



International Energy Agency

Implementing Agreement

on

**ELECTRICITY NETWORKS ANALYSIS, RESEARCH
AND DEVELOPMENT
(ENARD)**

PROGRAMME OF WORK

October 2009-September 2010

prepared
by

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1. Introduction

The present document describes the Programme-of-Work (PoW) for the fourth full year of the IEA Implementing Agreement on Electricity Networks Analysis, Research and Development (ENARD), October 2009 to September 2010. The PoW describes the specific activities that will be undertaken within ENARD during this fourth year, their anticipated outcomes and deliverables, the budgetary and Contracting Party financial provisions, together with an indication of the continuation and development of these activities, into the fifth year of ENARD's present 5 year Term. The PoW should be read in conjunction with the ENARD's Strategic Plan¹, which describes the vision and mission of the Implementing Agreement, its aim and objectives, operating structure, results and information protection and benefits, over its initial five year term, October 2006 to July 2011. The PoW contained herein was formally approved by the 7th ENARD Executive Committee (ExCo) meeting, held in Fredericia, Denmark, 21st-22nd October 2009.

2. Aim and Objectives

ENARD's aim is to develop as an authoritative, comprehensive and unbiased international source of information, data and advice, such as to inform Governmental officials, policymakers and key industry stakeholders of the pertinent issues relating to current and anticipated developments in electricity Transmission and Distribution (T&D) networks. The development of ENARD will also contribute to fulfilment of the objectives of the IEA's G8 Gleneagles Programme.

The objectives for ENARD's fourth year PoW will be coincident with those stated in the Strategic Plan, viz:-

- the collation, exchange and promulgation of information and data in relation to current and anticipated electricity T&D developments within the participating countries and associated programme activities;
- the in-depth review and analysis of the associated key research and development (R&D), design, operational and management issues in relation to electricity transmission networks;
- the complementary in-depth review and analysis of a range of key issues relating to the R&D, design, operation and management of electricity distribution networks; and

¹ IEA Implementing Agreement on Electricity Networks Analysis, Research and Development (ENARD). Strategic Plan, October 2006 to September 2011. Issue 1.0, 30th March 2006.

- the in-depth review and analysis of prevalent and anticipated regulatory frameworks and their associated impact on the economic evaluation and optimisation of network asset portfolios.

It is anticipated that the primary emphasis of the fourth year's activities will be in relation to the first three of these objectives.

3. Organisational and Management Structure

ENARD will be executed and delivered as an Implementing Agreement within the IEA's Energy Technology and R&D framework. In particular, it will be enacted by an organisational and management structure comprising:-

- An Executive Committee (ExCo), comprising Delegates from all the participating countries ("the participants"). The ExCo will be responsible for the ongoing development of an operational roadmap for ENARD, the identification, prioritisation and selection of particular work areas for analysis and review, the periodic review of the operational Annexes and the associated upward reporting to the End Use Working Party (EUWP) and the Committee on Energy Research and Technology (CERT). The ExCo Delegates will reflect and service the overall core objectives of ENARD.
- The ENARD Secretariat will support and facilitate the ExCo in the discharge of its duties.
- A series of specific operational Annexes, each with its own Operating Agent, to discharge the PoW in particular areas. Various sub-sets of the ENARD participant base will participate in one or more of the operational Annexes.

Figure 3.1 illustrates ENARD's organisational and management structure. Activities within the fourth year's PoW will principally relate to the delivery of the Annex I (Information Collation and Dissemination) work programme, including the delivery of a major international workshop "Electricity Grids – a key enabler in the delivery of a sustainable energy policy", the conclusion of the initial phases of Annexes II and III (DG System Integration and Infrastructure Asset Management, respectively) and the ongoing delivery of Annex IV, in relation to transmission system issues. Annexes II and III will also consider the case for the possible extensions of their respective work programmes, which may then be submitted to the ExCo, for its consideration and approval.

Significantly, the ExCo will also initiate discussion into the case for any renewal of ENARD's present 5 year Term, from July 2011 on, with a view to coming to a decision to request any such renewal (or otherwise), no later than the 8th ENARD ExCo Meeting, to be held Paris, France, April/May 2010. Consideration may also

be given to the case for developing any further new Annex(es), as may be deemed appropriate by the ExCo.

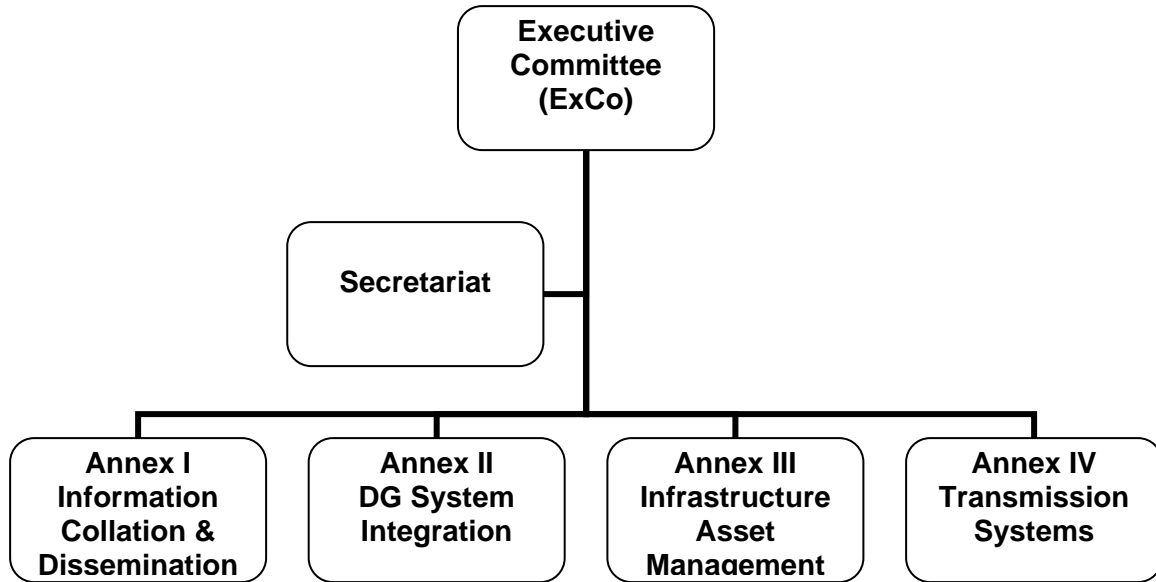


Figure 3.1:- Organisational and Management Structure

4. Programme of Work

The fourth year's PoW will principally relate to the ongoing delivery of the Annex I (Information Collation and Dissemination) work programme, including the delivery of a major international workshop "Electricity Grids – a key enabler in the delivery of a sustainable energy policy", the conclusion of the initial phases of Annexes II and III (DG System Integration and Infrastructure Asset Management, respectively) and the ongoing delivery of Annex IV, in relation to transmission system issues. Annexes II and III will also consider the case for the possible extensions of their respective work programmes, which may then be submitted to the ExCo, for its consideration and approval.

The ExCo will also initiate discussion into the case for any renewal of ENARD's present 5 year Term, from July 2011 on, with a view to coming to a decision to request any such renewal (or otherwise), no later than the 8th ENARD ExCo Meeting, to be held Paris, France, April/May 2010.

The anticipated scheduling of these activities is as shown in the Gantt chart below, figure 4.1.

Activity	Year							
	2009	2010				2011		
ExCo meetings	*		*		*		*	
Annex I								
Annex I workshops	*		*		*		*	
Annex II								
Annex III								
Annex IV								

Figure 4.1:- Programme of Work, October 2009 on

All countries participating in ENARD will participate in Annex I, with sub-sets of the overall ENARD participant base having the option to participate in Annexes II, III, IV and any further Annexes, as the Implementing Agreement develops.

4.1 Annex I: Information Collation and Dissemination

Scope

The central focus of Annex I in the year ahead will relate to the planning, organization and delivery of the ongoing series of topical workshops, the organisation and delivery of the major international workshop “Electricity Grids – a key enabler in the delivery of a sustainable energy policy”, the delivery of the information sub-task and the ongoing maintenance and development of the ENARD web-site. Annex I will also be responsible for the engagement with other initiatives and programmes, the facilitation and promotion of the Implementing Agreement as a whole, the provision of support to Annexes II, III and IV and the facilitation any further follow-on Annex(es), as may be deemed appropriate.

Workshops

The organisation and delivery of topical T&D related workshops will continue to be an essential element of Annex I, with candidate workshops for consideration during the Year 4 PoW including:-

- Balancing the variability of renewable electricity supplies (delivered October 2009);
- The major international workshop “Electricity Grids – a key enabler in the delivery of a sustainable energy policy”;
- “Markets & Regulation – financing the Smart Grid”

The first of these workshops, addressing the subject of “Balancing the variability of renewable electricity supplies”, was held October 2009, in Fredericia, Denmark and with the major international Electricity Grids Workshop to be held in Paris, 28th April 2010. The essential activities in relation to this latter Workshop are described in further detail in the sub-section below. The Year 4 PoW will also include provision for the planning and delivery of a further topical Workshop, on the subject of market and regulatory aspects, to be held September 2010.

The scope, extent and content of further workshops will be considered in the context of the overall ENARD work programme and its requirements for specific supporting information inputs, strategic guidance and direction.

Major International Workshop “Electricity Grids – a key enabler in the delivery of a sustainable energy policy”

The fourth year’s PoW shall include the performance of those further activities required in relation to the detailed planning, organisation and delivery of a major international Workshop “Electricity Grids – a key enabler in the delivery of a sustainable energy policy”, to be delivered in conjunction with the Electricity Co-ordination Group (ECG) of the End Use Working Party (EUWP) and the IEA Secretariat in Paris, 28th April 2010. A commitment to the organisation of this workshop was agreed by the ExCo at the 5th ExCo Meeting, held Washington DC, 22nd-23rd September 2008.

Information and Data Collation Activities

Annex I will continue to address a broad cross-section of issues, including those in relation to developmental, design, operational, maintenance, investment and regulatory aspects, all within the particular context of the developing challenges of network renewal, renewables integration and network resilience. Provision is made in the Annex I workplan for the performance of specific information collation and reporting activities, as may be requested by and agreed with the ExCo. Such activities may, for example, be called for by the ExCo to inform them on particular topics and issues and may either be solely for the consideration of the ExCo or for the purpose of more widespread dissemination, e.g. via the ENARD website.

