

DELIVERABLE REPORT

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Project acronym: N4E

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Deliverable reported: D5.5 Report on dissemination and promotion of the Project results

Due date: M48

Name, title and organization of leading partner: Dr. Gonçal Badenes - ICFO

Project website address: www.n4e.eu

This deliverable updates deliverable D5.4 with information related with dissemination to the industry, academia and scientific community.

1. Work package objectives.

Mainly the objectives of N4E dissemination are:

- To spread recent research results among academia and industry for wide-scale dissemination.
- To provide tools for reaching information to different communities.
- To create public awareness of research developments and their potential uses and to convey the benefits of nanophotonics for energy efficiency to user communities with persuasive messages.
- To facilitate information exchange between the participants of the Nanophotonics for Energy Efficiency NoE and other scientists and to encourage the commercial utilization of project results.
- To support interactions between the communities of the EU and other countries.
- To contribute to establishing a European nanophotonics community for energy-related issues

2. Work progress and achievements during the period.

Dissemination activities are among the main concerns of N4E. For dissemination, which was mainly planned to be towards academia, industry and public, the consortium uses typical routes such as refereed journals and international conferences.

A list of papers published by the Consortium in indexed journals relevant to the N4E is included in Annex 1.

Network members have participated in relevant international scientific conferences and workshops. The network also organizes open meetings and workshops to gather other scientists and industrial representatives for dissemination of results.

2.1 Dissemination within European initiatives:

Network has active collaboration agreements with the NEA (Nanophotonics Europe Association). Now, 5 Member Institutions (BILKENT, ICFO, LENS, UPC and US) of Nanophotonics Europe Association (NEA), are from Nanophotonics for Energy Efficiency Network of Excellence (N4E-NoE) partners.

A Nanophotonics Workshop was jointly organized by EU Photovoltaic Technology Platform, Nanophotonics Europe Association and Nanophotonics for Energy Efficiency Network of Excellence. The event was supported by Photonics21 and EPIC.

In addition to that, because of the participation of Dr Badenes (ICFO) in WG4 and WG6 in Photonics 21, an efficient information flow is constituted between NoE, NEA and Photonics21.

The Project co-organised the Complex Nanophotonics Science Camp in the UK on August 27-30, 2013 (see Annex 3 to this Deliverable Report). This summer school was aimed at bringing together early stage scientists to bridge nanophotonics, plasmonics and biophotonics of complex media. The Scientific Committee included Otto Muskens, from Southampton University and Riccardo Sapienza from Associate Member King's College London. One of the 3 keynote speakers was Niek van Hulst, from ICFO. The project also provided grants for a limited number of early-stage researchers, as detailed in the Project Progress Report.

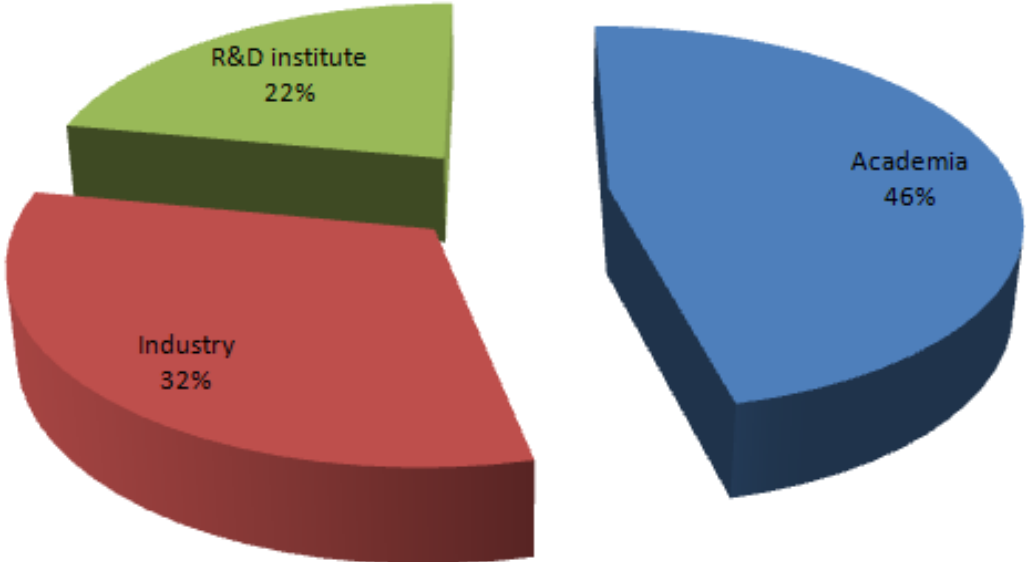
2.2 Associate members:

Network's one of the biggest aims is bringing together the Industry and Academia platforms. For this reason companies, R&D institutions and academic institutions can involve to the network as an Associate Member. This participation gives some opportunities to the Associate Members. They can attend Workshops, Summer Schools and other events, they can participate in the seed projects, they can participate in the Young Researcher Exchange programme and also they can use the expertise, know-how and resources of the network.

