

KYT2014 - Finnish Research Programme on Nuclear Waste Management

Brief presentation

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KYT2014 starting points 1

- The research programme is based on the Nuclear Energy Act (990/1987)
 - *"research aimed at ensuring that the authorities have such sufficient and comprehensive nuclear engineering expertise and other facilities at their disposal that are needed for comparisons of the various ways and methods of carrying out nuclear waste management"*
- International evaluation¹ in 2012 of KYT2014 research programme
 - Recommendations of the previous international evaluation (in 2007) have been taken into account
 - Research programme has reached its main goals
 - Recommendations were given, for instance concerning research topics, training, and collaboration with other research programmes

¹ Apted, M., Karlsson, F. & Salomaa, R., 2013. KYT 2014 Review Report, Publications of the Ministry of Employment and the Economy, Energy and Climate 10/2013, 29 p.

KYT2014 starting points 2

- Research period 2011-2014
- Annual budget 1,7 M€
- Funding from State Nuclear Waste Management Fund (VYR) into which nuclear waste producers pay annually 0,08 % of their assessed liability, respectively
 - Research organisations can also direct own funding in their projects

KYT2014 starting points 3: Changing environment for nuclear waste management

- Construction Licence application for Posiva's spent fuel disposal facility 28.12.2012
- Nuclear power decisions in Finland
 - OL3 Operating Licence application during next research period
 - OL4, FV1 Construction Licence application during research period?
 - FiR1 decommissioning being prepared, EIA started in 2013
- Nuclear waste events abroad
 - Sweden: SKB's Construction Licence application 3/2011
 - USA: Blue Ribbon Commission final report 2012 on America's nuclear future <= Yucca Mountain was abandoned 2010
 - EU: IGD-TP (Implementing Geological Disposal - Technology Platform)

KYT2014 focus of planning <= KYT2010 international evaluation 2007

- Large integrated projects in safety research
 - Coordinated projects (small research programmes up to the whole duration of the research period)
- Training
 - Training is among the assessment criteria of all project proposals

KYT2014 aims

- Basic aim is to produce high quality research results to be used by Finnish nuclear authorities
 - STUK: Radiation and Nuclear Safety Authority, Finland
 - TEM: Ministry of Employment and the Economy
- Nationally central research topics
- Topics directly related to the respective nuclear waste management duties of waste producers or authorities do not belong to KYT2014
- The results of the research programme are public and thus available for all participants
- The long-term aim of KYT2014 is, for its part, to
 - Maintain national knowhow in nuclear waste management
 - Promote collaboration between authorities, nuclear industry and scientists

KYT2014 assessment criteria of project proposals

- Relevance and usability of results are assessed against research needs
- Networking with other actors in the field, KYT2014 seeks well-integrated joint projects
- Training and scientific merits
 - New experts
 - New expertise
- Efficiency shown in previous KYT or other projects
- Realism in cost and work amount estimates

KYT2014 types of projects

- 1 year project
- Longer term project
- Coordinated project (new type of project)
 - Actually a small research programme

KYT2014 management

- Steering Group
 - TEM appoints
 - Strategic lines of the research programme
 - Can propose topical focus areas for TEM in the annual call for project proposals
 - Makes a recommendation for TEM of projects to be funded
- Support Groups
 - Appointed by the Steering Group
 - Assess the contents of project proposals
 - Follow up and guidance of the projects receiving funding
- Coordinator
 - Management of the research programme
- Website
 - <http://kyt2014.vtt.fi/>

KYT2014 Steering Group

| Member (deputy) | Organisation | Duty |
|------------------------------------|--------------|------------|
| Kaisa-Leena Hutri (Risto Paltemaa) | STUK | Chair |
| Mikko Paunio | STM | |
| Miliza Malmelin (Magnus Nyström) | YM | |
| Sami Hautakangas (Maiju Paunonen) | Fortum | |
| Marjut Vähänen (Juhani Vira) | Posiva | |
| Veijo Ryhänen (Liisa Heikinheimo) | TVO | |
| Jaana Avolahti (Jorma Aurela) | TEM | Vice Chair |
| Mia Ylä-Mella (Hanna Virlander) | Fennovoima | Expert |