It is envisaged that in servicing the requirements of this subtask, EA Technology will aim to access a representative cross-section of information drawn from various technical, scientific, utility, trade and conference publications, supplemented via specific dialogue with recognized experts in the field, drawn both from within and external to the ENARD participant base.

Specific outcomes from these activities are expected to include special purpose reports and/or specific factual briefing sheets.

Web Site and Dissemination Activities

Annex I will be continue to be responsible for the development and maintenance of the fully functional ENARD web-site (www.iea-enard.org). This will continue to service the requirements of the Implementing Agreement as a whole and will serve as the principal dissemination mechanism for ENARD, both within the participant base and Annex structure and on a wider open access basis. The former is and will continue to be satisfied via a series of restricted access arrangements, catering for the requirements of the ExCo, Secretariat, Annexes I, II and III and IV and any other operational Annexes, as appropriate². The public

² Noting that such other operational Annexes will be responsible for funding their respective area(s) of the web-site

access area of the web site will continue to provide overview descriptions of ENARD, its activities and Annexes, topical briefing sheets and workshop profiles, links to publicly available reports and will generally serve as a marketing tool for the Implementing Agreement.

Dissemination activities will be essentially two fold, viz:

- the exchange of confidential information and data, within Annex I and other operational Annexes, and to be limited to the individual Annex participants themselves;

and

- the provision of top level overview reports and outputs, not containing any sensitive information or data and suitable for publication in the public domain.

The subject of information exchange and confidentiality is discussed in more detail in section 5.

Operating Agent's Responsibilities

The Annex I Operating Agent will continue to be responsible for the overall management and delivery of its work programme and will work closely with the individual National Co-ordinators, such as to ensure the effective and expedient delivery of its objectives. It will continue to discharge its duties via the organisation and delivery of a programme of Workshops/Experts' Meetings, including the major international Workshop and via the specific further activities, as described below. The Operating Agent will submit regular six monthly reports to the ExCo and will implement the decisions of the ExCo.

The Operating Agent will source and collate appropriate information and data, as may be required by the ExCo for the preparation of specific special purpose reports and/or fact sheets. The Annex I Operating Agent will liaise with and accommodate the complementary activities of other international T&D programme activities and initiatives, including those of IEA, CIRED, CIGRE the European Commission, Eurelectric and IEEE. Appendix 1 provides a summary of complementary developments and initiatives, which are likely to be of particular interest in the present context; the participants in the Annex are also invited to propose linkages with further complementary initiatives, as appropriate. The Operating Agent will facilitate introductions and exchanges of information with these complementary initiatives on behalf of the other operational Annexes, as appropriate.

The Operating Agent will be responsible for working closely with selected National Co-ordinator(s) in relation to the organisation and delivery of the topical

Workshop(s), to be held in the Year 4 Annex I PoW and as described above. This/these Workshop(s) will identify pertinent issues for further consideration within the overall context of the Implementing Agreement, provide supporting input to the development of any further new Annex activities and support the specific dissemination objectives of Annex I.

The Operating Agent will be responsible for the ongoing maintenance of the ENARD web-site and will work closely with the ExCo, the Secretariat and Operating Agents of the other ENARD Annexes, in order to accommodate their requirements.

Annex I National Co-ordinators' Responsibilities

The Annex I National Co-ordinators will be responsible for the collation of relevant national T&D related information and data and for the submission of this to the Operating Agent, as may be required for the Operating Agent to fulfil its obligations to the ExCo. The National Co-ordinators' (or their nominees) will attend and participate in the Annex I Workshops and will support the Operating Agent, as may be required, in the collective analysis and discussion in respect to this information. The National Co-ordinators will also take the lead responsibility in relation to the dissemination of the Annex outputs on a national basis and in the engagement of relevant stakeholders in their respective countries.

Deliverables

The formal deliverables from Annex I will comprise workshop proceedings, special purpose reports, factual briefing sheets, outline proposals for candidate follow-on Annexes, the maintenance of the fully functional ENARD web-site and various other disseminational material. Specific deliverables from the Year 4 programme-of-work are expected to comprise:-

- the organisation and delivery of at least one topical workshop (on the subject of “balancing the variability of renewable electricity supplies”) and the publication of the associated proceedings;
- the organisation and delivery of the major international Workshop “Electricity Grids – a key enabler in the delivery of a sustainable energy policy” and the publication of the associated Workshop proceedings;
- initiation of the advance planning for and delivery of a further topical Workshop, to be held in conjunction with the 9th ExCo Meeting, September 2010;
- the production of a series of selected special purpose reports and/or factual briefing sheets, as to be agreed with the ExCo;
- the ongoing maintenance of the fully functional ENARD web-site, www.iea-enard.org; and
- the production of an intermediate (six monthly) and a Year 4 annual progress report, for consideration by the ExCo.

4.2 Annex II: DG System Integration

Details of the Annex II programme-of-work, associated activities, deliverables, funding and resource commitments for the year October 2009 to September 2010 are as provided in Appendix 2. Annex II was formally adopted by the ENARD Executive Committee, at its September 2007 meeting and commenced work via its inaugural Experts' Meeting, held Vienna, Austria, 13th-14th May 2008. It is therefore due to conclude its initial 24 month work programme, May 2010. The Annex II Operating Agent will discuss the draft findings from its work to date at its December 2009 Experts' Meeting, including the case for any further work, to be performed from May 2010 on. Any such case for such further work would then be presented to the 8th ExCo Meeting, April 2010, for the ExCo's consideration and approval.

4.3 Annex III: Infrastructure Asset Management

Details of the Annex III Phase 1 programme-of-work, associated activities, deliverables, funding and resource commitments for the year October 2009 to September 2010 are as provided in Appendix 3. Annex III was formally adopted by the ENARD Executive Committee, at its September 2007 meeting and commenced work via its inaugural Experts' Meeting, held in Chester, United Kingdom, 22nd-23rd April 2008. The present Phase 1 work programme will conclude by 31st December 2009. The Annex III Operating Agent discussed the draft findings, conclusions and policy messages from its work to date at the Annex III Experts' Meeting on 6th – 7th October 2009; including the case for a possible Phase 2 work programme. The outcome of these discussions was reported to the 7th ExCo Meeting; the Annex III Operating Agent is now to develop these into a formal Work Programme for a proposed Phase 2. This will then be progressed via Written Procedure, as appropriate.

4.4 Annex IV: Transmission System Issues

Details of the Annex IV programme-of-work, associated activities, deliverables, funding and resource commitments for the year October 2009 to September 2010 are as provided in Appendix 4. Annex IV was formally adopted by the ENARD Executive Committee, at its September 2008 meeting and commenced work via its inaugural Experts' Meeting, held Milan, Italy, 28th-29th April 2009.

4.5 Other Anticipated Activities

The activities in relation to the delivery of Annexes I, II, III and IV, including the the organisation and delivery of the major international Workshop, will comprise the principal focus of the fourth year of ENARD's activities. The fourth year will also see the ExCo give due consideration to the possibility of a formal request for a renewal of ENARD's present 5 year Term, which runs through to July 2011. Further anticipated activities in the fourth and fifth years of ENARD's present 5 year Term are anticipated to include:

- the development of the overall membership and participation base;
- the provision of underlying support to the IEA Office's G8 Grid Integration initiative;
- preparation of a circa 12 sided publication, highlighting the emerging policy messages to date, to be made available co-incidental with the April 2010 Grid Policy Workshop.
- the provision of support to the grids related chapter, due for publication in "Energy Technology Perspectives 2010" (ETP2010);
- selective engagement with the IEA Office's NEET³ initiative, including specific liaison with selected "plus five" countries;
- engagement and development of working relationships with other IEA Implementing Agreements; and
- the consideration of the basis for the development of further new Annexes, as appropriate.

5. Results and Information Protection

The principal results and outputs from the fourth and subsequent years' activities will comprise reports, databases, analyses and methodologies, developed within the framework of the operational Annexes and their associated activities.

In general terms, such results and outputs would remain confidential to the individual Annex participants for a period of not less than two years after the completion of the respective Annexes, unless all the relevant participants agree to an earlier release of information.

Each of the operational Annex(es) will also be required to produce an executive overview report of its activities, not containing any sensitive information or data, and which is suitable for publication in the public domain.

³ Networks of Excellence in Energy Technology

6. Budgetary Provisions

ENARD will be executed consistent with the organisational and management structure shown in Figure 3.1.

A funded Secretariat will be retained, for the essential discharge of this role, principally in support of the ExCo and its activities.

The ExCo will approve the appointment of an Operating Agent for each operational Annex, who will be responsible to the ExCo for the discharge and delivery of its Annex specific work programme.

The actual and anticipated budgetary provisions for the discharge of the Secretariat role and the Annex I, II III and IV Operating Agency roles, are as summarised in table 6.1 below.

All countries participating in ENARD will participate in Annex I. Sub-sets of the overall ENARD participant base will have the option to participate (or not to participate) in Annexes II, II, IV and any further Annexes, as the Implementing Agreement develops.

Table 6.1:- ENARD Budgetary Provisions, October 2009 to July 2011 (currencies as stated)

Role/activity	Budget (currencies as stated)	
	Oct.2009/ Sept.2010	Oct.2010/ July2011
Annex I Operating Agency & ENARD Secretariat (GB£)	£116,315	£103,210
Annex II Operating Agency	-	-
Annex III Operating Agency (GB£)	tbd	tbd
Annex IV Operating Agency⁴ (€)	€57,500	€14,375

⁴ Based on a 5 participants at €23,000 per participant; budget will increase pro-rata according to number of participants.

7. Contracting Party Financial and Manpower Provisions

The individual Contracting Party financial and manpower provisions will be dependent on the number of operational Annexes in which each Contracting Party chooses to participate.

All Contracting Parties will participate in Annex I and will be responsible for funding the Secretariat and Annex I Operating Agency on an equal cost share basis and will also be responsible for self-funding their own country specific activities.

Participation in any further Annex or Annexes is entirely at the discretion of the individual Contracting Parties.

Table 7.1 provides a summary overview of the provisions that need to be made for participation in Annex I, Annex II, Annex III and Annex IV.

