**IEA Implementing Agreement on**
**Electricity Networks Analysis, Research and Development (ENARD)**

# *Annex I Briefing Sheet*

## *"Active Network Management"*

### Annex I: Information Collation and Dissemination

## Introduction

Active network management (ANM) can be described as the control and management of network equipment and the devices they serve in normal conditions to enhance the utilisation of the network assets and minimise the requirement for their reinforcement. A working definition of ANM is "systems that implement pre-emptive action to maintain networks within their normal operating parameters".

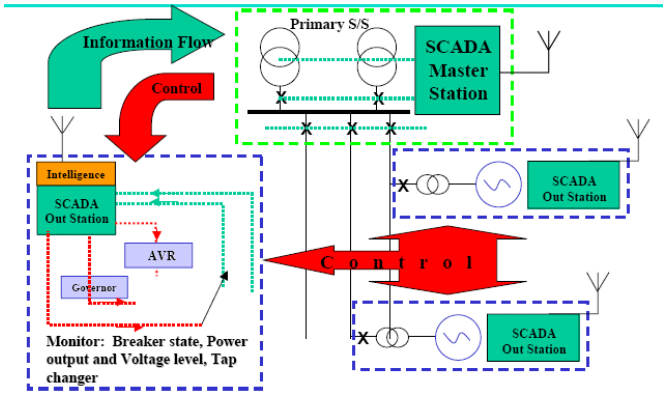
Opportunities for active management of networks are constrained by the large amount of existing equipment that is only part of the way through a long service life and is too expensive to replace early. Overall central control of large distribution networks is unlikely to be a realistic option. The lower voltage parts of the distribution network were designed for simple operation without active control. ANM does not include returning a network to its normal state following a fault or the operation of protection systems to manage faults and maintain a safe system.

## Active Networks

Distributed generation (DG) is often located in areas where infrastructure is sparse, conventional network reinforcement is costly and there are associated planning and environmental challenges.

A more interactive approach would enable the connection of more DG without reinforcement. Such an approach requires networks to be designed and operated such that both the generation and demand connected to them are actively managed.

An overview of how this "control" could be achieved is shown in the figure below:




Active Networks – Interactive Overview

Currently, control and acquisition of information is achieved from a central control scheme for the higher distribution voltage levels, although there is also some reporting from lower voltage control schemes to the central control system. Increased penetration of monitoring and control capabilities within the lower voltage networks is necessary for the evolution of Active Network Management.

Technologies that would extend the capabilities of a distribution system in the future include:

- communication and control systems;
- data acquisition and management;
- demand side management;
- energy storage;
- fault level management;

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- network monitoring and automation;
- power electronics;
- power flow management;
- protection systems; and
- voltage control.

## Management of Generation and Demand

Recent ANM schemes have demonstrated the potential for facilitating increased levels of DG without expensive network capital expenditure through either active voltage control or application of generator constraints via an extension of inter-tripping to meet network thermal limits.

The existing primary electrical infrastructure and the communications and control systems of distribution networks are capable of supporting some active management of generation and demand. Also, contractual arrangements with both generators and customers could include real time interaction of demand and generation. However, the integrated control of individual generation and demand customers, multiple generating units and network devices requires more radical thinking.

## Applications for ANM Devices

A new generation of digital relays and other Intelligent Electronic Devices (IEDs) enables new monitoring applications at all levels of the network which could facilitate the wider adoption of ANM.

Some applications for which ANM can be used are:

- Fault level control - the presence of DG increases fault levels - there are various options to control the increase;
- Security of supply - for higher voltages, a number of generators can be regarded as equal to the security provided by a parallel transformer;
- Network voltage control (real and reactive power flows) - distributed generators could modulate output to help maintain network voltage levels;
- Control system power flows via changes in network configuration; and
- Reduction in the number of short customer interruptions via short term islanding.

Using existing technology it is possible to implement local ANM solutions, but these are often not being implemented either because the technology is new or because there are insufficient business drivers for network operators to trial ANM solutions.

## ANM Developments

Although some ANM solutions are being put into practice or trial, many ideas are still at the research or development stage.

The extent of truly 'active network management' of distribution networks is currently quite limited. There are however a significant number of techniques at the research, development and field trial stage, potentially providing a platform for future implementation, either as a final solution, or to postpone network reinforcement.

Commercial drivers will also determine the extent of longer term implementation.

A diagrammatic illustration of the process to develop ANM is given below.

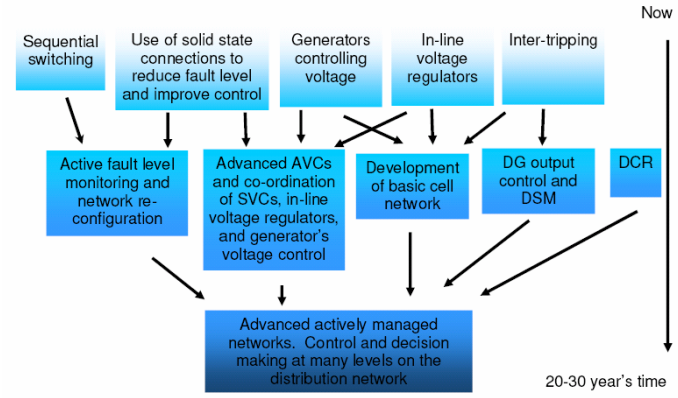


Illustration of the process to develop ANM

## References


1. Overview of ANM developments and practices in GB, International Conference on Electricity Distribution, CIRED, Vienna, 2007, Paper 714
2. A technical review and assessment of ANM infrastructures and practices, EA Technology, UK Distribution Working Group Programme 3, 2006, Report DTI URN Number 06/1196




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