Bandweaver

WHITE PAPER

# What are the economic benefits of Distributed Acoustic Sensing (DAS), Distributed Temperature Sensors (DTS) and Real Time Thermal Rating (RTTR) systems for transmission and distribution cables?

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One of the first questions asked when procuring or designing a DAS, DTS and/or RTTR system within a power cable monitoring scenario is always 'What are the benefits and the potential payback systems?'. This information can be hard to actively quantify, partly due to the complex nature of the full installation, but also due to the proprietary nature of the information (both technical and commercial).

This article discusses this topic and uses a few key data points in order to quantify certain elements of this argument.

## What are the applications where RTTR, DTS and DAS are required?

There is a range of applications where RTTR, DTS and DAS are utilized within power cable monitoring:

- Cable rating for buried cable and cable tunnels
- Accidental Third Party Interference (TPI) from road construction
- Perimeter and access Intrusion Detection Systems (PIDS)
- Overhead line galloping
- Metal theft from overhead towers
- Fault location in buried and subsea cables
- Subsea cable location
- Detection of anchor damage to subsea cables

Due to variable project size and the importance of specific monitoring applications to a specific scheme means, the benefits both operationally and in monetary terms will differ from application to application and from site to site.

## What are the potential benefits?

There are obvious gains and the impact can be clear in the short term in some cases, but many of these are part of longer term strategic initiatives and are intangible. These are difficult to quantify but that said, their scope can be huge particularly in terms of reputation damage and litigation.

Some of the potential benefits are detailed below:

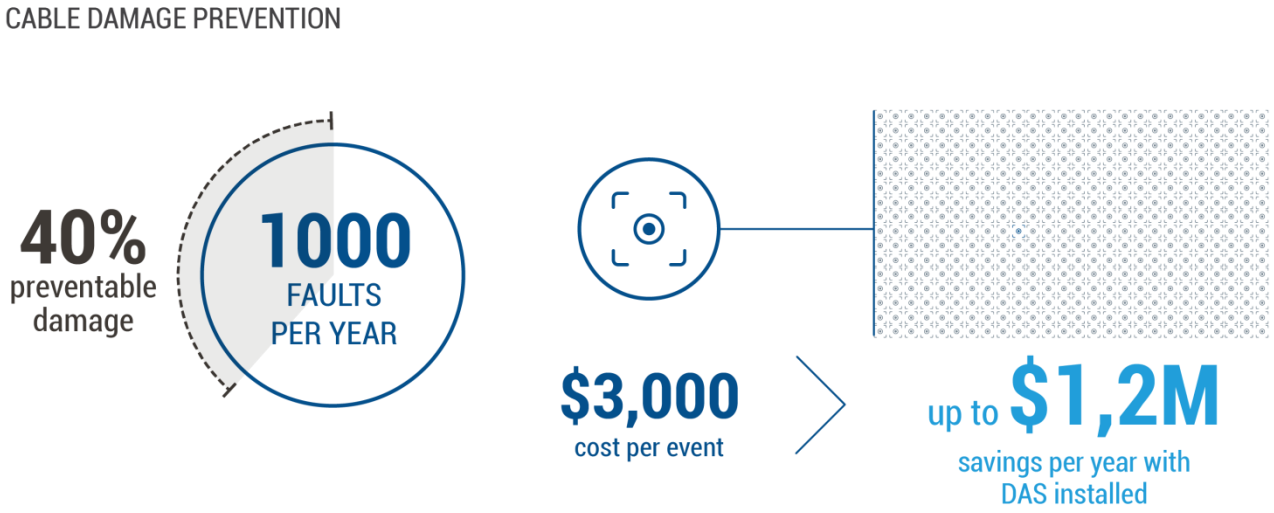
- Protection of reputation – Rapid and focused decision making which improves custodianship over grid assets
- Improved situational awareness, increased compliance, reduced risk of fines and lower insurance premiums
- Optimization of planned maintenance program and reduction in unscheduled downtime (Identification of potential thermal bottlenecks / pinch points..)
- Improved security, lower potential for malicious or accidental Third Party Intrusion (TPI)
- Reduced downtime leading to improved return on investment and delayed capital spending
- Defer costly upgrades - Maximization of component lifetime increasing return on investment and delayed capital spending
- Ease of installation, lowering overall cost of ownership (Increase the yield of distributed generation)

## EXAMPLE ONE: Return on Investment Calculation - DAS Prevention of Cable Damage

There are cost benefits of DAS for use in the prevention of cable damage, which is prevalent both to overhead lines and underground cables.