KYT2014 Support Group I: Buffer, backfill and canister

| Member | Organisation | Duty |
|--------------------|--------------|------------|
| Marko Alenius | STUK | Chair |
| Rainer Laaksonen | STUK | Vice Chair |
| Jaakko Leino | STUK | |
| Ari Luukkonen | STUK | |
| Tuulikki Sillanpää | STUK | |
| Pasi Kelokaski | Fortum | |
| Seppo Kasa | Posiva | |
| Kari Koskinen | Posiva | |
| Nina Paaso | TVO | |

KYT2014 Support Group II: Safety assessment and innovations

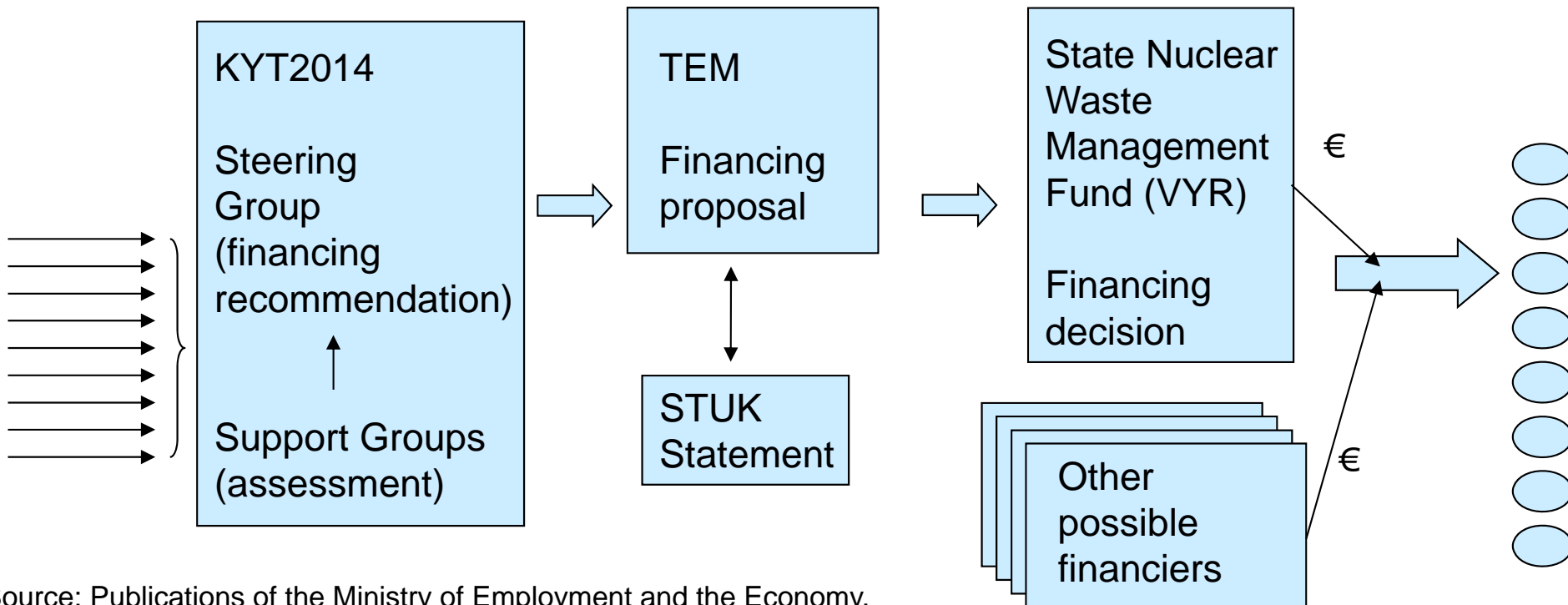
| Member | Organisation | Duty |
|--------------------|--------------|-------|
| Kai Hämäläinen | STUK | |
| Arto Isolankila | STUK | |
| Petri Jussila | STUK | Chair |
| Jarmo Lehikoinen | STUK | |
| Paula Ruotsalainen | STUK | |
| Tapani Eurajoki | Fortum | |
| Anne Lehtinen | Posiva | |
| Marja Vuorio | Posiva | |
| Pekka Viitanen | TVO | |

