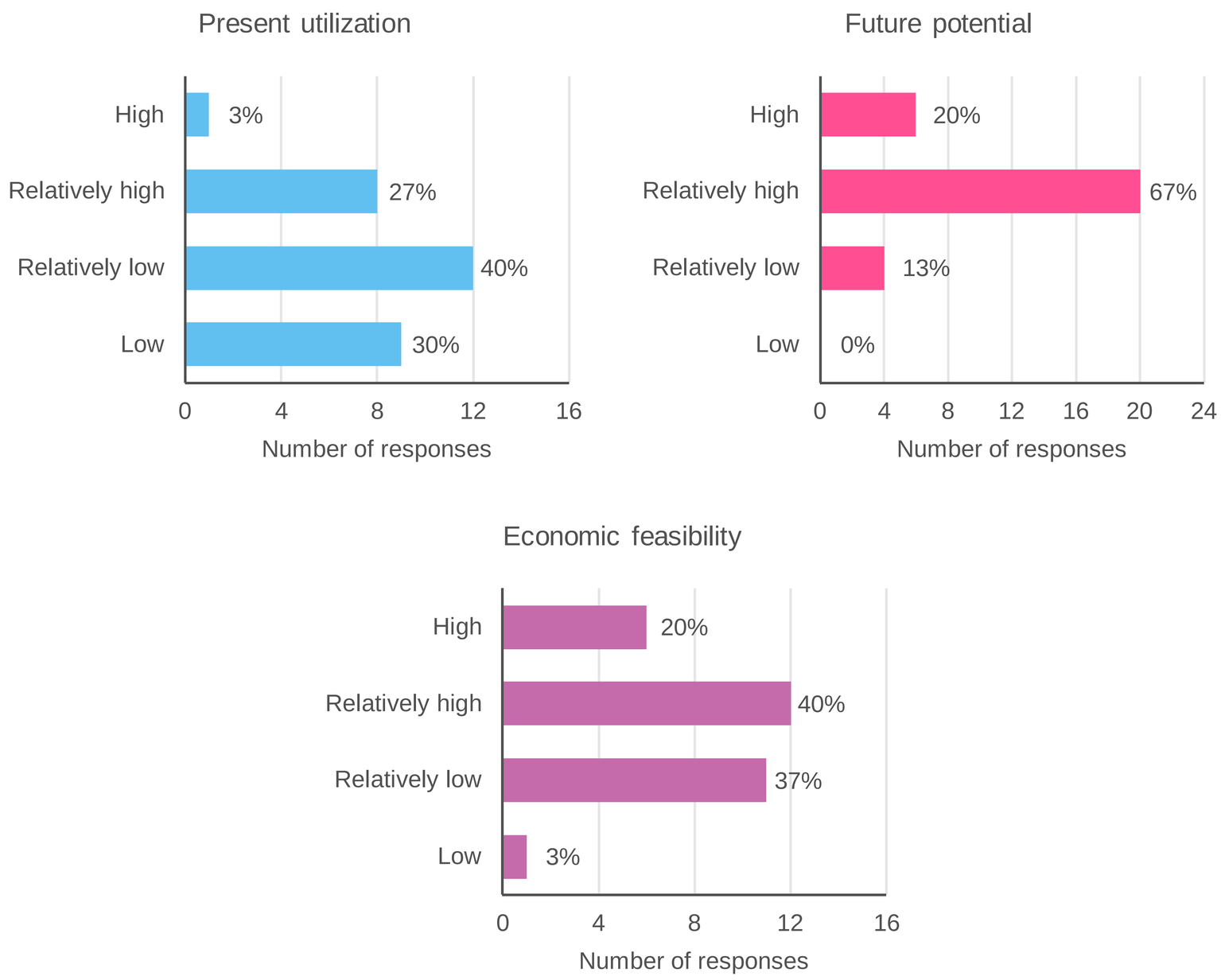

Figure 8. DSOs views of open databases. Present utilization rate, future potential and economic feasibility in asset management. Number of responded DSOs is 30.

2.4 Benefits of aerial photography

Aerial photography is an efficient tool to overview the area of operated energy system. Thus, several DSOs have taken it as a constant part of network operation and planning. At present aerial photography is a hot topic because of developed technology that has made unmanned aerial vehicle (UAV) a real option for a helicopter flight. The most significant benefit of the UAV is the price and thus it can be multiplied easily providing more efficiency for the observation of the environment. The issue was approached in the questionnaire with a statement “Unmanned aerial vehicles bring aerial photograghy to part of daily operation”. The majority of the DSOs agreed (83%) with the statement that indicates the potential of UAVs (Figure 9).