**Table 7.1: Contracting Party Financial and Manpower Provisions
(per Contracting Party)^{5,6}**

Role/Activity	Financial/manpower provision	
	Oct.2009/Sept.2010	Oct.2010/July2011
Annex I Operating Agency & ENARD Secretariat (£)	£8,125	£8,125
Annex I National Co-ordination Role	2 man-months	2 man-months
Annex II Operating Agency	-	-
Annex II National Co-ordination Role	2 man-months/ tbd ⁷	tbd ⁷
Annex III Operating Agency (£)	tbd ⁸	tbd ⁸
Annex III National Co-ordinator Role	1.5 man-weeks/ tbd ⁸	tbd ⁸
Annex IV Operating Agency (€)	€11,500	€2,875
Annex IV National Co-ordinator Role	2 man-months	0.5 man-months

The financial provisions for any further Annexes will be defined, as their work programmes may be developed.

⁵ The actual staging of the Contracting Party financial and manpower contributions agreed between the individual Annex Operating Agents and the individual Annex participants shall take precedence over the values presented in table 7.1, provided only that their respective totals are consistent with the bases of the respective Annexes.

⁶ Any future contributions that may be required for the continuation of the Annex II and Annex III work programmes have yet to-be-determined (tbd). These shall be determined at an appropriate time and do not impose any requirements for the existing Annex II and Annex III participants to participate in any proposed further activities of either Annex II or Annex III.

⁷ As may be required for any further work, beyond initial work programme, due to conclude, May 2010

⁸ As may be required for any follow on Phase 2 work programme

Appendix 1:-

Related Activities and Information Networks

Appendix 1: Related Activities and Information Networks

It is expected that the proposed new Implementing Agreement will pursue and maintain a pro-active communications and information exchange programme with various complementary initiatives, including the following:

A1.1 International Energy Agency

Working Parties and IEA Office Initiatives:

End Use Working Party
Fossil Fuels Working Party
Renewable Energy Working Party
Electricity Co-ordination Group
Energy Technology Perspectives 2010

Implementing Agreements:

Advanced Fuel Cells
Demand Side Management
Energy Conservation through Energy Storage
Energy Technology Data Exchange
Greenhouse Gas R&D Programme
Heat Pumping Technologies
High Temperature Superconductivity on the Electric Power Sector
Hydropower Technologies and Programmes
Ocean Energy Systems
Production and Utilisation of Hydrogen
Photovoltaic Power Systems
Wind Turbine Systems

A1.2 CIRED

Principally via themes:

Alpha 3: Operation, Control & Protection of Supply System
Alpha 4: Distributed Generation – Management & Utilisation of Electricity
Alpha 5: Power Distribution System Development

A1.3 CIGRE

Study Committees and their Working Groups including:

C1: System Development & Economics
C2: Power System Operation & Control
C3: System Environmental Performance
C4: System Technical Performance
C5: Electricity Markets and Regulation
C6: Distribution Systems & Dispersed Generation

A1.4 European Commission

SmartGrids: Technology Platform for Electricity Networks of the Future

A1.5 Eurelectric

Principally via:

Environmental & Sustainable Development Committee

Management Committee

Networks Committee

Working Group for Renewable Energy Sources

Appendix 2:-

Annex II “DG System Integration”

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

**Annex II
„DG System Integration in Distribution Networks”**

Author: Arsenal Research & IRM

**IEA Implementing Agreement on Electricity
Networks Analysis, Research and
Development (ENARD)
Work Programme for Annex II**

Annex II of IEA Implementing Agreement on Electricity Networks Analysis,
Research and Development (ENARD)

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i. ENARD Vision

“To facilitate the uptake of new operating procedures, architectures, methodologies and technologies in electricity T&D networks, such as to enhance their overall performance in relation to the developing challenges of network renewal, renewables integration and network resilience”

ii. What does ENARD do for YOU?

- ENARD membership permits active participation enabling direct exchange of countries / companies / peoples experiences.
- ENARD membership active contribution to positioning countries views, intentions & problems and/or solutions.
- ENARD membership brings together various stakeholders to exchange concerns and requirements
- ENARD’s participants have a better chance to have their interests taken up in the formulation of the compendium.
- The more active participants, the more versatile the ideas, the more input and therefore a more well rounded output.

1. Motivation

Due to current energy related framework conditions and technical developments the penetration of Distributed Energy Resources (DER) and especially Distributed Generation (DG) in distribution networks increases continuously and it can be expected that this increase will even grow in the future.

These results in a growing density of electricity resources within distribution networks, where technical issues related to the bidirectional power flow, reliability aspects (power quality and continuity of electricity supply), stability aspects, network capacity, network-, energy- and load management are becoming increasingly important. The common strategy to view electricity production as a negative load and the therefore resulting „fit & forget“ philosophy is not a sustainable and applicable solution for the future. Under such conditions, a significant rise of the share of DG would only be possible with a very cost intensive extension of network capacity. In addition, modelling, ICT, market and regulatory aspects play an important role when dealing with the growing share of DG in distribution networks.

Research on active integration of DER in distribution networks has been progressing over the past, but has not managed to progress from a theoretical concept to practical real life experience with active networks. There is virtually no global collaboration at the scientific level.

2. Objectives

- to build up and exchange knowledge on DER system integration aspects and existing active network approaches amongst the global players in distribution networks,
- to develop guideline(s) for network operators and political decision makers on how to manage and implement the transition from a passive to an active distribution network,
- to promote implementation possibilities for active distribution networks as an overall goal of this Annex II.

3. Values for participating countries:

1. Participation in the global process of decentralization and regionalisation of the energy structure taking account of the leading role of IEA in global energy strategies.
2. Delivering direct input, moulding and shaping the transitional process towards active distribution networks.

3. Being integrated into an international network of outstanding experts which brings together the various stakeholders.
4. Based on early discussions for recommendations, participants have the opportunity of parallel shaping the national strategy process in related fields.
5. Identifying market opportunities at an infant stage.

4. Approach

- Identifying countries and areas with DER integration and existing active networks as well as benchmark knowledge and experience in these areas to compile international comparable information about the various integration methods of distributed generation, energy storages and flexible demand in distribution networks, thus increasing the value added of distributed generation and demand response. This will help to manage problems caused by intermittent distributed generation (mainly based on Renewable Energy Resources - RES) in the physical distribution systems and in the electricity market.
- to define concepts for active network approaches taking into account local factors and to provide recommendations on individual designs (mix of technologies, architecture, size...),
- to compile and disseminate best practice examples and guideline(s) on implementing the transition from a passive to an active distribution network,
- survey of existing models and define requirements for improved modelling and the development of new concepts,
- complement other initiatives (EU and other international RTD-Projects, work of CIGRE, ...)

5. Scope

The scope of Annex II is DER system integration into low and medium voltage networks including technical, economical, organisational and regulatory aspects and related active distribution network operations. A detailed definition of the used terms within this Annex II can be found in Chapter 13.

The work programme is organised into three tasks:

- **Task 1: Aspects for Activation of Distribution Networks**
- **Task 2: Operation and Control of Active Distribution Networks**
- **Task 3: Cross Cutting Issues, Interrelation and Dissemination**

Activities within the tasks will be carried out on a task sharing basis, as practised in other IEA programmes as well.

6. Annex II Time Table

The first activities of the proposed Annex II will start in January 2008 with a start work shop for detailed Activity / Task planning and coordination. The Analysis/Evaluation Phase itself will last for a work period of 24 months, which will start in April 2008. So far commitment is only being sought initially for the Analysis/Evaluation Phase, running for 27 months from January 2008 to March 2010. Following the successful completion of the analysis/evaluation phase, an Annex review will take place, with a view to the development of a further (optional) extension phase. These results of the Analysis/Evaluation phase and addressed needs for the Extension Phase will be presented on an international conference in Vienna in Oct. 2010.

Annex 2 - Overview Graph

	2008												2009												2010												2011												
Tasks / Activities:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	
Task 1: Aspects for transition towards Active Distribution networks																																																	
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Activity 2.3.: Guideline and Recommendations																																																	
Task 3 : Cross Cutting Issues, Interrelation and Dissemination																																																	
Activity 3.1. Workshops and Dissemination:																																																	
Activity 3.2. Vision and Value analysis																																																	

7. Responsibilities

The Operating Agent (OA) is responsible for the overall technical and administrative management of work performed within Annex II and for implementing the decisions of the IEA ENARD Executive Committee. The work is structured on three levels: Annex, Tasks

and Activities. The OA, the task leaders and the activity leaders are responsible for the work undertaken at these levels as follows:

Operating Agent:

- Coordination, scheduling and communication between Tasks.
- Assisting task and activity leaders.
- Preparing, leading and summarizing Annex meetings (twice annually).
- Reporting to IEA ENARD Executive Committee (status & annual reports).
- Coordinate/ensure publications of technical reports and other materials.

Task Leader:

- Coordination, scheduling and communication between activities
- Assisting activity leaders within the Tasks.
- Reporting and coordinating at task level to OA

Activity Leader:

- Prepare activity plan and scheduling.
- Coordinate activity work and communicate with other participants.
- Produce and submit deliverables to task leader and OA.

8. Task 1: Aspects for transition towards Active Distribution networks

Task Leader: Austria

Participating Countries: Austria, Belgium, Italy, United Kingdom, Finland, Denmark, Sweden (t.b.a.), Switzerland (t.b.a.), Norway (t.b.a.)

Level of effort: 3 person months per country

Duration: 24 months

Start date: month no. 4 after start

Context: Due to the very diverse and plentiful technologies, which have to be integrated and simultaneously managed in active distribution networks, the entire system gets extremely complex. The high degree of reliability expected from this system as a whole requires very high standards on the single technologies and the components interactions. As the share of

distributed generation in distribution networks is rising, an optimal planning and activation of the network and integration of DER can produce advantages for the system itself.

Scope: The Task deals with state of art of active distribution networks. Among other aspects the architecture and planning methodology will be analysed. The transition process from passive to active networks will be considered with special attention.

Objectives: The objectives are to find common definitions (a common language), to provide engineering references and recommendations on system architecture, planning tools, best practices and lessons learnt. Architectural and planning methodology barriers will be identified; best practice examples and recommendations will be developed.

Method/Approach: To review national smart grids related definition and to review, analyse and document existing architectures and planning methodology of active distribution networks including barriers and models.

Deliverables: Reports will be formulated on the following topics: State of the art, trends, barriers and recommendations for active distribution networks architectures and planning methodology

Target Audience: DNO, TSO, political decision makers, system operators and researchers

Milestones: D1 - Report on State of the art, trends, barriers and recommendations for active distribution networks architectures and planning methodology

Description of Work for Activity:

Activity 1.0: IEA ENARD Annex II Definitions

Activity leader: **Austria**

Participating countries: all Countries

Level of effort: 0.1 PM per participating country

Duration: 6 months

Start date: month no. 4 after start

There are a couple of national definitions in the area of smart grids. To find a common language within IEA ENARD Annex II it is necessary to analyse national and international existing definitions and to find common definitions for the following terms (finding IEA definitions):

- Distribution network
- Smart grid
- Active network

- Distributed generation (DG)
- Distributed Energy Resources (DER)
- Demand Response (DR)...