One Asian operator reported that on their distribution network they had 900 sections of cable. This was a local network which could be covered by a single DAS unit.

In this region they reported 1000 faults per year, with 40% due to cable damage, which could have been prevented through early detection. The cost per event was $3000 leading to a cost of $1,200,000 per year.

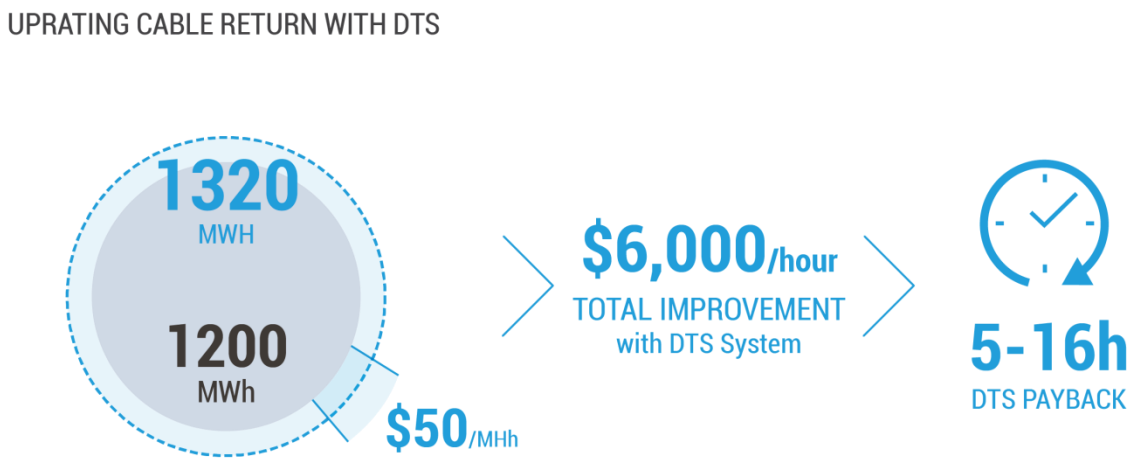



If we assume that the cost of a DAS is in the range from $100,000 to $500,000, and we make a conservative assumption that the DAS would detect and prevent 50% of these events, then the return on investment for the initial year is in the range of 83-600%.

## EXAMPLE TWO: Payback – the financial benefits of uprating of cable

BC Hydro illustrates the cost benefits of DTS for use in the ability to uprate cable. Using DTS and the RTTR system, this company was able to uprate their cable from 1200MWh to 1320MWh for the steady state cable rating[1].

If we take a price of $50 / MWh this means that the financial benefits for the additional rating are $6,000 per hour for every hour where this additional capacity is used.




If we take the range of DTS price from $30k to $100k, this means that the payback for the DTS is between 5 and 16 hours.

Although the additional capacity will not be required on a daily basis, the payback is very quick when it is.

## EXAMPLE THREE: Payback Reducing Downtime by Preventative Maintenance

A well planned Preventative Maintenance (PM) plan can be one of the most effective ways to reduce unplanned downtime and to defer capital spending.

Transpower proactively defines and breaks down their maintenance on a preventative and corrective basis, see figure 1 referenced in their RCP2 Maintenance Forecast 2013[2].