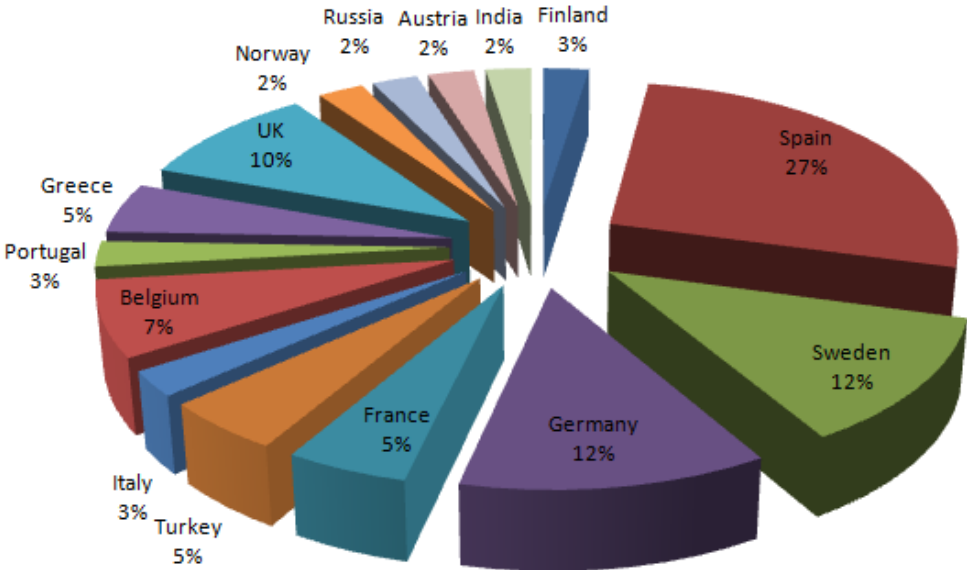
In 2013, Associate Membership list has been improved. At the end of Y4 number of Associate Members increased to 41. At the end of Y3 this number was just 22.

Associate Members are from different fields. Current membership pool is comprised of companies (industry), R&D institutions and academic institutions. These members are from several countries of Europe.

Types of Associate Members



Distribution of Members



2.3 Industry contacts:

In 2013, good number of companies has joined as Associate Members (see paragraph above).

Lumiblade Philips Technologie GmbH was visited by the young researchers from the Network. They had the opportunity to visit the facilities and discuss technical issues with Lumiblade engineers.

An Industrial Workshop was organized in Stockholm - Sweden in November 2013 (see paragraph above). This event provided to constitute a durable communication and collaboration between industry and academia.

2.4 Web page and Other Social Platforms:

A specific section on News and Dissemination is already in the web page, which has been completely redesigned during Y3 of the project. Relevant news regarding the network events and other relevant news regarding nanophotonics for energy are regularly posted on the web.

A consolidated view of resources and expertise available in the Network, together with a single contact for people and institutions seeking common projects or services is available on the "Contact Us" link in the main page <http://n4e.eu/>

Also, other means of communication are being used, like LinkedIn, Twitter and Facebook accounts. All news published in the N4E website, are also published in these other social / professional sites. This way we ensure a wider communication.

For example, the LinkedIn Nanophotonics for Energy Efficiency Group was created on December 2, 2010. Now it has 361 members. In March 2013 this number was 284. There is a % 27 increment in one year. Only in 2013, 51 discussion topics were opened.

2.5 Attended policy and strategy meetings relevant to the N4E

- **Nano Meta 2013 Conference:** Seefeld, Austria (Jan. 3 – 6, 2013)
- **SPIE Photonics West 2013:** San Francisco, USA (Feb. 2 – 7, 2013)
- **nanoPT 2013:** Porto, Portugal (Feb. 13 – 15, 2013)
- **ImagineNano 2013:** Bilbao, Spain (Apr. 23 – 26, 2013)
N4E was participated as a sponsor in this event.
- **SPIE Microtechnologies 2013:** Grenoble, France (Apr. 24 – 26, 2013)
- **Photonics21 Annual Meeting 2013:** Brussels, Belgium (Apr. 29 – 30, 2013)
- **International Workshop "Photonics of Functional Nanomaterials":** Hong Kong, China (May 6 – 9, 2013)
- **SEMICON Singapore 2013:** Singapore (May 7 – 9, 2013)
- **Smart Lighting 2013 Conference:** Frankfurt, Germany (May 14 – 15, 2013) – Summary Report in Annex 2.
- **The International Conference on Surface Plasmon Photonics SPP6:** Ottawa, Canada (May 26 – 31, 2013)