The common definitions ensure that all participants in Annex II and the target groups of the publications and guidelines are going to speak about the same things. First suggestions can be found in chapter 13.

Activity 1.1: Survey of Existing Active Networks

Activity leader: **United Kingdom**

Participating countries: United Kingdom, Austria, Italy, Finland, Denmark, Sweden (t.b.a.), Switzerland (t.b.a.), Norway (t.b.a.)

Level of effort: 1,5 PM per participating country

Duration: 12 months

Start date: month no. 4 after start

This activity will survey national experiences in the field of active distribution networks in terms of:

- grid layout (structure, design, characteristics)
- types of existing components:
 - DER (Distributed Generation, Distributed Storage, Demand Response)
 - Storage Technologies
 - DSM or DR used
- type and share of renewable energy sources
- choice of communication
- protection issues
- unintentional islanding
- interconnection aspects
- planning tools, software simulation programmes
- type of services provided (network parallel operation or islanding mode)
- Information collation from other IEA Activities, European Technology Platform Smart Grids, EU Projects

Activity 1.2. Benchmarking and Identification of Needs

Activity leader: **Norway (t.b.a.)**

Participating countries: Norway (t.b.a.), Austria, Belgium, Italy, United Kingdom, Finland, Denmark, Sweden (t.b.a.), Switzerland (t.b.a.)

Level of effort: 1,5 PM per participant country

Duration: 12 months

Start date: month 16 after start

Activity 1.2 and 2.3 will be performed in close contact and common discussions.

Contents:

- Methods to compare and identify strengths and weaknesses (“Benchmarking”)
- Identification of barriers
- Possibilities to overcome the barriers
- Trends on further development
- Requirements
- Development of guidelines for the transition towards active distribution network planning
- Identification of fields of technology development for improvement of active network operation

9. Task 2: Management of Active Distribution Networks (technical, economical, organisational)

Task Leader: Switzerland (t.b.a.)

Participating Countries: Switzerland (t.b.a.), Austria, Belgium, Italy, United Kingdom, Finland, Denmark, Sweden (t.b.a.), Norway (t.b.a.)

Level of effort: 5 PM per country

Duration: 24 months

Start date: month 4 after start

Context: Active distribution networks require coordinated operation and control mechanisms. The control can be divided into two levels:

1. reliability, security and quality of supply,
2. technical and economic optimisation and the contribution of all DER components.

Scope: This Task will focus on investigation of control and operational strategies to facilitate stable and optimal operation of active distribution networks, in either parallel operation and/or islanding operation. Attention will be paid to incorporate predictive and/or forecasting strategies and models to deal with the variability of the renewable and/or fluctuating energy input and load and the optimisation.

Objectives: To foster the development of control and operational strategies that can be

utilised to improve the reliability, operation and performance of active distribution grids.

Method/Approach: To review, analyse and document technical and economical operation and control of existing active network approaches, definition of technical and economical operation and control requirements and recommendations developed; identification of organisational barriers.

Deliverables: Report: SoA, trends, barriers and recommendations for control and operation of active distribution networks. Current state of the art, trends, barriers and recommendations for control and operation of active distribution networks.

Target Audience: DNO, TSO, political decision makers, system operators and researchers

Milestones: D2 - Report on: SoA, trends, barriers and recommendations for control and operation of active distribution networks. Current state of the art, trends, barriers and recommendations for control and operation of active distribution networks.

Description of Work:

Activity 2.1.: Surveying Technical, Economical and Organisational Operation and Control Approaches

Activity leader: **Finland**

Participating Countries: Finland, Austria, Italy, United Kingdom, Denmark, Sweden (t.b.a.), Switzerland (t.b.c.), Norway (t.b.c.)

Level of effort: 2 PM per participant country

Duration: 15 months

Start date: month 4

This activity will survey national experiences in the field of active distribution networks in terms of:

- type of services provided (network parallel operation or islanding mode possible)
- active network operation and control concepts and tools
- distribution automation (ie. fault location & isolation, switching planning, load management, voltage regulation, reactive power compensation etc)
- Metering aspects
- System balancing
- Power quality
- Black start availability
- Disconnection and connection to main grid
- Ancillary services (Win / Win / Win)
- Trends on further development

Activity 2.2.: Commercial Market Regulatory

Activity leader: **Denmark**

Participating Countries: Denmark, Austria, Belgium, Italy, United Kingdom, Finland, Denmark, Sweden (t.b.a.), Switzerland (t.b.a.), Norway (t.b.a.)

Level of effort: 2 PM per participant country

Duration: 15 months

Start date: month 4

Because there are so few examples of commercial activities concerning active network management, for developing this activity some scoping research to identify the barriers/drivers to commercial arrangements for active networks will be necessary. This would require an analysis of the existing relationships between e.g. DNOs and generators/loads and maybe suppliers and customers (including generators through existing power purchase agreements/bilateral contracts) and electricity markets in general..

Conclusions could be made on how interactions would need to develop to allow the incorporation of more elaborate contracts and development of commercial arrangements for active management services.

Some initial work has already been done in EU projects on analysis of contracts between parties to identify the conditions necessary for development of new business models for DG integration. These methods could be extrapolated across annex participants to survey national conditions and used as a basis for the development of new commercial approaches for active network management.

Topics:

- Electricity markets
- Organisational framework
- Business model of active distribution networks

Activity 2.3.: Guideline and Recommendations

Activity leader: Austria.

Participating Countries: Austria, Belgium, Italy, Finland, Denmark, Sweden (t.b.a.), Switzerland (t.b.a.), Norway (t.b.a.)

Level of effort: 1 PM per participant country

Duration: 11 months

Start date: month 17

Activity 1.2 and 2.3 will be performed in close contact and common discussions.

Based on the analysis of national experience, guidelines and recommendations for the organisational framework, business models and the operation and control of active networks with a high penetration of distributed renewable energies will be developed.

10. Task 3: Cross Cutting Issues, Interrelation and Dissemination

Task Leader: Austria

Participating Countries: Austria, Belgium

Level of effort (PM): 2

Duration: 34 months

Start date: month 1

Context: Vision and value of active network integration, interrelation with existing activities, dealing with aspects of active distribution networks is relevant for avoiding duplication of work and exchanging of knowledge. Dissemination will play a relevant role for supporting a wide implementation.

Scope: The Task will focus on strengthening interrelation and perform dissemination of relevant information about active distribution networks.

Objectives: To develop a clear vision of active distribution networks and to evaluate the micro- and macroeconomic benefit; to perform dissemination activities for active distribution networks, to strengthen interrelation with relevant actors and to avoid duplication of work.

Method/Approach: Workshops, conferences, online support tools for information exchange and dissemination, development of value reports and guidelines for stakeholders to assist DNO's to progress from passive to active approach.

Deliverables: Reports on interrelation and dissemination activities, guidelines for stakeholders to assist DNO's to progress from passive to active approach, vision and value report.

Target Audience: DNO's, Public, Governments, other IEA Tasks

Milestones: D3 - Reports on interrelation and dissemination activities, guidelines for stakeholders to assist DNO's to progress from passive to active approach, vision and value report.

Activity 3.1. Workshops and Dissemination:

Activity leader: Austria.

Participating Countries: Austria, Belgium

Level of effort (PM): 1

Duration: 34 months

Start date: month 1

Contents:

- performing joint topical workshops for information exchange between Tasks 1, 2 and 3
- performing joint topical workshops with IEA
 - IEA Wind – Annex 25: Design and Operation of Power Systems with Large Amounts of **Wind** Power
 - IEA PVPS – Task 10 (Urban Scale PV) and Task 11: PV Hybrid Mini Grids as well as the concluded Task 5 (Grid interconnection of building integrated and other dispersed photovoltaic systems)
 - IEA DSM: Task XVII Renewables and Distributed Generation
 - ...
- Workshops with utilities in conjunction with Annex II expert meeting
- Workshops with national stakeholders in conjunction with Annex II experts meeting – these regional workshops should be organised to link the IEA activity with the national stakeholders in the hosting country
- Cooperation with G8 project grid integration of RE – (Gleneagles plan of action)
- Cooperation with NEET activities
- Discussion and dissemination of guidelines for stakeholders to assist DNO's to progress from passive to active approach (Based on experiences of Tasks I and II)
- Presentation at Conferences
- IEA Publications

Activity 3.2. Vision and Value Analysis

Activity leader: Austria.

Participating Countries: Austria

Level of effort (PM): 1

Duration: 24 months

Start date: month 4

Topics:

- Discussions & vision workshops
- preparation of value reports (what is the value of DG integration – PVPS T-10 value report as model)
 - Climatic value
 - Economic value, value of using local resources
 - Employment
 - Increase in security
 - Other values

11. Annex II Deliverables

- Detailed in-country surveys of current state of the Art, lessons learnt, limitations, future developments etc...
- Complementary fore sighting activities and abstraction, visions goals for the future (e.g. growth), future fully integrated active networks
- International overview report drawing out key messages
- Formulation of guidelines for stakeholders to assist DNO's to progress from passive to active approach
- Report on interrelation and dissemination activities
- Requirements / needs for further actions and work (focus on IEA activities)

12. Estimated Resources needed

For country participation within Annex II it is suggested to be obligatory to participate/support/finance at least 1 Activity in each Task!

Operating Agent: Suggested: 2 PM per year

Austria

Task leaders: Suggested: 1,5 PM per year

Task 1: Austria

Task 2: Suggested: Switzerland

Task 3: Austria

Activity leaders: Suggested: 1 PM per year

Activity 1.0: Austria

Activity 1.1:	United Kingdom
Activity 1.2:	Suggested: Norway
Activity 2.1:	Finland
Activity 2.2:	Denmark
Activity 2.3:	Austria
Activity 3.1:	Austria
Activity 3.2:	Austria

13. Definition of Terms

Active Networks: the term within Annex II will be used for distribution networks, able to deal with the integration of a high share of Distributed Generation (DG).

Distributed Generation (DG): generators connected to the medium or low voltage distribution networks.

Distributed Energy Resources (DER): DG, Storage and DR connected to the medium or low voltage distribution networks.