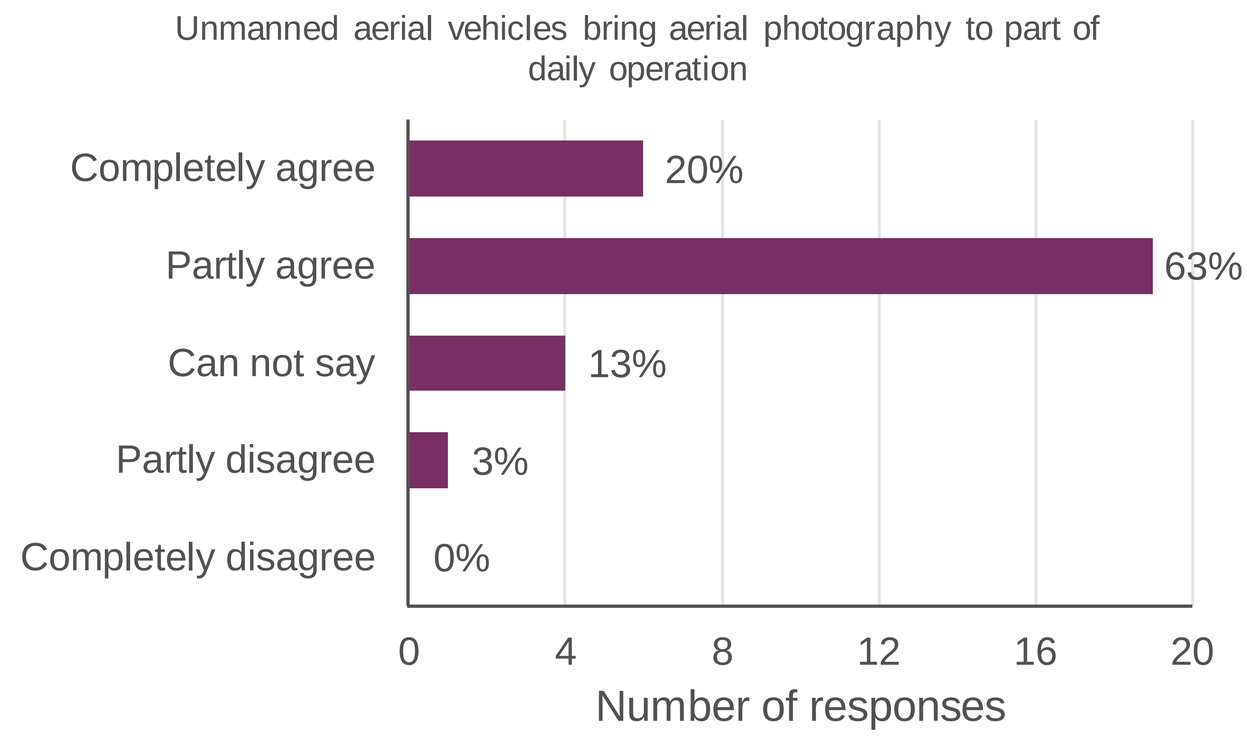

Figure 9. The role of UAVs in daily operation and thus in asset management. Number of responded DSOs is 30.

The DSOs were also asked to assess the usability and potential of aerial photography as part asset management. Figure 10 shows the responses of the DSOs. It can be observed that present use is quite moderate, but again major part of DSOs see potential (80%) in aerial photography. In addition, the economic feasibility is seen “high” or “relatively high” in most of the companies (67%)