- **Conference on Lasers and Electro-Optics (CLEO: 2013):** San Jose, USA (Jun. 9 – 14, 2013)
- **EuroNanoForum 2013:** Dublin, Ireland (Jun. 18 – 20, 2013)
- **SPIE Optics + Photonics 2013:** San Diego, USA (Aug. 25 – 29, 2013)
- **2013 International Conference on Solar Energy Materials and Energy Engineering (SEMEE 2013):** Hong Kong, China (Sep. 1 – 2, 2013)
- **SEMICON Taiwan 2013:** Taipei City, Taiwan (4 September 2013)
- **Trends in Nanotechnology International Conference (TNT2013):** Seville, Spain (Sep. 9 – 13, 2013)
- **39th International Conference on Micro and Nano Engineering (MNE 2013):** London, UK (Sep. 16 – 19, 2013)
- **28th European Photovoltaic Solar Energy Conference and Exhibition (EU PVSEC 2013):** Paris, France (Oct. 1 – 3, 2013)
- **ICT 2013 – Conference:** Vilnius, Lithuania (Nov. 6 – 8, 2013)
- **ForumLED Europe 2013:** Paris, France (Nov. 26 – 27, 2013)

2.6 Network Events:

2.6.1 2nd Industry-Academia Workshop on Nanophotonics for Energy Efficiency: November 11-12, 2013 in Stockholm – Sweden:

2nd Industry-Academia Workshop on Nanophotonics for Energy Efficiency was organized in the Scandic Viktoria Tower hotel, in Stockholm on 11-12th November 2013.

The scope of the workshop was on recent progress in nanophotonics for photovoltaics and lighting. Towards this objective, the workshop gathered world leading research groups working on these topics and several industrial players including SMEs, start-ups and research institutes engaged in technology development and transfer. Amongst the topics covered included the latest developments in PV and lighting with a survey of the state-of-the-art and analysis of the different nanophotonics approaches.

There were 19 invited talks, 8 from partner institutions, 11 were external of which 4 were associate members of the network. 8 of the talks were from the industry and technology transfer institutes.

Participants: A total of 59 participants registered for the event. Industrial participants included Aaxus, Solvoltaics, Hamamatsu, Aledia, Acreo, VTT, Exeger, IMEC, Obducat Technologies, Photonicsweden, Solibro Research, SP Solar Energy Group.

Program:

Monday, November 11, 2013

11:45 Lunch and Networking

- 12:45 **Gonçal Badenes (ICFO, Barcelona):** N4E Network of Excellence: Collaboration Opportunities
- 13:00 **Alexandre Lagrange (CEA-LETI, Grenoble):** Current and Future Trends in Visible LED Technologies
- 13:30 **Talha Erdem (Bilkent University, Ankara):** Nanocrystal Optoelectronics for Semiconductor Lighting and Lasers
- 14:00 **Babak Keidari (Obducat Technologies AB, Lund):** Nanoimprint Lithography for Manufacturing of High Power LEDs
- 14:15 **Alexander Weiland (Aaxus AB, Lund/Malmö):** LEDs in Intelligent Lighting Solutions
- 15:00 Coffee Break
- 15:15 **Ramon Alcubilla (UPC, Barcelona):** Status and Perspectives in Photovoltaic Solar Cells
- 15:45 **Hast Jukka (VTT Technical Research Centre of Finland, Helsinki):** Roll-to-Roll Printing Process for Manufacturing Flexible, Lightweight and Arbitrary Shape Thin-Film Photovoltaics
- 16:15 **Hernán Míguez (CSIC Institute of Materials, Sevilla):** Design and Integration of Photonic Nanostructures in Dye Solar Cells
- 16:45 **Mikael Björk (Solvoltaics AB, Lund):** Wave Concentrated Nanowire Photovoltaics
- 17:15 Coffee Break
- 17:30 **Sven Södergren (Solibro Research AB, Uppsala):** CIGS-Based PV Technology at Solibro
- 17:45 **Qin Wang (ACREO Swedish ICT, Kista):** Integration of Nanostructures onto Optoelectronic Devices for Light Manipulation and Harvesting
- 18:00 **Pierre-Yves Fonjallaz (PhotonicSweden):** A Brief Overview of the Swedish Photonics
- 18:15 Discussion
- 19:15 Dinner and Networking