Demand Response (DR): measures at the consumer's side to adapt the load shape to the generation characteristics with respect to the timing and level. There are various types of demand response methods as listed below:

- Type1: Initiatives that are based on sending price signals to customers. There is a wide range of initiatives of this type, but the basic characteristic of all of them is that the electricity price is different at different times of the day. Both prices and time periods can be fixed and pre-established, or can be completely variable.
- Type2: Indirect load control initiatives which force or encourage customers to reduce their consumption during certain periods. The main characteristic of this type of initiative is that the actual reduction must be executed by the customer itself.
- Type3: Direct load control programs where utilities, TSOs or program operators directly disconnect part of the customer's load. These initiatives require the existence of a direct communication system between the initiative promoter and the participating customers.
- Type 4: Initiatives or market structures that allow the participation of the customers offering load reduction. Under these initiatives a customer can present bids offering to reduce part of its load at a given price. If the bid is accepted, the customer will execute the demand reduction itself.

Appendix 3:-
Infrastructure Asset Management

Appendix 3.1:-

Annex Text

International Energy Agency

Implementing Agreement

on

**ELECTRICITY NETWORKS ANALYSIS, RESEARCH
AND DEVELOPMENT
(ENARD)**

**Annex III:-
“Infrastructure Asset Management
Phase 1:- Distribution Systems”**

prepared
by

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August 2008**

1 Introduction

1.1 Background

ENARD, the IEA Implementing Agreement on Electricity Networks Analysis, Research and Development, was established as a new Implementing Agreement in July 2006 with a view to facilitating the uptake of new operating procedures, architectures, methodologies and technologies in electricity T&D networks, such as to enhance their overall performance in relation to the developing challenges of network renewal, renewables integration and network resilience (the “3Rs” of electrical power systems).

ENARD’s present Annex I (Information Collation and Dissemination) work programme is responsible for the systematic collation and dissemination of T&D network related information and data and also for the organisation and delivery of a series of topical experts’ meetings and workshops. The latter are regarded as a key enabling mechanism in the identification of priority areas, to be addressed in detail, in potential new Annexes.

ENARD’s inaugural Annex I Experts’ Meeting, held 28th September 2006, addressed the subject of “Distribution Systems and End User Aspects”⁹. The meeting succeeded in identifying two principal priority areas in relation to distribution systems, firstly those in relation to today’s “here and now networks” and, secondly, those in relation to tomorrow’s “new” networks. Whilst it is recognised that significant programme efforts at both national and international levels are increasingly directed towards the latter, the issues associated with the management of an increasingly ageing electrical infrastructure are receiving far less attention on a co-ordinated international basis, notwithstanding that they will remain at the centre of T&D operations, for at least the next 20 to 30 years. A further specific workshop on the subject of “Managing an Ageing Infra-structure”, was therefore organised and delivered in conjunction with the CIRED 19th International Conference and Exhibition on Electricity Distribution, held Vienna, 21st-24th May 2007¹⁰.

1.2 The ENARD/CIRED Workshop “Managing an Ageing Infrastructure”, May 2007

The joint ENARD/CIRED workshop, held Monday 21st May 2007, drew the support of over 30 delegates from 16 countries and highlighted the challenges of managing the renewal of ageing infrastructure faced by many distribution network operators.

The importance of accessing and using asset information and engineering knowledge in a systematic manner in order to understand (and demonstrate) requirements for investment was a central theme of the workshop.

⁹ Proceedings of Experts’ Meeting on ENARD Annex I Experts’ Meeting on “Distribution Systems and End User Aspects”, held Milan, September 2006. EA Technology report no.6055, November 2006.

¹⁰ Proceedings of Joint ENARD/CIRED Workshop on “Managing an Ageing Infrastructure”, held Reed Messe, Vienna, 21st May 2007. EA Technology report no.6117, June 2007.

Specific methodologies based on systematic use of engineering knowledge and asset information were presented. There were practical examples of the application of such systems. These demonstrated the value of achieving a consistent definition of current condition, performance and risk for individual assets that could be used as a platform to estimate future condition, performance and risk, thus enabling the effect of different investment programmes to be demonstrated and related directly to company/network key performance indicators.

Due to the nature of assets that make up distribution systems, their diversity, the large numbers and the wide geographic spread, it is both impractical and totally uneconomic to undertake comprehensive, specific condition assessment for all assets. Therefore it is necessary to use generic knowledge and engineering experience of the assets as a major input to these systematic processes. Knowledge of End-of-Life (EoL) issues, expected lifetimes, ageing and degradation processes and effective condition assessment techniques was therefore identified as an essential prerequisite for successful asset management.

The subsequent CIRED conference itself re-emphasised the growing importance of these areas. There were several papers proposing or describing risk based approaches to asset management. These papers and many others referred to the need for improved understanding of EoL issues and ageing/degradation processes.

1.3 Annex III

The joint ENARD/CIRED workshop and the CIRED conference itself have confirmed the considerable benefits to be obtained from the sharing of knowledge and experience in relation to the ageing and degradation of the distribution asset base and associated issues, in order to assist with the development and implementation of effective strategies for managing ageing networks.

The Annex III work programme, as described below, is therefore intended to address these issues and to contribute to ENARD's core objectives in relation to the operation and management of electricity T&D networks¹¹.

The Phase 1 programme-of-work, as described herein, will specifically address issues in relation to the distribution asset base, with the option of any further phase(s) to the Annex extending this work to cover the transmission asset base and further issues, as may be identified.

¹¹ ENARD Strategic Plan, October 2006 – September 2011. Issue 1.0, 30th March 2006.

2 Aim and Objectives

Annex III aims to address the challenges associated with the management of increasingly ageing T&D asset bases within the participating countries and beyond, via the exchange of information and data in relation to the ageing, degradation, failure and end-of-life characteristics of the T&D asset base and the complementary development of new asset management techniques and methodologies.

The objectives of the Phase 1 programme-of-work, which specifically addresses the distribution asset base, are to:-

- Develop an authoritative, substantive and robust international information base in relation to the ageing, degradation, failure and EoL characteristics of the principal asset categories within the distribution asset base;
- Develop a detailed understanding of risk based definitions and methodologies;
- Source, collate and systematically analyse relevant case study information, providing practical examples of the use of asset information in condition or risk based asset management decision making;
- Cross reference this information and data with that available in relation to the transmission system asset base and to elicit similarities and differences; and
- Distil the above into a comprehensive information base and digest, for use and application within the participating countries.

The output of the Annex will be a vital reference and provide significant benchmarks for asset managers attempting to build and use condition or risk based processes to define the need and justify future investment programmes that enable economic renewal and continuation of satisfactory performance of distribution networks. Such objectives are noted to be entirely consistent with ENARD's core objectives.

3 Activities

Annex III Phase 1 will address the above objectives via the performance of a structured programme-of-work, co-ordinated by the Operating Agent and involving the full and active participation of the Annex Participants. The programme-of-work itself is structured into a number of defined tasks, with these being described below.

Task 1: Definition and Categorisation of Principal Distribution Asset Groups

Task 1 will:

(i) reach agreement between the Annex Participants in relation to the definition and categorisation of the principal distribution asset groups, with these anticipated to be categorised by:-

- Asset type, eg:-
 - Cables;
 - Overhead lines;
 - Switchgear;
 - Transformers
- Voltage level;
- Construction;
- Insulating medium.

(ii) define and confirm detail of information to be collected in Tasks 2, 3 and 4.

Completion of Task 1 will serve as the essential precursor to the subsequent development of the Annex III programme-of-work and will provide a set of readily recognised and acceptable definitions for the Participants to work to.

Task 2: Collation of Distribution Network Operator Experience

Task 2 will see the sourcing by the Participants of reliable practical operational experience from the distribution network operator communities in the participating countries, within the terms of a structured framework provided by the Operating Agent, in terms of such factors as:-

- The specification and design parameters of the existing asset base;
- The current applicable policies for asset refurbishment and replacement;
- The currently applicable criteria used to define End-of-Life (EoL);
- Typical asset lifetimes achieved in practice;
- Critical degradation and failure processes;
- Identification of principal ageing and EoL indicators;
- Experience to date in the application of condition assessment techniques.

This information to be complemented by a discussion of the factors that affect the individual issues (for example the relationship between environment, duty, maintenance regime and the ageing, lifetime and ultimate EoL of assets).

Task 3: Review of Existing and Proposed Methods of Quantifying Asset Related Risk

Task 3 will see the sourcing by the Participants, within a structured framework developed by the Operating Agent, of details and practical experience of methodologies (existing and proposed) designed to quantify asset condition and/or risk for use in asset management decision making (to define and justify investment programmes). This will include consideration of:

- Asset risk definition;
- Detail of risk categories (Network performance, safety, financial etc.);
- Unit of risk (Monetary or other);
- Relationship between asset condition, performance and risk;
- Building network risk from asset risk;
- The use of condition or risk in investment planning.

The Operating Agent will then collate this information and provide supplementary commentary, in order to be able to feedback an international overview to the full Participant base.

Task 4: Assessment of Distribution Asset Management Case Study Material

Task 4 will source, collate and systematically analyse distribution asset case study material (practical examples of the use of condition and or risk based methodologies in asset management decision making), both from within the Annex participant base and from selected non-participating countries, where this is particularly applicable. Task 4 will be conducted within a structured framework, provided by the Operating Agent.

Task 5: Consolidation of Information from Tasks 2, 3 and 4

Task 5 will bring together all the information collected in Tasks 2, 3 and 4 to produce a comprehensive information base. Task 5 will principally be undertaken by the Operating Agent, using the information and data provided by the Participants in Tasks 2, 3 and 4.

The information from Task 2 will be used to create a definitive reference that can be used to set asset specific benchmarks for critical input values to condition and risk based asset management methodologies.

The information from Tasks 3 and 4 will be presented as a digest of ideas and practical experience for creating and using condition and/or risk based processes to determine asset manage actions.

4 Deliverables

The principal deliverables associated with the Annex III Phase 1 programme of work are anticipated to include:-

- the development and production of an authoritative, substantive and robust international information base in relation to the ageing, degradation, failure and EoL characteristics of the principal distribution asset categories;
- an international overview report describing existing and proposed methods of quantifying asset related risk;
- a further international overview report describing the analysis and assessment of case study information on distribution asset management and highlighting key complementarities and differences with the application of asset management techniques within the transmission sector;
- a final report, summarising the messages from all the above and identifying the need for further targeted R&D, as appropriate.