KYT2014 Support Group III: Society and Man

| Member | Organisation | Duty |
|----------------------|--------------|--------|
| Jaana Avolahti | TEM | Chair |
| Juhani Tirkkonen | TEM | |
| Jarmo Lehtinen | STUK | |
| Timo Seppälä | Posiva | |
| Tiina Tigerstedt | Fennovoima | Expert |
| Juha Poikola | TVO | |
| Anna-Maria Länsimies | Fortum | |
| Miliza Malmelin | YM | |

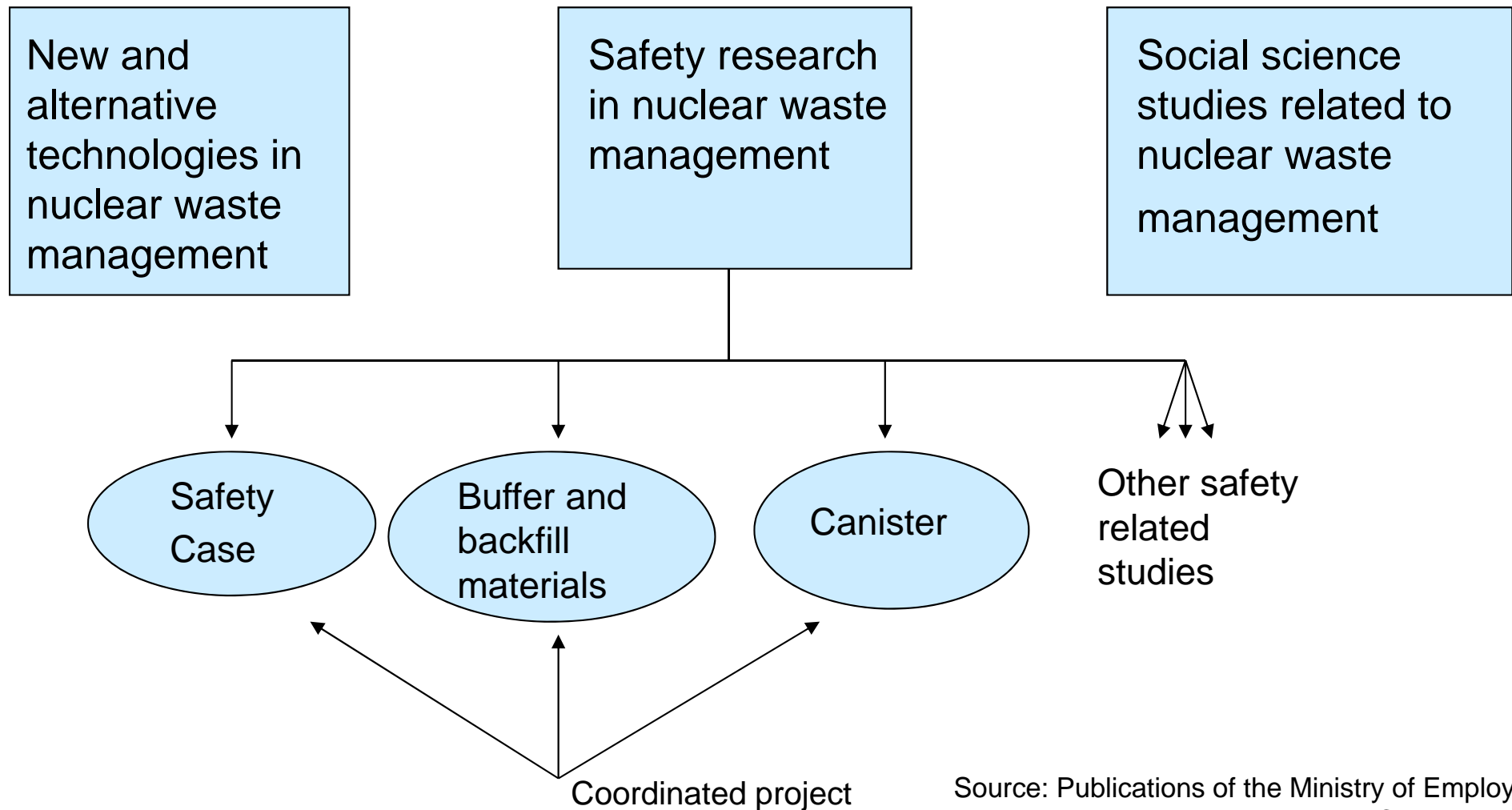
Decision making in KYT2014 about project proposals

| Project proposals | Assessment | Financing proposal | Financing decision | Projects to be financed |
|-------------------|--------------|--------------------|--------------------|-------------------------|
| (October) | (Nov.- Dec.) | (January) | (March) | |