Tuesday, November 12, 2013

- 08:30 **Bo Monemar (Lund University, Lund):** Nanowire-based Emitters for Solid State Lighting
- 09:00 **Saulius Marcinkevicius (KTH-Royal Institute of**

- Technology, Kista):** Near-field Optical Spectroscopy of GaN-based Nanostructures for LED applications
- 09:30 **Christos Trompoukis (IMEC, Leuven): From Nanoscale to Gigawatt:** Photonic Nanostructures for Solar Cells
- 10:00 **Alexandre Dmitriev (CTH Chalmers University of Technology, Göteborg):** Solar Nanoplasmonics: Photovoltaics and Thermal
- 10:30 Coffee Break
- 10:45 **Gerasimos Konstantatos (ICFO, Barcelona):** Solution-Processed Photovoltaics and Optoelectronics
- 11:15 **Nikolai Gaponik (TUD Technical University, Dresden):** Architectures of Colloidal Quantum Dots for Photonic and Optoelectronic Applications
- 11:45 **Hans Ägren, Guanying Chen, Paras N. Prasad (KTH-Royal Institute of Technology, Stockholm and Institute for Lasers, Photonics and Biophotonics, SUNY-Buffalo):** Upconversion Nanotechnology for Energy Conversion
- 12:30 Lunch and Networking

List of attendees:

S. No	First Name	Last Name	Organization	Country
1	Talha	Erdem	BILKENT UNIVERSITY	Turkey
2	Qin	Wang	Acreo AB	Sweden
3	Alexander	Weiland	Aaxus AB	Sweden
4	Truls	Löwgren	Aledia SAS	France
5	Alexandre	Lagrange	CEA-LETI	France
6	Silvia Maria	Pietralunga	CNR-IFN	Italy
7	Per	Sjödén	Consultant	
8	Ana	Garcia Navarro	CSIC	Spain
9	Hernán	Míguez	CSIC	Spain
10	Alexander	Dmitriev	CTH	Sweden
11	Henrik	Lindstrom	Exeger	Sweden
12	Camilla	Niva	Exeger	Sweden
13	Mats	Hede	Hamamatsu Photonics	Sweden
14	Gonçal	Badenes	ICFO	Spain
15	Elen	Garcia	ICFO	Spain
16	Gerasimos	Konstantatos	ICFO	Spain

17	Alvaro	Blanco	ICMM-CSIC	Spain
18	Christos	Trompoukis	IMEC	Belgium
19	Hans	Ågren	KTH	Sweden
20	Srinivasan	Anand	KTH	Sweden
21	Bikash Dev	Choudhury	KTH	Sweden
22	Apurba	Dev	KTH	Sweden
23	Ignat	Harczuk	KTH	Sweden
24	Jing	Huang	KTH	Sweden
25	Ruslan	Ivanov	KTH	Sweden
26	Maria	Kanellopoulou	KTH	Sweden
27	Himanshu	Kataria	KTH	Sweden
28	Di Matteo	Loreto	KTH	Sweden
29	Sebastian	Lourdudoss	KTH	Sweden
30	Saulius	Marcinkevicius	KTH	Sweden
31	Federico	Pevere	KTH	Sweden
32	Pankaj Kumar	Sahoo	KTH	Sweden
33	Reza	Sanatinia	KTH	Sweden
34	Marcin	Swillo	KTH	Sweden
35	Ilya	Sychugov	KTH	Sweden
36	Chunze	Yuan	KTH	Sweden
37	Asghar Jamshidi	Zavaraki	KTH	Sweden
38	Mario	Agio	LENS	Italy
39	Maryam	Hajji	Lund University	Sweden
40	Bo	Monemar	Lund University	Sweden
41	Babak	Keidari	Obducat Technologies AB	Sweden
42	Pierre-Yves	Fonjallaz	PhotonicSweden	Sweden
43	Sven	Södergren	Solibro Research AB	Sweden
44	Mikael	Björk	Solvoltaics AB	Sweden
45	Anne	Anderson	SP Solar Energy Group	Sweden
46	Nikolai	Gaponik	TU Dresden	Germany
47	André	Wolf	TU Dresden	Germany
48	Ramon	Alcubilla	UPC	Spain
49	Isidro	Martin	UPC	Spain
50	Delphine	Lebrun	Uppsala University	Sweden
51	Hast	Jukka	VTT Technical Research Centre of Finland	Finland
52	Anna	Fucikova	KTH	Sweden