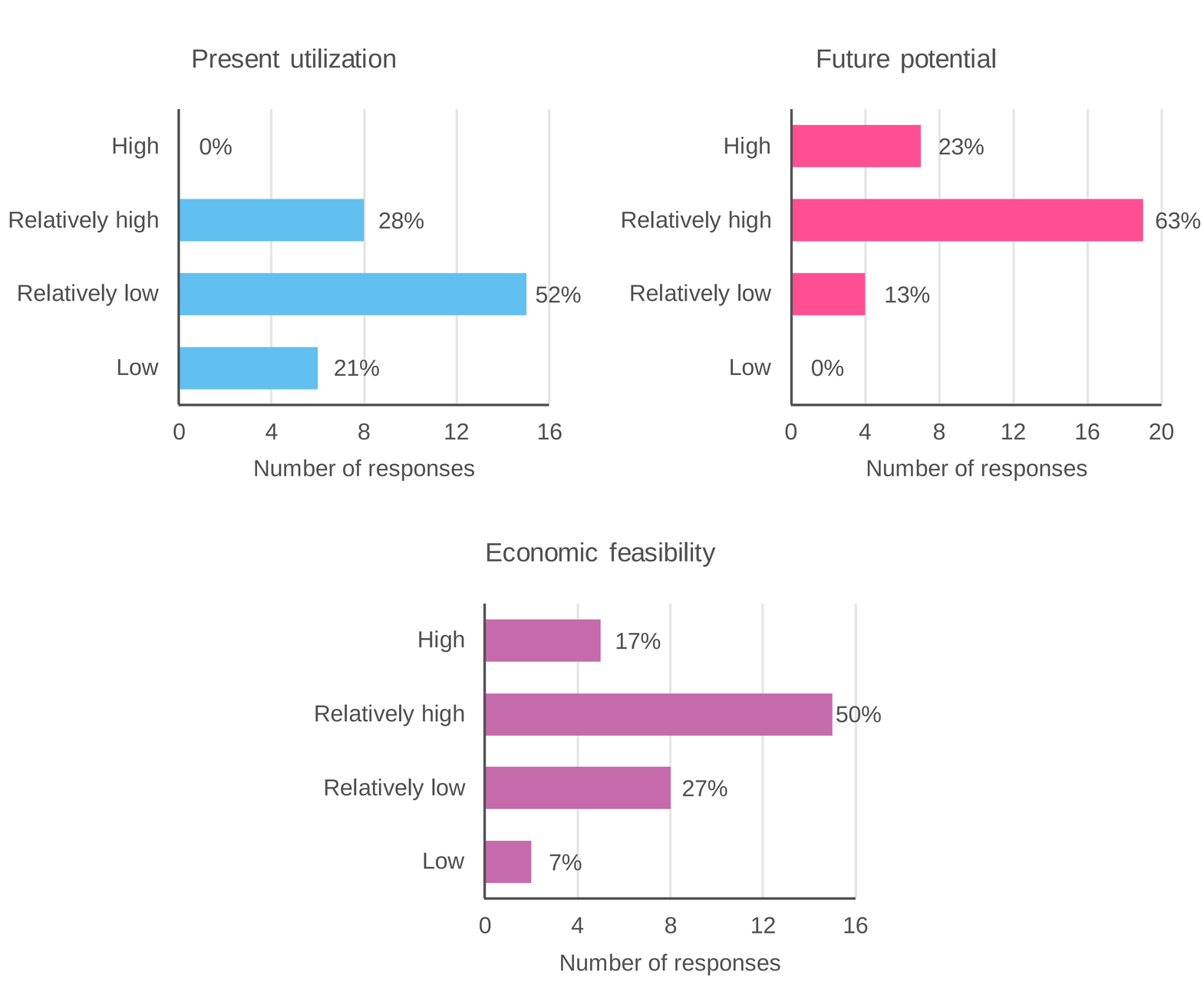

Figure 10. DSOs views of aerial photography. Present utilization rate, future potential and economic feasibility in asset management. Number of responded DSOs is 30.

2.5 Utilization of weather data

Weather data have a significant role to assess operational part of energy system planning. For instance, forecasting of irradiation or windiness can provide crucial information for the system to estimate production of photovoltaic panels and wind turbines. Thus, forecasts effect on the dimensioning and operation of the energy networks. In addition to the weather forecast, the weather statistics have important role in providing information, such as lightning statistics, to develop network reliability.

Figure 11 presets the DSOs responses to a statement “Weather information and forecast have essential role in strategy process”. Biggest part (74%) of the DSOs agrees with the statement, which indicate the importance of compiling the statistics and knowing of the weather.

