

A Profile of European NREN's

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Every country in Europe has one National Research and Education Network (NREN)

(ex. Latvia, Romania and Russia)

Data about NRENs

Home pages of those NREN's which are *members of TERENA* can be reached from http://www.terena.nl/about/terena_member_map.html

Home pages of those NREN's which are *members of CEENet* can be reached from http://www.ceenet.org/ceenet_cbyc_list.html

TERENA Compendium (2000, 2001, 2002, 2003, 2004)

Focus Study on Funding, Management and Operation of European Research Networks, TERENA Report, 2004

All these studies are available on paper and electronically at <http://www.terena.nl/compendium/>



UKERNA

Mission Statement

Advancing and supporting the UK's education and research network.

Objectives

To take responsibility for the networking programme of the **education, learning and research communities** in the United Kingdom; and to research, develop and provide advanced electronic communication facilities for use within these communities, and to facilitate the electronic connectivity of these communities to external third parties."



SWITCH

Our Mission

SWITCH was established with the objective “to create, promote and offer the necessary basis for the effective use of modern methods of telecomputing in teaching and research in Switzerland, to be involved in and to support such methods.”

Our Vision

In order to fulfil this role now and in the future, SWITCH is constantly **improving and expanding its infrastructure and services for universities and the wider public.**

SWITCH meets the needs of Swiss universities by

- providing customised access to SWITCH's own network with high-quality Internet technologies and bandwidth greater than the current requirement,
- providing rapid connections to foreign networks and excellent international contacts,
- providing network services offering additional benefits which are not available on the market or which are not of adequate quality and which may also be offered to the public too.

As a technically leading, competent company, SWITCH plays a key role for the Internet in Switzerland.



HEAnet: Mission statement

HEAnet and its staff are committed to delivering and supporting **network infrastructure** and **associated services** in furtherance of national and international objectives **for Irish education and research**.

HEAnet fulfils its mission by focusing on:

- delivering the best network and the best services at the best value
- developing and supporting services to meet the needs of our community
- providing strategic opportunities for **global collaboration** by Irish education and research
- gaining leverage from expertise, scale and position as a national network service
- **encouraging the transfer of technology** from HEAnet to the rest of the Internet



Users

- **Universities**

All NREN's connect universities and nearly all universities are connected to NREN's.

- **Institutes of higher/further education**

Nearly all NREN's connect these this type of institutions and in those countries where this is possible around two thirds of institutes of higher/further education are connected to the NREN.

- **Research institutes**

Large majority of all NREN's connect these type of institutions and around 75 % of research institutes are connected to the NREN

- **Primary and secondary schools**

Almost all NREN's allow such connections.

In small countries (e.g. Greece, Portugal, Luxemburg, Slovenia) the majority of schools are connected to the NREN

- **Libraries**

Almost all NREN's allow such connections.

Only in small countries the majority of libraries are connected to NREN's.

- **Hospitals (other than university hospitals)**

More than half of NREN's would allow this, but actually only a very small percentage are connected to them.

- **Government departments**

Most of NREN's would allow this, but only a very small percentage are connected to them.



Users

- With smaller countries it is more often found that the NREN connects schools, libraries and governmental departments.
- NREN's which connect universities and research institutes serve anywhere from a few tens to a few hundred customers.
- NREN's which are more involved with schools and libraries connect anywhere from a thousand to several thousand customers.
- Some NREN's also provide direct individual access (via cable, dial up or ADSL) to some customers (students, professors etc).



Comments

- Some NREN's provide more support to individual users
 - E.g. they provide training and user support to individual users
- Some NREN's have much larger user community
 - NREN's in large countries have to serve more universities
 - NREN's in small countries often connect schools and libraries (and not only universities and research institutions)
 - Some NREN's provide individual access to users (direct dial up access, etc.)

Universities are more demanding in bandwidth and reliability but on the other hand schools and libraries need more support.

- Those NREN's which light dark fibre themselves need additional staff .



Activities of NREN's

For their user community:

- Operating a special network
- Providing associated services
- Enhancing the network and developing new services

For the whole internet community:

- Transfer of new technology

Sometimes (especially in small countries)

- Registering domains
- Running neutral Internet exchange



Activities connected with the network

- Management of the network
- Monitoring of the network
- Customer support in case of problems
- Maintenance of the network

- Planning the next generation of the network
- Running public tenders for telecommunication infrastructure
- Testing equipment
- Running public tenders for equipment
- Connecting new customers/upgrading connections



