

## **ANNEX : PLAN FOR USING AND DISSEMINATING THE KNOWLEDGE (PERIOD 1)**

### **1.1. Exploitable knowledge and its use**

Though the planned “Exploitation” task (WP5.2) starts only at month 12, it is worth recalling the strategy presented in the Description of Work.

The project outputs are actually twofold; they will include a completely new tunable laser source in the Mid IR, which is a product in its own right and is based on several subcomponents also worth exploiting in the long term, and a prototype MIR spectrometer that is specifically designed to be applied in harsh industrial environments and that shows strong prospects for profitable implementation in the mid term. The ultimate target for the project is to realize a robust industrial instrument for in situ gas measurements and that has the potential to provide the industrial end user with a tool that fulfills most of his measurement requirements at reasonable costs. Moreover, the technology developed during this project will provide a platform for further exploitation through development of instrumentation for other non-industrial applications with a particular focus on new medical diagnostic tools.

It is important to note that in addition to the scientific and technological achievements by the project partners significant benefits will be derived from 3rd party users of the technology -e.g. industrial customers who will use the technology to improve their processes/yields/products/material efficiencies/emissions/waste etc.

Starting with prospects for the MIR spectrometer, a recent market study made by a US Market analyst company quantifies the total market for continuous and intermittent air pollution monitoring systems and services to 1.1 bill USD in 2005 expanding to 1.5 bill USD in 2008. The market segment includes ambient and stack measurements, and for most of the applications a continuous monitoring system covering several gases is required. The market driver is first of all the growing awareness of the impact increased emissions will have on the environment, resulting in new directives as well as an increasing number of regulated pollutants. Additionally, maximum emission levels are being revised and reduced, thus eliminating some of the traditional measurement techniques used so far.

The customer base is primarily power generation and waste incineration and there is a dramatic growth of new plants being built. There are 124 new plants under construction scheduled to start up in 2006. Most of these are in the emerging industrialized countries (China, Korea and India) and a substantial portion of these are coal fired. A similar number of waste incinerators are being built in the same areas.

The market situation in Europe is that with the exception of stack monitors, where European companies dominate the European markets, the other market segments are dominated (> 50% market share) by US and Japanese companies. Single line spectroscopy is expected to play a major role in the next generation of instruments for all market segments, and as Europe is currently ahead of both US and Japan in commercial exploitation of the related technology, prospects to dramatically increase future market shares for European companies appear very strong.

The market potential for a new product with the potential of covering these market segments is, as indicated above, very large. The VILLAGE project is, in addition to the above markets, aiming particularly at new applications in the process industry where reliable instruments meeting the process requirements are not readily available, and where specific critical measurements will have an impact on both product quality and process yield. Some relevant targets for a mid-term exploitation include versatile monitoring of:

- Reduced levels of NO<sub>2</sub> due to reduction of NO<sub>x</sub> emissions from engines and industry
- Reduced NO<sub>x</sub> emissions from power plants and incinerators (up to 90%)
- Reduced HCl emissions from incinerators (typically from current 50 to 10 mg/m<sup>3</sup>)
- Reduced NH<sub>3</sub> emissions from SCR/SNCR plants in power generation and incineration, from typically 10 to < 2 ppm
- Reduced NO<sub>x</sub> emissions from glass melters (reduction >> 10%)
- Reduced HF emissions from brick works and manufacture of ceramic tiles (typically from current 50 to below 5 ppm)
- Trace levels of H<sub>2</sub>O and other impurities for improved yield in semiconductor manufacturing
- Real-time CO and O<sub>2</sub> concentrations measurements for reduced cost in production of steel by improved post combustion (realistic 20% reduction of energy cost expected)

NEO has established itself as one of the leading manufacturers of TDL based instruments, and expects a substantial growth in the sales of its current range of products in the next 5 years in particular for new process control applications. Due to the limited number of emission gases that can be measured in the NIR, the products emerging from this project will primarily be addressed to the emission and ambient air control markets. Sales of tunable single line spectroscopic instruments are expected to grow as follows:

Time range (years)	Number of systems per year				Direct sales (M€)
	Europe	USA	Far East	Rest of World	
5	25	25	50	10	5
10	50	50	100	50	15

Finally, the exploitation of the sub-components of the Village projects also benefits from significant potential. Special emphasis will be put during the project on the demonstration of their manufacturability. Taking into account the requirements for protection of Intellectual Property, the above-mentioned dissemination strategy will help evaluate the following potential licensing opportunities:

- TRT is able to ensure small scale production of OP-GaAs crystals up to 20 to 30 samples per year. Above that a preferred solution would be to subcontract the template fabrication and dicing/polishing tasks and license the HVPE growth step. Potential candidates for this include III/V GIE, a subsidiary of Alcatel targeting medium scale development of GaAs components, and the University of Clermont-Ferrand (France) currently planning 2<sup>nd</sup> growth.
- The Tm- fibre sources developed by ORC will have a huge range of applications in areas such as remote sensing, laser radar, spectroscopy, metrology and medicine. Successful exploitation of similar sources has already been demonstrated through licensing to one of the ORC's most well-known spin-out companies, Southampton Photonics (SPI). This is one avenue for exploitation that will be vigorously pursued. In addition, exploitation routes for some or all of the technology developed in WP1, via licensing of patents and transfer of technology to other laser manufacturers, will also be considered to maximise the impact of our work.
- HHUD has already successfully transferred technology to a SME: it licensed its cw-OPO invention, after protection by a European and a US patent, to the German company LINOS, now producing cw-OPOs in the 1.5 to 3.5 μm spectral range, for research laboratory use. With this background, HHUD is very aware of the need to protect IP and to stimulate companies working in diverse application fields. HHUD thus can be helpful in establishing direct links between NEO and third parties, as well as open up new directions of research and application of the GaAs sources.

## 1.2. Dissemination of knowledge

While the “Dissemination” effort during the first year of the project (Task WP5.1) was mostly focused on the creation of the VILLAGE project website, first promising results have also enabled early dissemination through standard scientific channels. The table below lists those items and some future dissemination opportunities more recently identified:

	Planned/ actual date	Type	Type of audience	Countries addressed	Size of audience	Partner involved
1	02/2007	Project website	General public	All		All
2	03/2007	Poster	Higher education	Germany	300	HHUD
3	09/2007	Conference	Research	All	500	ORC
4	06/2007	Direct contact	Research	Germany	10	HHUD
5	(09/2007)	Conference/Exhibition	Research/Industry	Europe	500	NEO
6	(12/2007)	Publication	Research	All		TRT

Explanatory notes:

- Item 1 is the project website (<http://www.neo.no/village/>) described in Deliverable D5.1 and recently updated. It will be presented during the first review meeting.
- Item 2 corresponds to a presentation of the VILLAGE concept during the Annual Meeting of the German Physical Society, AMOP section (atomic, molecular and plasma physics), 19 – 23 March 2007 in Düsseldorf (Poster title: “Development of mid-IR CW narrowband 5 – 15 µm tunable laser source for molecular spectroscopy”).
- Item 3 is the accepted paper on the Tm fiber laser work that will be presented at the “Bragg Gratings, Photosensitivity and Poling in Glass Waveguides” (BGPP) OSA meeting in September 2007 in Quebec, Canada.
- Item 4 is related to early promotion of the VILLAGE project to another team of Heinrich Heine University (<http://www.ilm.uni-duesseldorf.de/tracegas/>) working on medical applications of gas spectroscopy. All partners subsequently had the opportunity to make a fruitful visit to their labs during the 14-15/06/2007 meeting in Düsseldorf.
- Item 5 is an event NEO will attend as an invited speaker, the Field Laser Applications in Industry and Research international conference (FLAIR’07, Florence). P. Kaspersen expects to seize the opportunity to promote the first results of VILLAGE to a large audience.
- Item 6 follows a general talk on OP-GaAs that TRT will give during the 15<sup>th</sup> International Conference on Crystal Growth (ICCG’07, Salt Lake City). The opportunity to publish results in a special issue of the Journal of Crystal Growth, and include recent achievements from VILLAGE, will be sought.