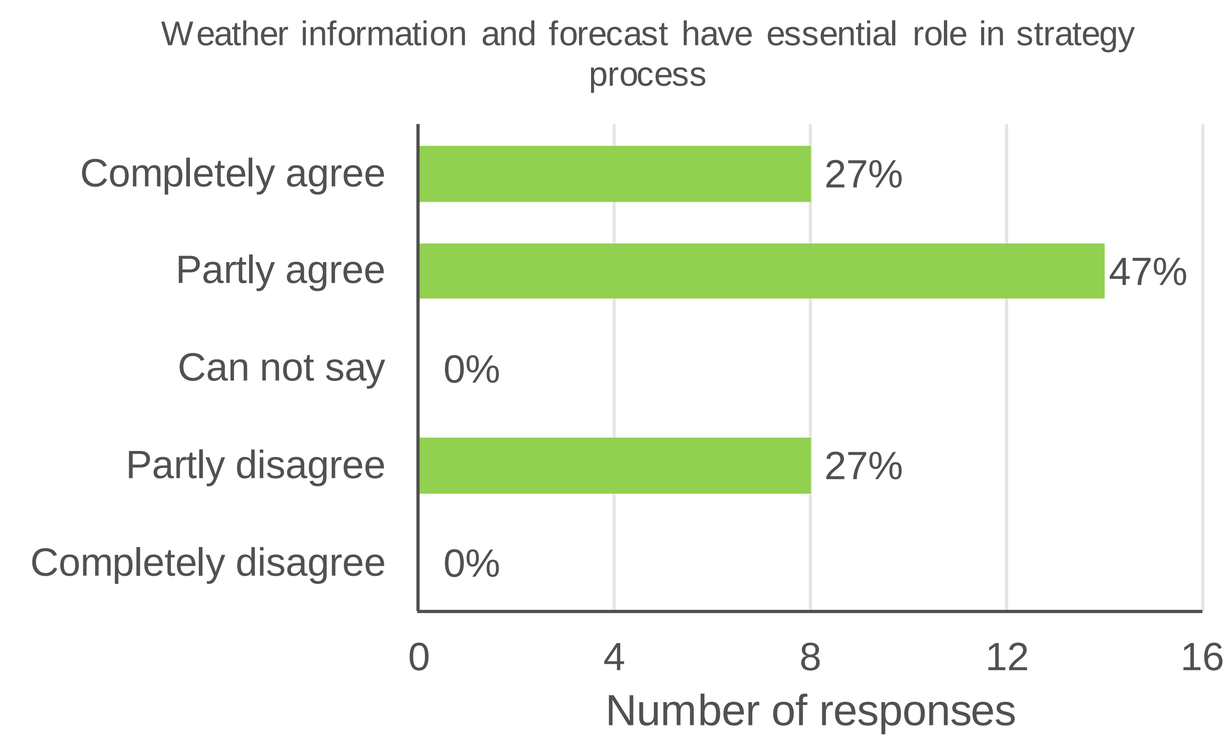

Figure 11. The role of weather information and forecasts in asset management. Number of responded DSOs is 30.

In the questionnaire, the weather aspect was approached more closely with assessment of the present utilization and potential of temperature, windiness and lightning as part of asset management. Figure 12, Figure 13 and Figure 14 shows the responses of the DSOs. The responses indicate that the present utilization is not high in considered cases that is also the result of the assessment of the potential in future.