5 Timescales

Annex III Phase 1 will be implemented over a 21 month period, effectively commencing at the time of its inaugural Experts' Meeting, 22nd-23rd April 2008 and with five countries participating at this time¹².

The programme-of-work, tasks and other activities within the Annex shall be performed in accordance with the Gantt chart shown in figure 5.1 below.

Activity	Year/quarter						
	2008			2009			
	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Task 1							
Task 2							
Task 3							
Task 4							
Task 5							
Experts' Meetings	*		*		*		*

Figure 5.1: Annex III Phase 1 Timescales

¹² The value of Annex III Phase 1 will increase in proportion to the number of Participants and the nature and extent of the information and data provided. It is believed that a least four Participants will be required in order for the Operating Agent to deliver meaningful results, relative to the Annex objectives.

6 Rights and Obligations

6.1 Rights

The principal results and outputs from the Annex III programme-of-work will remain confidential to the Annex III Participants for a period of not less than two years after the completion of the Annex, unless all the Participants agree to an earlier release of information.

The Annex will also be required to produce an executive overview report of its activities, not containing any sensitive information or data, and which is suitable for publication in the public domain.

Although the Phase 1 programme-of-work, as described herein, is not anticipated to lead to the development of any new Intellectual Property (IP), the ownership and commercial exploitation of any IP which may be produced shall be established by the unanimous vote of the ENARD Executive Committee, consistent with Article 8 of the ENARD Implementing Agreement.

6.2 Obligations on the Operating Agent

The Annex III Operating Agent will be responsible for the overall management and delivery of the Annex III work programme and will work closely with the individual Participants, such as to ensure the effective and expedient delivery of its objectives. It will discharge its duties via the organisation and delivery of a programme of six-monthly Experts' meetings and via specific further activities, as may be required. The Operating Agent will submit regular six monthly reports to the ExCo and will implement the decisions of the ExCo.

The Operating Agent will be specifically responsible for:-

- the establishment of a co-ordinated framework for the collation of the desired information and data, the specification of their desired formats and for the compilation and appropriate cross-referencing of all the information received, such as to produce an authoritative, substantive and robust international information base in relation to the ageing, degradation, failure and EoL characteristics of the principal distribution asset categories;
- actively engaging with the network of National Experts, by means of one or more of the Experts' Meetings and via supplementary one to one dialogue, in order to elicit the necessary information in relation to the application, meaning and understanding of risk based definitions and methodologies in the participating countries;
- actively engaging with the network of National Experts, by means of one of more of the Experts' Meetings and via supplementary one to one dialogue, in order to elicit the necessary case study information on

the application of asset management methodologies within the power distribution networks of the participating countries; and

- the production of the Annex deliverables, as described in section 4 above and for the commissioning of a dedicated Annex III restricted access area, within the structure of the existing ENARD web-site. This latter provision will provide an on-line information resource, for the use of the Operating Agent and the Annex Participants.

6.3 Obligations on the Participating Countries

Each participating country within Annex III shall be required to nominate a National Co-ordinator (otherwise known as a “National Expert” or “Expert”). The National Experts will be expected to have a good working knowledge of distribution asset management terminology and methodologies. Each National Expert will be required to:-

- Provide the Operating Agent with a National Participation Letter, indicating their commitment to the Annex. The collective set of National Participation Letters represent the National Participation Plan;
- Attend and participate in the programme of 6 monthly Experts’ meetings, to be organised by the Operating Agent in the discharge of its obligations;
- Support the Operating Agent in the discharge of its obligations via the timely and appropriate provision of information, data and other material, as may reasonably be required to service the requirements of the programme-of-work, as described in section 3 above;
- Take the lead responsibility on an individual national basis in relation to the sourcing and collation of any information inputs that may reasonably be required to service the requirements of the Annex;
- Take the lead responsibility on an individual national basis for the dissemination of the outputs from the Annex.

7 Budgets

The performance of Annex III Phase 1 will require a combination of financial and in-kind contributions, as described below.

7.1 Operating Agent

The Operating Agent role will be funded on a cost-share basis, between the participating countries. A financial contribution of £17,000 per participating country is required (payable over the 21 months of Annex III Phase 1) for the discharge of the Operating Agent’s duties, subject to a minimum of four countries participating in the Annex.

7.2 Annex Participants

The Annex Participants will be expected to support National Expert participation at a minimum level of 12 person-weeks per participating country,

over the 21 months of Annex III Phase 1. Multiple Experts may be assigned, as appropriate, eg from the power distribution sector, industry R&D centres etc.

All participating countries will be required to provide National Expert representation and contribution to the four Experts' meetings, to be held throughout the discharge of Annex III Phase 1. Travel and accommodation costs for these meetings shall be the responsibility of the Annex Participants.

Active participation is expected outside of the programme of Experts' Meetings, including, but not limited to, ongoing dialogue and information exchange via e:mail, the Annex III portion of the ENARD web-site, occasional conference calls and related.

7.3 Budgetary Overview

Table 6.1 below provides a budgetary overview of the contributions required from the Annex Participants, for the delivery of Annex III Phase 1.

Table 6.1:- Contributions required from Annex Participants for Annex III Phase 1

Role/Activity	Financial/manpower provision	
	Jan. to Dec. 2008	Jan. to Sept. 2009
Annex III Operating Agency ¹³	£9,000	£8,000
Annex III National Co-ordination/ National Expert Role	8 person weeks	4 person weeks

8 Further Work

It is recognised at the outset that Annex III Phase 1 may well generate new ideas for the application of practical asset management techniques and/or identify the requirement for further targeted R&D. The Annex Participants shall therefore review the basis for any such further work, towards the end of Phase 1, or as may be requested by the ExCo. Subject to the conclusions of such review, the basis for the extension of the Annex, via future follow-on Phases shall be determined, for submission to the ExCo. There shall however be no obligation on any Participant in Annex III Phase 1 to participate in any future Phase(s) of the Annex, as may be decided.

¹³ Subject to a minimum of four countries participating in the Annex

**Appendix 3.2:-
Programme of Work**

ENARD Annex III: Infrastructure Asset Management

1 Programme of Work

August 2008

1 Aim and Objectives

1.1 Aim

Annex III aims to address the challenges associated with the management of increasingly ageing T&D asset bases within the participating countries and beyond, via the exchange of information and data in relation to the ageing, degradation, failure and end-of-life characteristics of the T&D asset base and the complementary development of new asset management techniques and methodologies.

1.2 Objectives

The objectives of the Phase 1 programme of work, which specifically addresses the distribution asset base, are to:

- Develop an authoritative, substantive and robust international information base in relation to the ageing, degradation, failure and end of life characteristics of the principal asset categories within the distribution asset base;
- Develop a detailed understanding of risk based definitions and methodologies;
- Source, collate and systematically analyse relevant case study information, providing practical examples of the use of asset information in condition or risk based asset management decision making;
- Cross reference this information and data with that available in relation to the transmission system asset base and to elicit similarities and differences; and
- Distil the above into a comprehensive information base and digest, for use and application within the participating countries.

2 Programme of Work

2.1 Introduction

The Annex III Phase 1 programme of work has been devised to specifically address issues in relation to the distribution asset base, with the option of any further phase(s) to Annex III extending this work to cover the transmission asset base and further issues, as may be identified. The Annex III programme of work is structured into a five principal tasks, as described in sub-sections 1.2 – 1.6 below.

Annex III Phase 1 will be implemented over a 21 month period, in accordance with the Schedule of Work timetable shown under Figure 1, at the end of this paper. Annex III participants recognise that adherence to the reporting timelines and milestones set out in the schedule will ensure that the Annex III programme of work is delivered in an efficient and cost effective manner, consistent with delivering the Annex III aim and objectives as agreed by the ExCo.

2.2 Task 1: Definition and Categorisation of Principal Distribution Asset Groups

Task 1 will see participants agree to:

- the definition and categorisation of the principal distribution asset groups; and
- the detail of the information to be collected under Tasks 2, 3 and 4.

Completion of Task 1 will serve as the essential precursor to the subsequent development of the Annex III programme of work and will provide a set of readily recognised and acceptable definitions for the Annex III participants to work to.

Task 1 was completed at the inaugural meeting of Annex III participants which took place at EA Technology, Capenhurst, UK over the period 22-23 Apr 08.

2.3 Task 2: Collation of Distribution Network Operator Experience

Task 2 will see Annex III participants provide reliable information on assets and asset management within their own countries. This information will be sourced from the distribution network operator communities hence it will reflect current operational experience in each of the participating countries.

Annex III participants will review all information collected, looking to understand all of the influencing factors such as the relationship between environment, duty, maintenance regime and the ageing, lifetime and ultimate end-of-life of assets. The intention of this review is to understand the reasons behind the different processes and procedures in the participating countries, with the ultimate intention of identifying the routes and the barriers to achieving improved practice.

At the inaugural meeting of Annex III, the participants agreed on the type and level of information that should be reported on each asset group.

2.4 Task 3: Review of Existing and Proposed Methods of Quantifying Asset Related Risk

Task 3 will see Annex III participants provide information on the methodologies (existing and proposed) designed to quantify asset condition and/or risk for use in asset management decision making, to define and justify investment programmes. This information will include consideration of:

- Asset risk definition;
- Detail of risk categories (Network performance, safety, financial etc.);
- Unit of risk (Monetary or other);
- Relationship between asset condition, performance and risk;
- Building network risk from asset risk;
- The use of condition or risk in investment planning.

As per Task 2, Annex III participants agreed reporting requirements for Task 3 at their inaugural meeting.

2.5 Task 4: Assessment of Distribution Asset Management Case Study Material

Task 4 will see the Annex III Operating Agent source, collate and systematically analyse distribution asset case study material i.e. practical examples of the use of condition and or risk based methodologies in asset management decision making. This information will be sourced from both Annex III participants and from selected non-participating countries, where this is particularly applicable.

2.6 Task 5: Consolidation of Information from Tasks 2, 3 and 4

Task 5 will bring together all the information collected in Tasks 2, 3 and 4 to produce a comprehensive information base. Task 5 will principally be undertaken by the Operating Agent, using the information and data provided by the Annex III participants in Tasks 2, 3 and 4.

The information from Task 2 will be used to create a definitive reference that can be used to set asset specific benchmarks for critical input values to condition and risk based asset management methodologies.

The information from Tasks 3 and 4 will be presented as a digest of ideas and practical experience for creating and using condition and/or risk based processes to determine asset management actions.