53	Balaji	Manavaimaran	KTH	Sweden
54	Giriprasanth	Omanakuttan	KTH	Sweden
55	Fatemeh	Sangghaleh	KTH	Sweden
56	Yanting	Sun	KTH	Sweden
57	Clivia	Sotomayor Torres	ICN,ICRE, BarcelonaKTH	Spain

2.6.2 "Nanophotonics - essential ingredient for efficient and cost-effective solar cells?" Workshop: October 03, 2013 in Paris – France :

Jointly organized by EU Photovoltaic Technology Platform, Nanophotonics Europe Association and Nanophotonics for Energy Efficiency Network of Excellence, and supported by Photonics21 and EPIC.

A forum for the Nanophotonics and Photovoltaics communities to exchange ideas, to inform one another of latest developments, issues, challenges and opportunities, and to discuss joint future activities.

2.6.3 N4E 1st User's Meeting: June 19-20, 2013 in Madrid – Spain:

A 2-day Network User's Meeting was organized in The Instituto de Ciencia de Materiales de Madrid (ICMM) in Madrid, on June 19-20, 2013. It was an opportunity for all N4E network Partners and Associates Members to meet, exchange ideas, explore synergies and get to know each other. There were some oral presentations (with questions and answers), and lots of opportunities to discuss possible collaborations and future common activities.

Program:

Wednesday, June 19, 2013

- 14:15 Welcome
- 14:20 (FRET-mediated amplified spontaneous emission in biopolymer complexes) **ICMM-CSIC**
- 14:40 (Periodic Si-ZnO hierarchical nanostructure arrays for broadband antireflection coating) **KTH**
- 15:00 (Morphology-Dependent Excitonic Interaction of Polyfluorene Nanoparticles Hybridized with InGaN/GaN Quantum Well Nanopillars) **BILKENT**
- 15:20 (Electrospray as an effective method to create ordered polystyrene and silica nanostructures) **UPV**
- 15:40 (Jordi Martorell) **ICFO**
- 16:00 Coffee Break
- 16:20 Talk of **TU Dresden**
- 16:40 (L. Marsal*) Associate Member **U. Tarragona**
- 17:00 (B. H. Juárez*) Associate Member **IMDEA NANO**
- 17:20 (Hernán Míguez) Associate Member **ICMSE-CSIC**
- 17:40 (B. Romero) Associate Member **URJC**
- 21:00 Meeting Dinner at Asador de Aranda

Thursday, June 20, 2013

- 09:00 (High optical quality III-V nanopillar arrays with suppressed broadband reflectance for photovoltaic applications) **KTH**
- 09:20 (D. Gutierrez) Associate Member **LEITAT**
- 09:40 Talk of **CEA-LETI**
- 10:00 Coffee Break
- 10:20 Talk of **US**
- 10:40 Talk of **LENS**
- 11:00 Networking session
- 12:30 Pincho Lunch

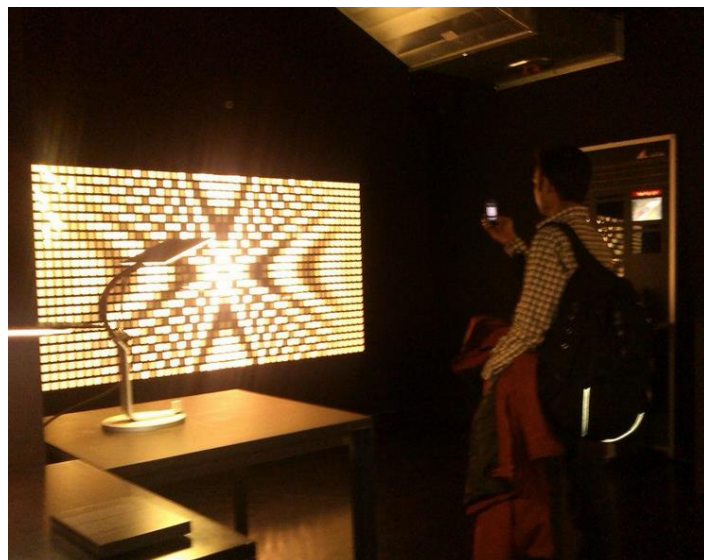
List of attendees: 8 of them from Associate Member Institutions.