Source: Publications of the Ministry of Employment and the Economy. Energy and the Climate 72/2010

KYT2014 research topics



Source: Publications of the Ministry of Employment and the Economy. Energy and the Climate 72/2010

New and alternative technologies in nuclear waste management

- Nuclear waste management solutions based on spent fuel reprocessing
- Nuclide partitioning and transmutation (P&T)
- Alternatives in geological disposal, e.g. deep bore holes
- Retrievability
- Storage alternatives, e.g. dry storage, long-term storage
- New solutions in low and medium level waste management, e.g. shallow land disposal of very low level waste
- New solutions for implementing decommissioning

Safety research in nuclear waste management : Safety Case

- Work aiming to obtain expertise to do an integrated Safety Case for a KBS-3 type repository in crystalline bedrock
- Coordinated project, attention paid to
 - Formulation of scenarios
 - Alternative conceptual models and interpretations
 - Development of methods to do uncertainty analysis
 - New sources of methodological information (safety assessment type of work outside nuclear waste research, e.g. geological disposal of CO₂)
 - Presentation of safety case for wider audiences (principles, methods, and limitations of Safety Case)
- Aims at training experts in mathematical safety assessment

Safety research in nuclear waste management : Buffer and backfill materials

- Coordinated project
- Development of methodological toolbox
 - Coupled processes (THCMBR¹)
 - Microstructure of bentonite
- Safety relevant issues
 - Erosion phenomena (piping and chemical erosion)
 - Long-term stability (mineralogical alterations)
 - Effects of high pH (cementitious materials)
 - Iron-bentonite -interaction
 - Effects of high salinity
 - Effects of freezing

¹ THCMBR process = thermo-hydro-chemical-mechanical-biological-radiation process

Safety research in nuclear waste management : Canister

- Coordinated project
- Long-term corrosion resistance of canister
 - Stress corrosion cracking
 - Mass flows of corroding agents through buffer
- Long-term mechanical durability of canister
 - Design criteria are considered to be fulfilled in "normal evolution"
 - Creep
 - Rock shear has been studied in safety assessments as failure mode
 - Mechanical buffering capability of bentonite buffer

Safety research in nuclear waste management : Other safety related studies

- Long-term behaviour of concrete structures in disposal conditions
- Studies related to the conclusion of long-term experiments that simulate disposal conditions for low and medium level waste
- The effect of spent fuel properties on disposal safety, e.g. the effect of increased burn-up or disposal of new types of spent fuel, like MOX
- The importance of C-14 in the disposal of spent fuel, low and medium level waste, and decommissioning waste
- Bedrock investigations from disposal safety point of view
- Biosphere studies from disposal safety point of view
- Reliability of the assessment of costs of nuclear waste management
- Techniques and methods for the decommissioning of nuclear facilities
- Operational safety of disposal facility

Social science studies related to nuclear waste management

- The aim is to support decision making and the preparation thereof
- Independence and reliability of different actors
- Ethical discussion
- Long time spans considered
 - Reliability of information / knowledge
 - Conservation of information / knowledge