3 Deliverables

The principal deliverables associated with the Annex III, Phase 1 programme of work are:

- the development and production of an authoritative, substantive and robust international information base in relation to the ageing, degradation, failure and end-of-life characteristics of the principal distribution asset categories;
- an international overview report describing existing and proposed methods of quantifying asset related risk;
- a further international overview report describing the analysis and assessment of case study information on distribution asset management, highlighting key complementarities and differences with the application of asset management techniques within the transmission sector;
- a final report, summarising the messages from all the above and identifying the need for further targeted R&D, as appropriate.

It is intended that the output of Annex III will be a vital reference that provides significant benchmarks for asset managers attempting to build and use condition or risk based processes to define the need and justify future investment programmes that enable economic renewal and continuation of satisfactory performance of distribution networks. Such objectives are noted to be entirely consistent with ENARD's core objectives.

The detailed outputs of Annex III will remain confidential to the participants of Annex III, however the general theme of the outputs will be made publicly available to the ExCo and others.

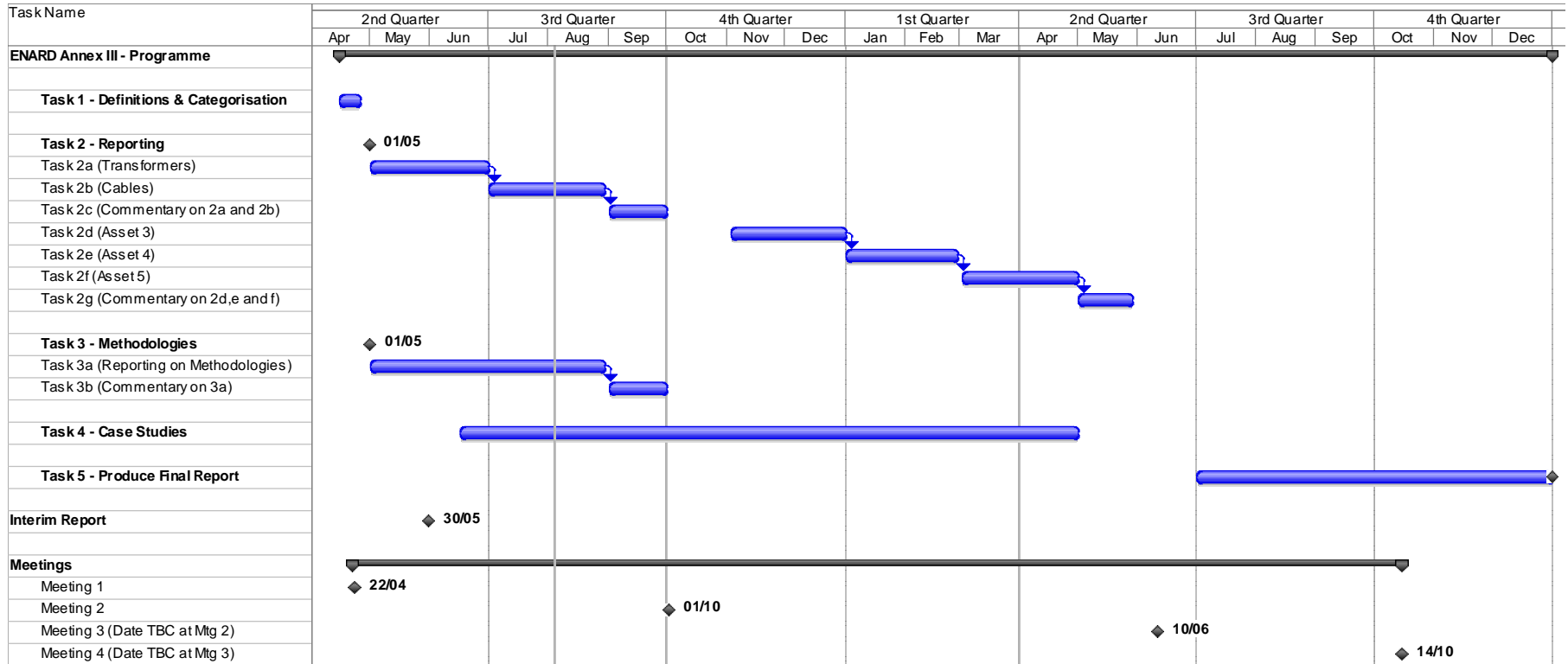


Figure 1 Annex III Schedule of Work

Appendix 4:-

Annex IV “Transmission Systems”

International Energy Agency
Implementing Agreement
on
ELECTRICITY NETWORKS ANALYSIS,
RESEARCH AND DEVELOPMENT
(ENARD)

Annex IV
”Transmission systems”

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1. Introduction

1.1. Background and Motivation

ENARD, the IEA Implementing Agreement on Electricity Networks Analysis, Research and Development, was established as a new Implementing Agreement in July 2006 with a view to facilitating the uptake of new operating procedures, architectures, methodologies and technologies in electricity T&D networks, such as to enhance their overall performance in relation to the developing challenges of electricity markets, renewables integration, network renewal and network resilience.

ENARD's Annex I (Information Collation and Dissemination) work programme is responsible for the systematic collation and dissemination of T&D network related information and data and also for the organisation and delivery of a series of topical experts' meetings and workshops. The latter are regarded as a key enabling mechanism in the identification of priority areas, to be addressed in detail, in potential new Annexes.

One of the priority areas is power transmission. Transmission systems will continue to play a key role in the power systems of the future and are expected to become increasingly important for a number of reasons:

- The present emphasis on climate change and CO₂ mitigation is likely to result in an increased share of electricity as a primary energy carrier, with consequentially increased pressures to maintain high quality and secure electricity supplies.
- Present targets for development and deployment of renewable energy sources in general, and wind energy in particular, are a main driver for transmission system developments. Offshore wind, representing a vast and largely untapped potential, is a special challenge in this respect.
- A key challenge to be addressed in the context of any such massive development of variable generation such as wind relates to its regulation and balancing. This will require flexible transmission solutions, improved operational tools and enlarged balancing markets.
- The development of a fully integrated, liberalised market is a key element for the future and sets new challenges for the grids of the future. The user will become a key player in the electricity system.
- Transmission grids can be made more flexible and controllable as new technologies based on advanced power electronics become available.
- Permits for new installations of overhead transmission lines are difficult to obtain due to pressure of the general public. New challenges, both technical and economical, arise from the increasing trend to force the use of cables in transmission networks to avoid overhead lines.

ENARD's contribution to this process is to act as an authoritative, comprehensive and unbiased source of information, data and advice to Governments, policymakers and key industry stakeholders, whilst also supporting the IEA's G8 Gleneagles Programme-of-Work.

1.2. The ENARD Annex I Transmission Systems Workshop, September 2007

The ENARD Annex I transmission systems workshop¹⁴ was convened to help develop the structure and content of a dedicated new ENARD work programme activity (Annex) in this area. The workshop drew the support of 24 participants from 12 countries and comprised a series of expert presentations, dedicated working groups and open discussion and dialogue.

Consensus was reached in relation to the development of a dedicated ENARD transmission systems Annex (Annex IV), with the objective of addressing various technological, operational and planning issues, such as to provide authoritative guidance to the IEA, G8 and CEC, whilst also being of real value and use to its essential TSO stakeholders. The workshop concluded by reaching agreement on the anticipated scope of the new Annex and for its forward development, with a view to its formal presentation to the April 2008 ENARD Executive Committee meeting.

1.3. Scope of Annex IV

The aim of the new Annex IV is to establish a long term vision for developments in transmission systems beyond 2020. The scope of the work includes addressing the main barriers towards a necessary development of transmission capacity and to identify the most promising solutions and challenges in terms of expansion planning and market analysis, secure operation of the transmission networks and the need for new transmission technology.

The Annex should be of real relevance to TSOs and other key stakeholders by addressing the most relevant issues, such as risk management, risk based planning, technology to enhance capacity and utilisation, lower maintenance and increased reliability by introducing new technologies.

Other key considerations in the development of the new Annex are:

- It should provide an added value extra-European dimension by helping facilitate high level political objectives and providing guidance to the IEA, G8 and CEC.
- It should address incentives to enhance transmission capacity (both via better use of existing systems and via planning and implementation of system expansions).
- It should similarly address the provision of adequate levels of system security.
- It should provide a valuable information exchange forum.
- It should provide insight on how market integration can be enhanced.
- It should give indication on how the integration of variable energy sources is enhanced by more flexible grids.
- It should identify and highlight examples of "best practice".

¹⁴ Proceedings of the ENARD Annex I Transmission Systems Workshop, held in Trondheim, Norway, September 2007. EA Technology report no.6179, October 2007

It is emphasised that the new Annex must take an overall system view, considering transmission in the overall system context and as a key enabler in allowing operation of generation in a well functioning power market. Furthermore, it should demonstrate an appreciation and understanding of different TSO and political objectives (eg, via the “building of bridges” between political objectives and the tasks and responsibilities of the TSOs).

2. Objectives

The main objective of the Annex is to establish a long term vision for developments in transmission systems with the aim to serve as an essential information exchange forum and service ENARD's 3Rs of power systems development, namely network Renewal, Renewables integration and network Resilience.

The work will address the main barriers towards a necessary development of transmission capacity and identify the most important challenges in terms of expansion planning and market analysis, secure operation of the transmission networks and the need for new transmission technology. In addition to the integration of renewables the focus has to include all new low carbon generation, including clean fossil fuels and new nuclear energy, as these are all essential in terms of long term network developments.

The long term vision will identify and describe the most promising solutions related to the various technological, operational and planning aspects, including the need for development and application of new methods and tools. Finally the Annex should address the specific R&D activities needed as a result of the vision.

The Annex will be organised in two main activities focusing on the different areas of responsibility for transmission system operators:

- Expansion Planning and Market analysis
- System Operation Management and Security

A close coordination is necessary between the work carried out in the two activities in order to avoid overlaps and realising that for example the tools developed for operational purposes could also be of interest for planning studies. There is also a significant potential in integration of the various tools that are used for more efficient data management.

3. Activities

Task 1: Expansion Planning and Market Analysis

Context: Unbundling of the electric power industry creates new challenges for transmission expansion planning, in terms of environmental concerns (difficulties in getting construction permits especially for overhead lines), cost of transmission projects and the uncertainties concerning the benefit and profitability of transmission projects in a changing environment. The time horizon from planning and consenting processes to actual construction and commissioning of transmission projects are often longer than the corresponding process to construct new power plants. This represents a huge challenge towards the development of cost optimised and efficient transmission networks.