S. No	First Name	Last Name	Organization	Country
1	Ramon	Alcubilla	UPC	Spain
2	Sandra	Bermejo	UPC	Spain
3	Arnau	Coll	UPC	Spain
4	Nikolai	Gaponik	TU Dresden	Germany
5	Stephen	Hickey	TU Dresden	Germany
6	Sepideh	Zakeri	LENS	Italy
7	Srinivasan	Anand	KTH	Sweden
8	Apurba	Dev	KTH	Sweden
9	Reza	Sanatinia	KTH	Sweden
10	Alexandre	Lagrange	CEA-LETI	France
11	Pavlos	Lagoudakis	US	UK
12	Gonçal	Badenes	ICFO	Spain
13	Elen	Garcia	ICFO	Spain
14	Jordi	Martorell	ICFO	Spain
15	Özgün	Akyüz	BILKENT UNIVERSITY	Turkey
16	Talha	Erdem	BILKENT UNIVERSITY	Turkey
17	Alvaro	Blanco	ICMM-CSIC	Spain
18	Cefe	López	ICMM-CSIC	Spain
19	Juan	Galisteo-López	ICMM-CSIC	Spain
20	Marta	Ibiate	ICMM-CSIC	Spain

21	Andre	Espinha	ICMM-CSIC	Spain
22	Alberto	Muñoz	ICMM-CSIC	Spain
23	Luz	Karime Gil	ICMM-CSIC	Spain
24	David	Gutierrez	Leitat Technological Center	Spain
25	Monica	della Pirriera	Leitat Technological Center	Spain
26	Lluís	Marsal	URV Universitat Rovira i Virgili	Spain
27	Hernán	Míguez	CSIC-ICMSE	Spain
28	Beatriz	Romero	URJC Universidad Rey Juan Carlos	Spain
29	Belén	Arredondo	URJC Universidad Rey Juan Carlos	Spain
30	Beatriz H.	Juárez	UAM-IMDEANano	Spain
31	Paul	Bartholomeus	Sgenia	Spain

2.6.4 N4E network visits Lumiblade: April 25, 2013 in Aachen – Germany:

The Nanophotonics for Energy Efficiency Network of Excellence visited Lumiblade in Aachen on April 25, 2013. The event, mainly targeting young researchers from the Network, included a visit to the Creative Lab and a detailed discussion with Lumiblade engineers.



Philips Technologie Aachen-Rothe Erde

2.6.5 N4E Hybrid Nanophotonics Workshop: March 26-27, 2013 in Southampton – United Kingdom:

A 2-day Hands-on Workshop on Hybrid Nanophotonics, with parallel technical training sessions, was organized in the University of Southampton. Attendees found opportunity to discuss and analyze the fundamental physical properties and applications of novel hybrid optoelectronic architectures that address the global strategy for improved energy efficiency.



Clean-room training for early stage researchers organized by the N4E network at the University of Southampton

2.7 Network Events Scheduled for 5th year (tentative):

- 2.7.1 **Preparatory and 4th Review Meeting:** March 17-18, 2013 in Brussels – Belgium
- 2.7.2 **NaNaX 6 – Nanoscience with Nanocrystals Conference:** May 18-23, 2014 in Bad Hofgastein – Austria
- 2.7.3 **N4E User's Meeting:** June 19-20, 2014 in Istanbul – Turkey
- 2.7.4 **Teleconf. for preparation of workshops:** September 9th, 2014 online
- 2.7.5 **Industry-Academia Workshop (Photovoltaics):** September 25-26, 2014 in Amsterdam – Netherlands
- 2.7.6 **Industry-Academia Workshop (Solid State Lightening):** November 25-26, 2014 in Paris – France
- 2.7.7 **Final Project Meeting:** December 11-12, 2014 in Barcelona – Spain

2.8 Dissemination to public

There are some several ways for spreading the results of NoE research work among researchers within the network, larger scientific community, industry, policy makers and the general public.

The website (www.n4e.eu) is being used for announcing N4E results. It is also a tool for getting involved to the network as an Associate Member. The website also presents a calendar of forthcoming events related to the project activities. The website operates as a virtual network tool for networking (web-portal). The webpage is dynamic and it is modified during the project according to the incoming developments.

As mentioned above, other means of communication are being used, like **LinkedIn**, **Twitter**, **Google+** and **Facebook** accounts. All news published in the N4E web is also published in these other social / professional sites. This way we ensure a wider communication. These social networks are the best and effective way for spreading the results of NoE research work to the general public.

Besides the web and social networks, the N4E Network members also take every opportunity to disseminate results to the public in general. In particular, during 2013, the following appearances in media have originated from the N4E NoE:

An article, which is about the role of nanophotonics in energy efficiency, was published in **European Energy Innovation (Spring 2013 – pages 25-26)**. European Energy Innovation (EEI) blends information from European institutions, national administrations and the energy industry to highlight the significant energy challenges facing Europe today and the innovative technologies being deployed to meet them. If you are interested in energy, you should be reading European Energy Innovation. The magazine is distributed to opinion leaders and formers in National Governments; The EU Parliament and the EU Commission; Industry and Academia.