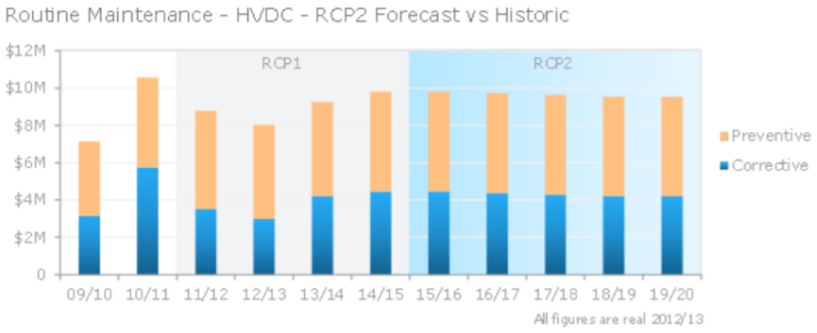
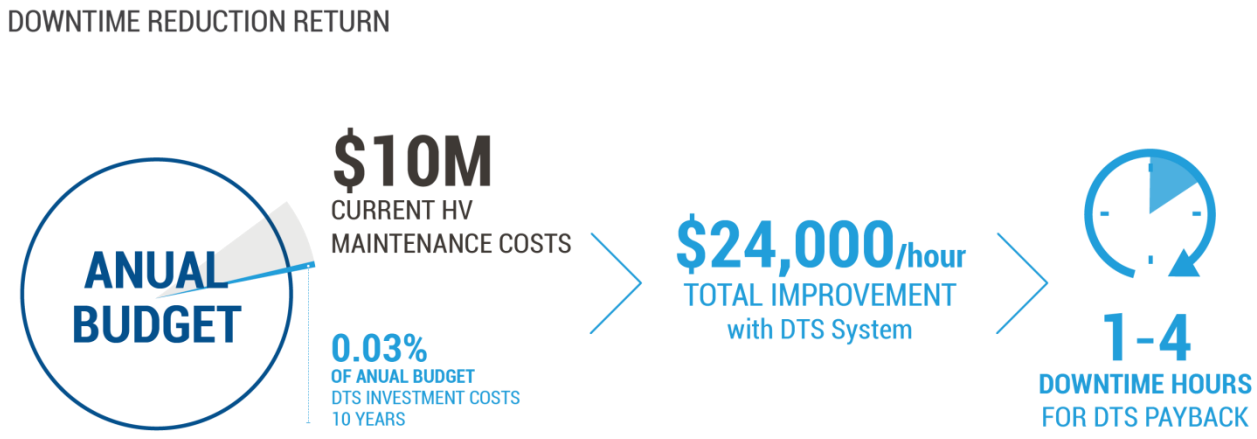



Figure 1

For HV cable alone the run rate of maintenance is $10M. If we use the figure $30 to $100k cost for a DTS and assume this lasts 10 years (Bandweaver MTBF* is >19 years for example), this corresponds to 0.03% of the annual budget.




For a 1200MV cable and assuming a 40% capacity at $50/MWh , the revenue per hour is $24,000. Again, if we take the cost of a DTS in the range of $30k to $100k, then all it needs to do is prevent 1 to 4 hours of downtime per year to pay for itself.

## THINKING LONG TERM

Although the above examples are very crude, they provide an insight into the magnitude of the savings made. These are reactive examples showing short term gains. It is important to think strategically but there are challenges.

One problem is that the benefits can often be deferred further down the line (sometimes as long as 40 years, which exceeds a lot of individual careers within a company), therefore it's important to think long term when considering capital spending on DTS/DAS at the beginning of the project.

Similarly, companies assessing capital spending should consider how the spend may protect a company's reputation. It is vitally important to plan ahead – prevention is better than cure.

## References

1. TD world article on BC Hydro uprating of cable
http://tdworld.com/underground-tampd/monitoring-produces-higher-cable-ratings
2. Transpower RCP2 Maintenance Forecast
https://www.transpower.co.nz/sites/default/files/uncontrolled_docs/AP02%20-%20RCP2%20Maintenance%20Forecast.pdf

*Mean Time Between Failures

## About Bandweaver Technologies

Bandweaver has been providing advanced fiber optic monitoring sensors and integrated technologies since 2002. Their technology portfolio covers a wide range of sensors including distributed Temperature Sensors (DTS) and Distributed Acoustic Sensors (DAS) and integrated smart intelligent software solutions. Within the Power and Utilities sectors, Bandweaver's distributed fiber optic acoustic and temperature sensing systems provide the operator with real time critical information on their network. This assists in reducing planned and unplanned maintenance and avoiding catastrophic failure along with managing risk effectively.
www.bandweaver.com

## Media Contacts:

If you would like further information please contact our marketing partners:

**Austin Marketing**
214 Station Road
Addlestone
Surrey KT15 2PH
+44 (0)1932 847 006
marketing@austinmarketing.co.uk