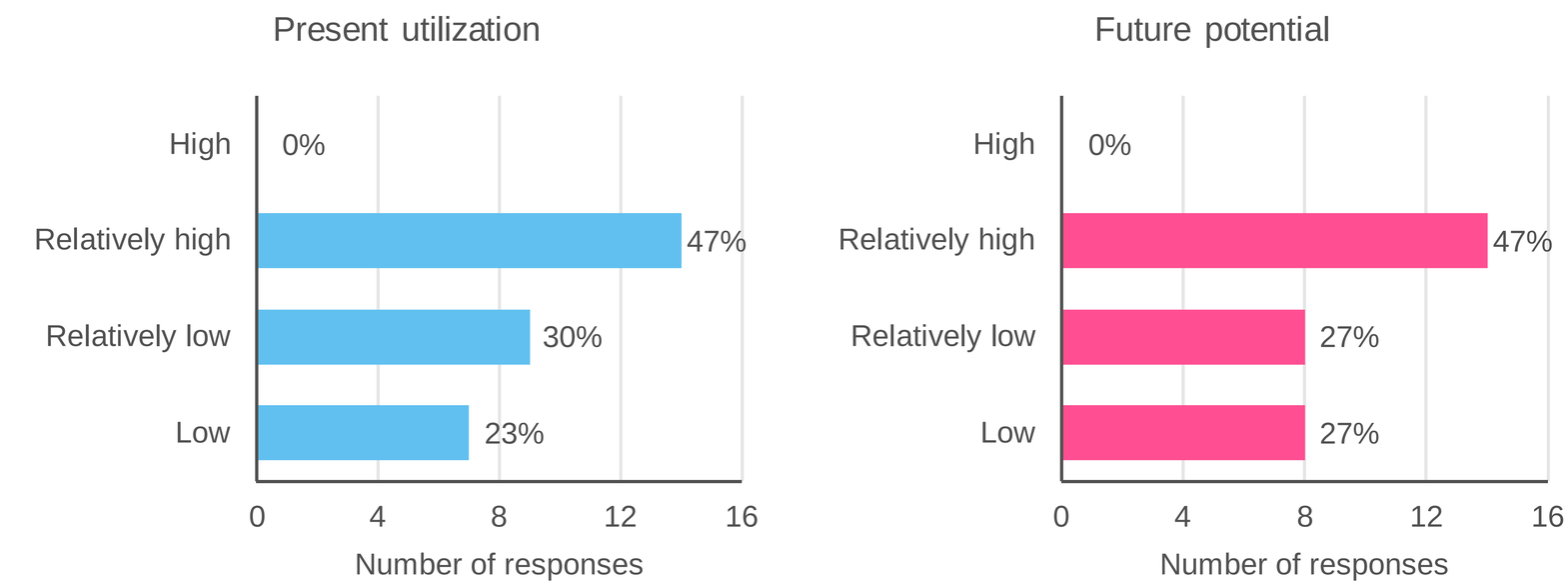

Figure 12. Role of environment temperature in asset management. Present utilization rate and potential. Number of responded DSOs is 30.

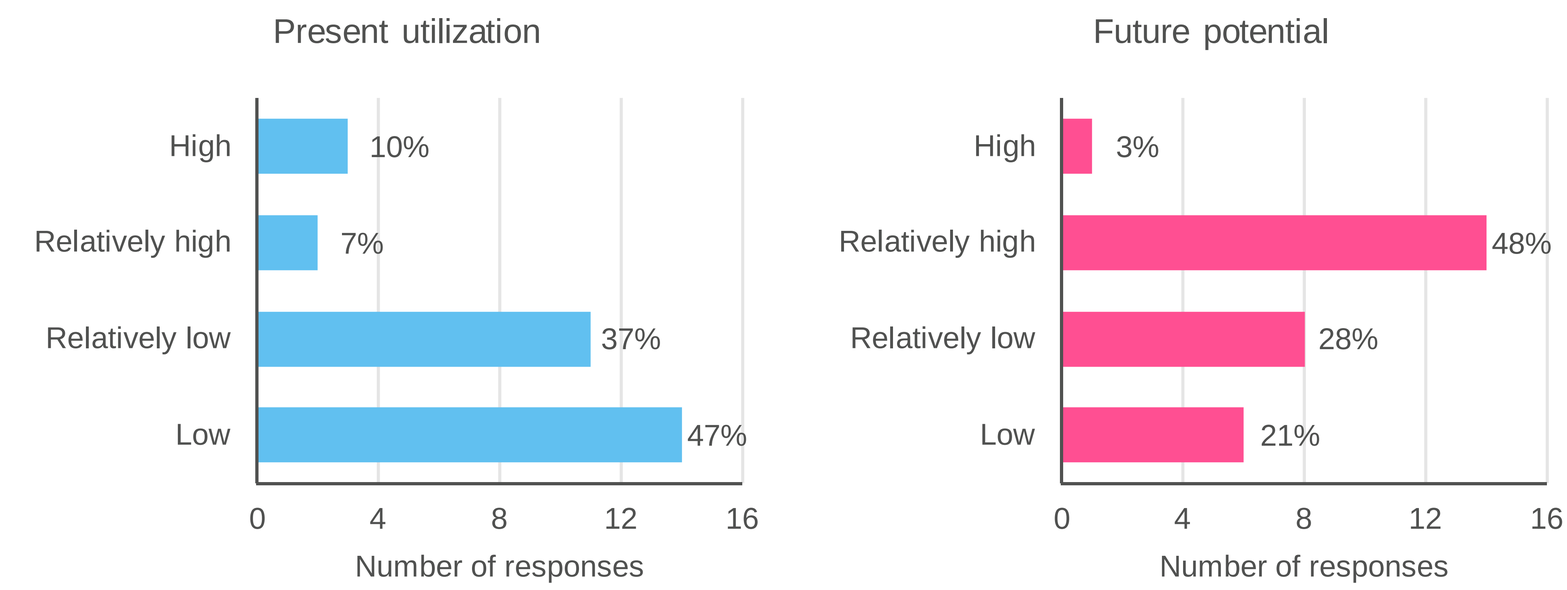

Figure 13. Role of windiness in asset management. Present utilization rate and potential. Number of responded DSOs is 30.