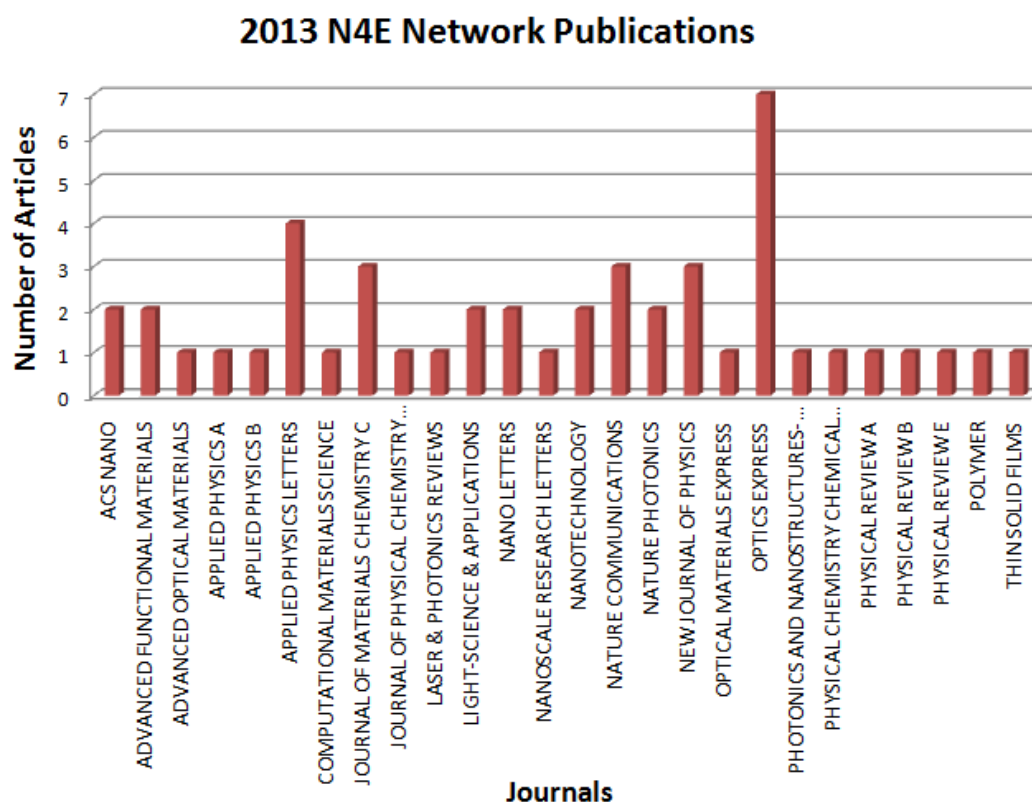
<http://www.europeanenergyinnovation.eu/Portals/0/publications/EuropeanEnergyInnovation-Spring2013.pdf>

Factsheet, flyers, leaflets, banner, logo, pen-drive, poster and other promotional materials are available for display and distribution at various events.