Objective: The aim of this activity is therefore to assess available methods and tools for transmission expansion planning, and to identify the need for new tools that integrate market modelling, network analysis and security assessment, also including the possible contribution of promising transmission technologies.

Scope: Support tools are expected to be of increasing importance and value for various tasks related to transmission planning. The main challenges and possible activities of interest to this task include:

- Transmission system planning in context of market rules.
- Analyses related to societal levels of risk and cost.
- Policy towards undergrounding.
- Risk based planning.
- Regulatory issues and consenting processes:
 - Investment incentives for cross border capacity.
 - Financing of transmission system infrastructure.
- Analyses related to grid solutions and integration of large scale wind power (onshore and offshore grids) and of other variable energy sources (photovoltaics, tidal).
- Analyses of congestion management and efficiency of the power markets.
- Selective introduction of competition for system expansions.
- Most promising (existing and emerging) technologies.

Deliverables: D1 - Report on availability and application of planning tools, market and network models and on the identification of need for new tools

Target audience: Transmission system operators, regulating authorities, political decision makers, researchers

Activity 1.1: Assessment of available methods and tools for transmission expansion planning

Activity 1.2: Potential of transmission technologies in enhancing power system exploitation

Activity 1.3: Identification of requirements for tools addressing new transmission planning needs

Task 2: System Operation Management and Security

Context: The development of electric power systems with a larger mix of generation technologies and an increased penetration of renewable energy sources is expected to lead to larger and more frequent changes in generation and load behaviour in the future. Generation will also be located further away from demand. This emphasises the need for new methods and tools for monitoring and control of power systems, including the activation of the loads (demand side participation).

Objective: The aim of this activity is therefore to assess available methods and tools for operational monitoring and control, and in particular to identify the need for new tools and methods to manage future challenges in balancing control also accounting for the potential of transmission technologies. This also includes market design and management of balancing services, as well as methods for adequate provision and distribution of operational reserves and other ancillary services. The development of real time markets is an essential element.

Scope: A key issue to be addressed is the operational challenges related to massive development of offshore wind power. One example to illustrate this problem area is the visions of a North Sea “supergrid” to harness the potential of deep water offshore wind and tidal energy. Development of the necessary transmission capacity to tap into this potential and its control is a huge task. This requires new thinking about the management and exchange of balancing services, and the possibilities and impacts of enlarged control areas (across borders and interconnections) need to be thoroughly analysed.

Another area of interest is Wide Area Monitoring Systems (WAMS) based on synchronised phasor measurements. Together with developments in ICT this technology provides for a number of new applications and functions within control centres related to state estimation and situational awareness. The contribution of this Annex would be to identify and describe the most promising applications from a system operation point of view.

Important challenges and possible activities of interest to this task include:

- Development of balancing and real time markets.
- Probabilistic (risk) based operation planning methodologies.
- Development of flexibility (e.g. frequency response capability) of low carbon generation plant including renewables to ensure adequate balancing cover under rapidly varying generation mix.
- Load (demand) as a resource with reference to the IEA’s Implementing Agreement on Demand Side Participation (DSP).
- Application of WAMS for improved situational awareness.
- Application of power flow control in the grid (phase shifting transformers, FACTS and HVDC).
- Crisis management/security of supply.

Deliverables: D2 - Report on availability and application of advanced operational tools and on needs for new operational monitoring and control tools

Target audience: Transmission system operators, regulating authorities, political decision makers, researchers

Activity 2.1: Assessment of available methods and tools for operational monitoring and control

Activity 2.2: Role of transmission technologies to enhance power system control

Activity 2.3: Identification of needs for new methods and tools to manage balancing control

4. Deliverables

The main deliverables will be workshops and reports, including an executive summary report

- Workshops, tentatively in collaboration with other relevant organisations, such as CIGRE.
- Reports:
 - D1 - Report on availability and application of planning tools, market and network models and on the identification of need for new tools
 - D2 - Report on availability and application of advanced operational tools and on needs for new operational monitoring and control tools
- Executive summary describing a long term vision for developments in transmission systems, the need for further R&D and recommendations regarding policy developments.

5. Timescales

Annex IV will be implemented over a 2 year period, commencing at such time as five countries are able to commit to the Annex. For initial planning purposes, a 1st January 2009 commencement is assumed, but the start-up workshop may be in late 2008 if possible.

The programme-of-work, tasks and other activities within the Annex shall be performed in accordance with the Gantt chart shown in the figure below.

Activity	Year/quarter							
	2009				2010			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Annex work planning								
Task 1								
Activity 1.1								
Activity 1.2								
Activity 1.3								
Task 2								
Activity 2.1								
Activity 2.2								
Activity 2.3								
Final reporting								
Expert meetings (XM)	WS		XM		XM			XM
Workshops (WS)	Startup							(final)

6. Rights and Obligations

6.1. Rights

The principal results and outputs from the Annex IV programme-of-work will remain confidential to the Annex IV Participants for a period of not less than two years after the completion of the Annex, unless all the Participants agree to an earlier release of information.

The Annex will also be required to produce an executive overview report of its activities, not containing any sensitive information or data, and which is suitable for publication in the public domain.

Although the programme-of-work, as described herein, is not anticipated to lead to the development of any new Intellectual Property (IP), the ownership and commercial exploitation of any IP which may be produced shall be established by the unanimous vote of the ENARD Executive Committee, consistent with Article 8 of the ENARD Implementing Agreement.

6.2. Obligations of the Operating Agent

The Operating Agent (OA) is responsible for the overall technical and administrative management of work performed within Annex IV and for implementing the decisions of the IEA ENARD Executive Committee. The work is structured on two levels: Annex and Activities. The OA and the Activity leaders are responsible for the work undertaken at these levels as follows:

Operating Agent:

- Coordination, scheduling and communication between Activities.
- Assisting Activity leaders.
- Preparing, leading and summarizing Annex meetings (twice annually).
- Reporting to IEA ENARD Executive Committee (status & annual reports).
- Coordinate/ensure publications of technical reports and other materials.

The responsibility as Operating Agent will be shared equally between CESI RICERCA and SINTEF energy Research.

6.3. Obligations of the Participating countries

Each participating country within Annex IV shall be required to nominate a National Co-ordinator (otherwise known as a “National Expert” or “Expert”). The National Experts will be expected to have a good working knowledge of transmission system operation and planning terminology and methodologies. Each National Expert will be required to:

- Provide the Operating Agent with a National Participation Letter, indicating their commitment to the Annex. The collective set of National Participation Letters represent the National Participation Plan;
- Attend and participate in the programme of two Experts’ meetings per year, to be organised by the

- Operating Agent in the discharge of its obligations;
- Support the Operating Agent in the discharge of its obligations via the timely and appropriate provision of information, data and other material, as may reasonably be required to service the requirements of the programme-of-work, as described in section 3 above;
 - Take the lead responsibility on an individual national basis in relation to the sourcing and collation of any information inputs that may reasonably be required to service the requirements of the Annex;
 - Take the lead responsibility on an individual national basis for the dissemination of the outputs from the Annex.

The work is further structured on two levels: Tasks and Activities. The Task Leaders and the Activity Leaders are responsible for the work undertaken at these levels as follows:

Task Leader:

- Prepare task plan and scheduling.
- Coordination, scheduling and communication between activities
- Produce and submit deliverables at Task level to OA

Activity Leader:

- Prepare activity plan and scheduling.
- Coordinate activity work and communicate with other participants.
- Reporting on activity work to Task Leader.

7. Budgets

The performance of Annex IV will require a combination of financial and in-kind contributions, as described below.

7.1 Operating Agent

The Operating Agent role will be funded on a cost-share basis, between the participating countries. A financial contribution of EUR 23,000 per participating country is required (payable over the 24 months of Annex IV) for the discharge of the Operating Agent's duties, subject to a minimum of five countries participating in the Annex.

7.2 Annex Participants

The Annex Participants will be expected to support National Expert participation at a minimum level of 4 person-months per participating country, over the 24 months of Annex IV. Multiple Experts may be assigned, as appropriate, e.g. from the power transmission sector (especially TSOs), industry R&D centres etc.

All participating countries will be required to provide National Expert representation and contribution to the four Experts' meetings, to be held throughout the discharge of Annex IV. Travel and accommodation

costs for these meetings shall be the responsibility of the Annex Participants.

Active participation is expected outside of the programme of Experts' Meetings, including, but not limited to, ongoing dialogue and information exchange via email, the Annex IV portion of the ENARD web-site, occasional conference calls and related.

7.3 Budgetary Overview

Table 7.1 below provides a budgetary overview of the contributions required from the Annex Participants, for the delivery of Annex IV, based upon the assumption of a 1st January 2009 commencement.

Table 7.1:- Contributions required from Annex Participants for Annex III

Role/Activity	Financial/manpower provision	
	2009	2010
Annex IV Operating Agency	EUR 12.000,-	EUR 11.000,-
Annex IV National Coordination/ National Expert role	2 Person Months	2 Person Months

8 Related working groups and activities

Task 1

IEA Wind Energy Systems – Annex 25: Design and Operation of Power Systems with Large Amounts of Wind Power

IEA Demand-Side Management – Annex 17: Integration of Demand Side Management, Energy Efficiency, Distributed Generation and Renewable Energy Sources

CIGRE Study Committees

C1: System Development and Economics

C5: Electricity Markets and Regulation

IEEE Power & Energy Society: Technical Committee Power System Planning and Implementation

Task 2

IEA Wind Energy Systems – Annex 21. Dynamic models of Wind Farms Power System studies

IEA Demand-Side Management - Annex 18 Demand Side Management and Climate Change

VLPGO: Very Large Power Grid Operators

CIGRE Study Committee

C2: System Operation and Control

C4: System Technical Performance

IEEE Power & Energy Society Technical Committee Power System Operations

IEEE Power & Energy Society Technical Committee Power System Analysis, Computing and Economics

9 Further Work

It is recognised at the outset that Annex IV may well generate new ideas for the application of practical transmission system techniques and/or identify the requirement for further targeted R&D. The Annex Participants shall therefore review the basis for any such further work, towards the completion of the Annex, or as may be requested by the ExCo. Subject to the conclusions of such review, the basis for the extension of the Annex, via future follow-on Annexes shall be determined, for submission to the ExCo. There shall however be no obligation on any Participant in Annex IV to participate in any future Annexes, as may be decided.