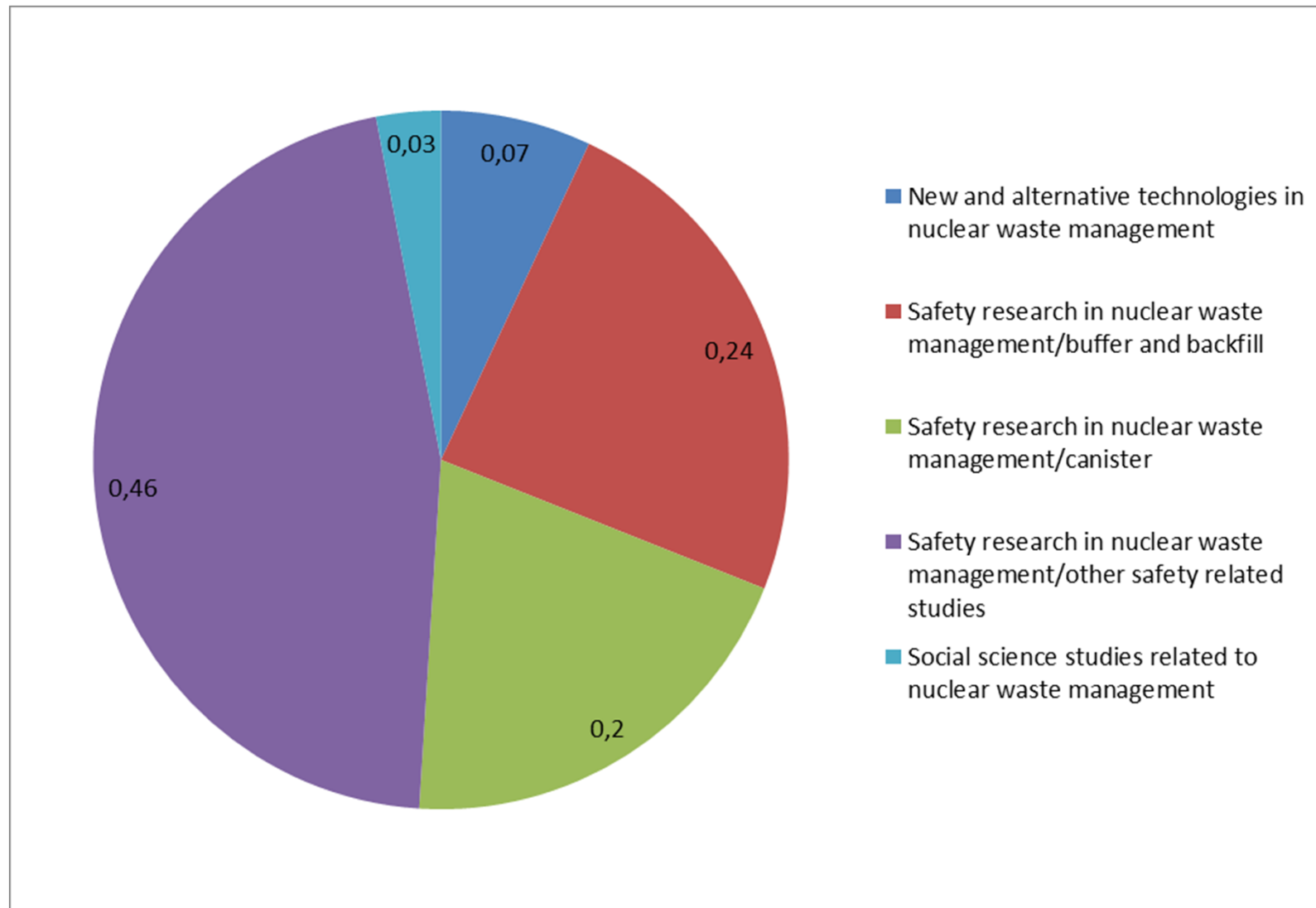
KYT2014 collaboration

- Thematic seminars
- Other research programmes
 - Scientific collaboration
- YTERA project of the Academy of Finland
 - Graduate School for nuclear technology and radiochemistry
- EU
- International expert organisations, e.g. OECD NEA