Annex 1: N4E 2013 Publications

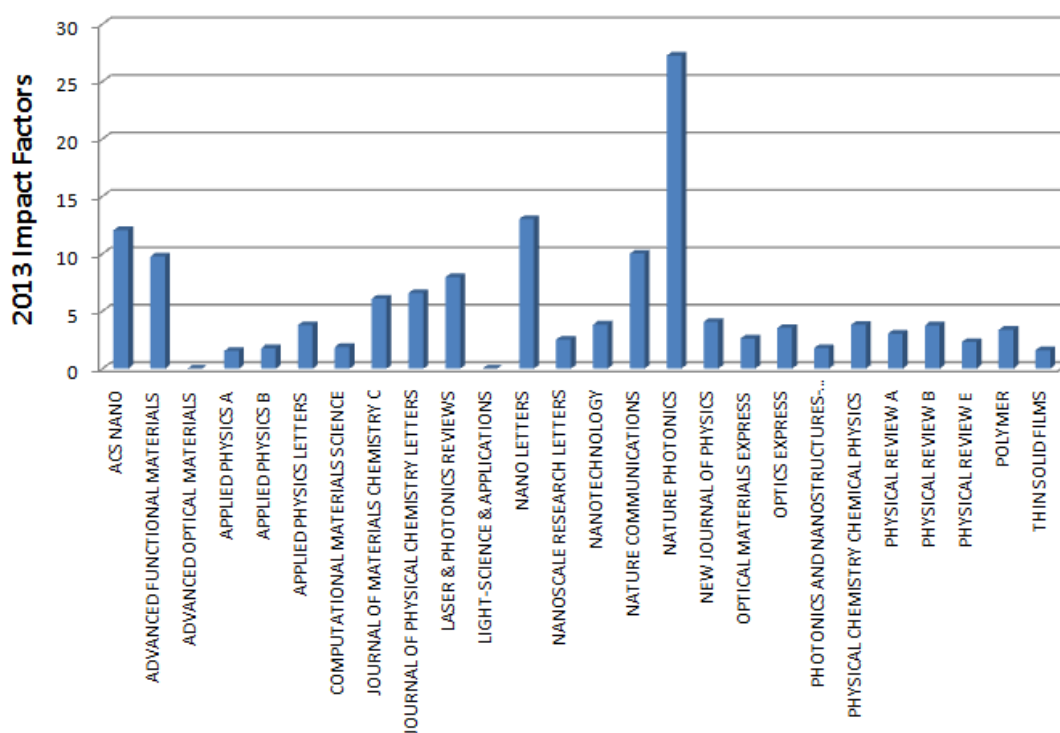
Research activities have already fed from previous network actions (seed projects) and during **2013**, **47*** publications have acknowledged the N4E project, most of them of important scientific quality and high impact factor, which contributes to spread the N4E network worldwide. Among them **2 Nature Photonics**, **2 Nano Letters**, **2 ACS Nano**, **3 Nature Communications**, **2 Adv. Func. Mater.** and **1 Laser & Photonics Reviews** can be highlighted. The average impact factor is **5.895**, according to Year 2012 impact factor of the journals.

5 papers, (**7**, **15**, **20**, **29** and **38**) involve at least two partners within the N4E network and they are the result of previous seed projects or new collaborations. 9 papers, (**3**, **25**, **27**, **31**, **32**, **37**, **39**, **40** and **47**) are from partners within N4E network and their topics are either indirect related with energy efficiency or derived from previous N4E related work. The rest of the papers, involve one partner within the N4E network and their topics are directly related with energy efficiency.



* Performing an advanced search in Web of Science with FUNDING AGENCY: (N4E) OR FUNDING AGENCY: (nanophotonics4energy) OR FUNDING AGENCY: (nanophotonics for energy) OR FUNDING AGENCY: (n4e) OR FUNDING AGENCY: (Nanophotonics for Energy) OR FUNDING AGENCY: (Nanophotonics4Energy) OR FUNDING AGENCY: (248855) OR FUNDING AGENCY: (NANOPHOTONICS FOR ENERGY) OR GRANT NUMBER: (nanophotonics4energy) OR GRANT NUMBER: (nanophotonics for energy) OR GRANT NUMBER: (n4e) OR GRANT NUMBER: (Nanophotonics for Energy) OR GRANT NUMBER: (Nanophotonics4Energy) OR GRANT NUMBER: (248855) OR GRANT NUMBER: (NANOPHOTONICS FOR ENERGY) AND Timespan=2013. Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH.

2013 Impact Factor Distribution of Journals



Field: Web of Science Categories	Record Count	% of 47	Bar Chart
MATERIALS SCIENCE MULTIDISCIPLINARY	19	40.426 %	■
PHYSICS APPLIED	19	40.426 %	■
OPTICS	17	36.170 %	■
NANOSCIENCE NANOTECHNOLOGY	13	27.660 %	■
CHEMISTRY PHYSICAL	10	21.277 %	■
PHYSICS CONDENSED MATTER	7	14.894 %	■
CHEMISTRY MULTIDISCIPLINARY	6	12.766 %	■
MULTIDISCIPLINARY SCIENCES	3	6.383 %	■
PHYSICS ATOMIC MOLECULAR CHEMICAL	3	6.383 %	■
PHYSICS MULTIDISCIPLINARY	3	6.383 %	■
Field: Web of Science Categories	Record Count	% of 47	Bar Chart

Subjects of the publications can be categorized within the following research themes

Field: Countries/Territories	Record Count	% of 47	Bar Chart
SPAIN	20	42.553 %	
ITALY	14	29.787 %	
TURKEY	10	21.277 %	
SINGAPORE	7	14.894 %	
ENGLAND	6	12.766 %	
SWEDEN	6	12.766 %	
USA	5	10.638 %	
GERMANY	3	6.383 %	
NETHERLANDS	3	6.383 %	
Field: Countries/Territories	Record Count	% of 47	Bar Chart

Distribution of publications by country of origin of author.

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