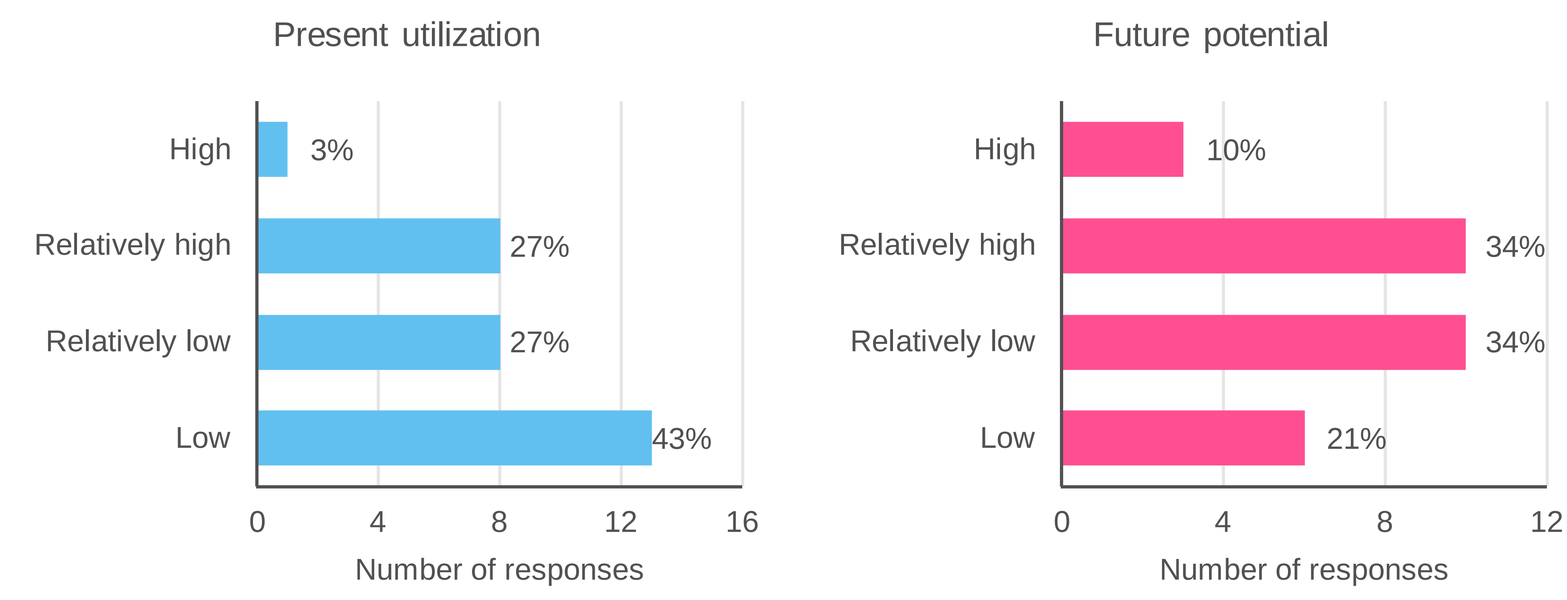

Figure 14. Role of lightning in asset management. Present utilization rate and potential. Number of responded DSOs is 30.

2.6 Discussion

This study is based on a questionnaire focused on electricity distribution system operators. A challenge in this type of research is to form the questions so that the results describe the actual situation in the research area. The goal of the study was to determine the economic feasibility of data harvesting in asset management and the study provides an assessment of the feasibility.

The responses of the reached DSOs indicate that data harvesting has potential to improve asset management process by a feasible way. The responses were quite similar in most of the subjects. Typically a small proportion (10–20%) of DSOs indicated “high” potential or feasibility for the subject and a bigger amount (40–70%) of DSOs indicated “relatively high” potential or feasibility. Only the potential of weather related issues were ranked lower where at least half of the DSOs assessed that the potential is low or relatively low.

3 Conclusion

A general viewpoint in the electricity distribution sector is that, at present, the opportunities of grid measurements, open data and other new possibilities are either not used in asset management or the utilization rate is rather low, but though, there are significant opportunities to develop the processes so that they improve asset management. Moreover, in general the DSOs see the processes feasible, which indicate that the DSOs would be interesting in developing the data exploitation processes or to buy services, which utilize the available data to enhance the asset management.