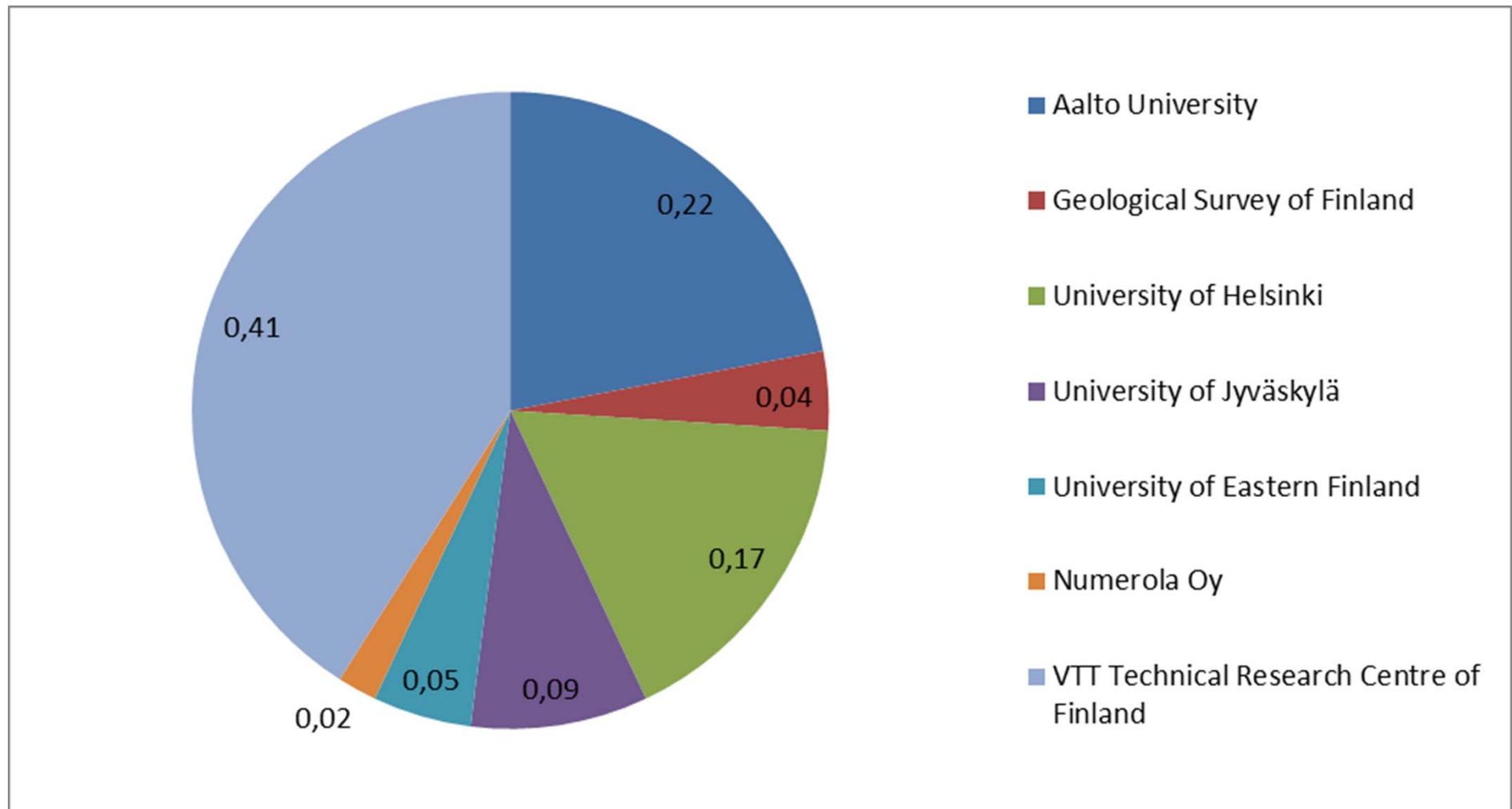
KYT2014 call for project proposals 2014

- In total 34 research project proposals, total funding requested 2,3 M€
- Funding for 28 research projects
 - Aalto (7), GTK (2), HY (5), JY (3), UEF (1), Numerola Oy (1), VTT (9)
- 2 coordinated projects
 - Buffer and backfill materials (BOA, VTT)
 - Canister (L-TICO, VTT)

KYT2014 call for project proposals 2014: Distribution of VYR funding 1702 k€ between research topics in 2014



KYT2014 call for project proposals 2014: Distribution of VYR funding 1702 k€ between research institutes in 2014



KYT2014 summary

- Based on Nuclear Energy Act
- Research period 2011-2014
- Budget 1,7 M€/a
- Call of project proposals annually
- New things
 - Coordinated projects in safety research
- Framework programme (in English):
http://www.tem.fi/files/28692/TEM_72_2010_netti.pdf
- More information at KYT2014 website (<http://kyt2014.vtt.fi/>)

And finally

- Thank you for your attention!