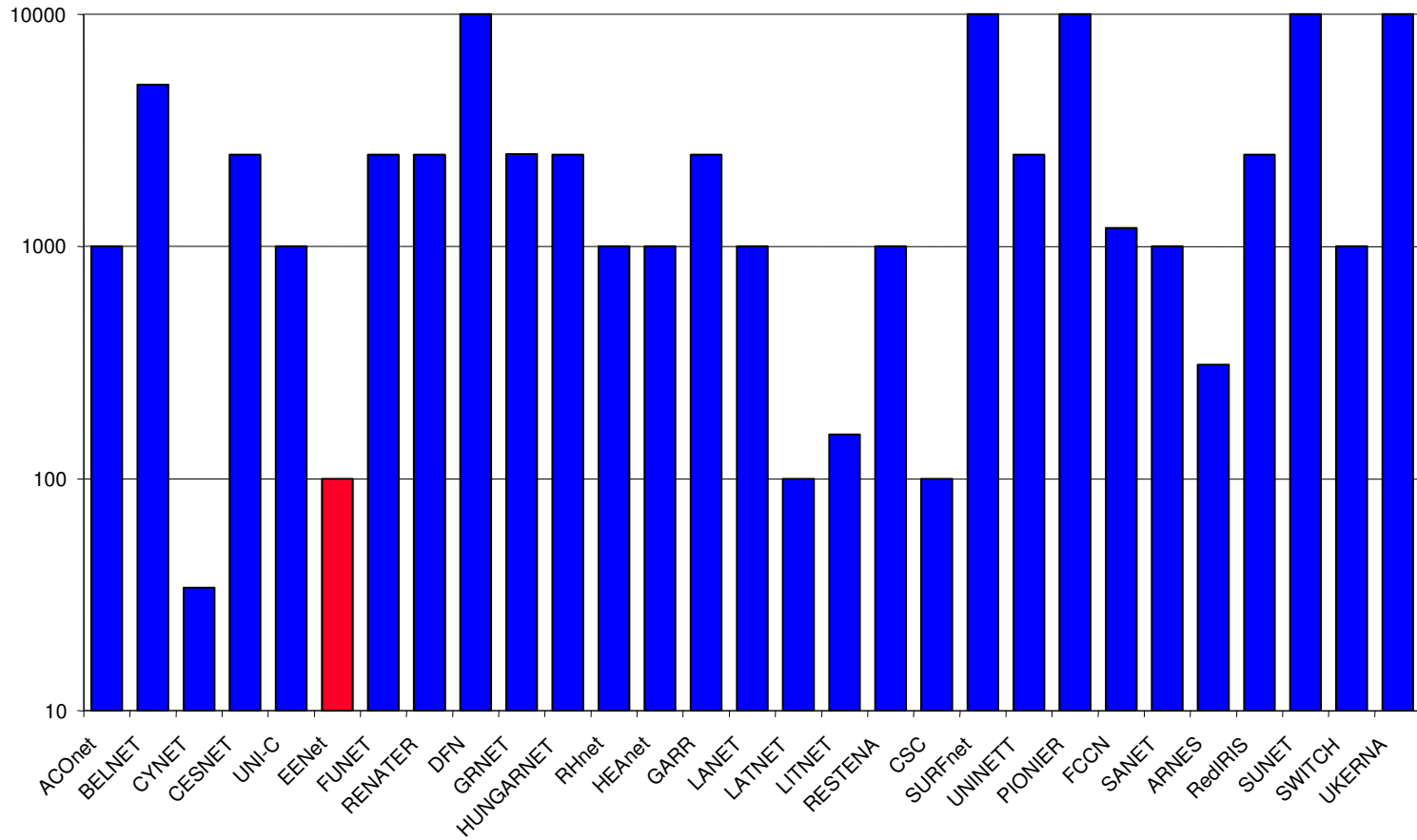
Technologies used on the core network

- SDH connectivity is still used by many NREN's
- Those who still use ATM would like to phase it out.
- More and more NREN's are leasing lambdas.
- Some are leasing dark fibre and building their own CWDM or DWDM systems.
- Most of NREN's use, or are planning to use Gb or 10 Gb Ethernet.

- NREN's usually plan to double the capacity of the core network every year.



Core Capacity on the Networks



Customer Empowered Network Concept

- Many NREN's in Europe lease, buy IRU (irrevocable rights of use) or build dark fibre and than light it with their own equipment.
- The decision depends on:
 - the prices of lambdas in the area of interest
 - availability and prices of dark fibre
 - expected exploitation period of the communication paths
 - expected number of dedicated links on the routes
 - cost of capital (and possibilities of loans) for buying IRU and purchase of the transmission equipment
- More and more NRENs in Europe follow this concept



Price for optical infrastructure

- This data is difficult to get and varies greatly from country to country.
- The following prices are calculated as an average from a few known cases in EU countries
- Intercity connections
 - 15 years IRU for a pair of fibres: EUR 600.000/100 km
 - plus each year 5% for maintenance
 - One year lease for a pair of fibres: EUR 70.000 /100 km
- Building fibre in towns (96 strands)
 - Cable with 96 strands: EUR 50.000/1 km
 - plus each year 5% for maintenance



External connectivity

Connection of the NREN network to the outside world is realised through the following ways:

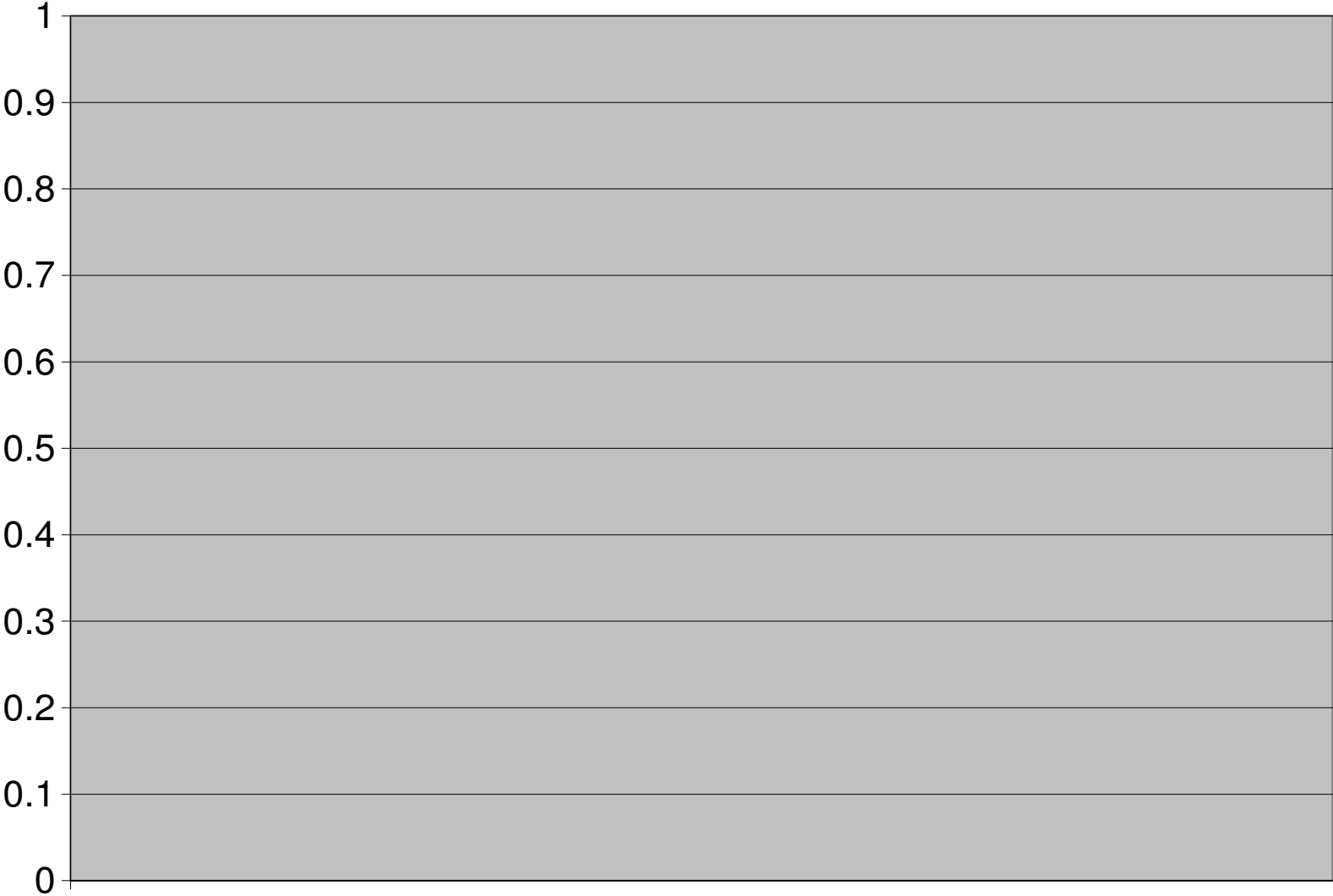
- Connection to GEANT (with GEANT PoP in the country or a special line to the GENAT PoP in another country)
- Special connections to research community in other countries
- Peerings/Internet Exchanges
- Connection to Commodity Internet



GEANT connection in Mbps per 1 mil inhabitants



GEANT connection in Mbps per 1 mil inhabitants



Column A

Row 1



Typical bandwidth

Data from EU and EFTA countries

Type of institution	Typical bandwidth
University	10 Mbps – 1 Gbps
Institute of higher/ further education	2 – 100 Mbps
Research institute	2 Mbps – 1 Gbps
Secondary school	128 kbps – 100 Mbps
Primary school	128 kbps – 2 Mbps
Library	128 kbps – 10 Mbps



Services

- E-mail, FTP, News, WWW hosting
- Security
CERT – incident response team
- Antispam, antivirus
- Time service (NTP)
- Videoconferencing and video streaming
- Directory services (LDAP)
- Co-location
- Annual conferences
- Consultancy
(new communication technologies, network security,
legal questions, innovative applications)



Projects

- Quality of Service
 - End-to-End Network Performance
 - IPv6
 - Wireless LAN
 - PKI/CA
 - AA
-
- TERENA technical programme



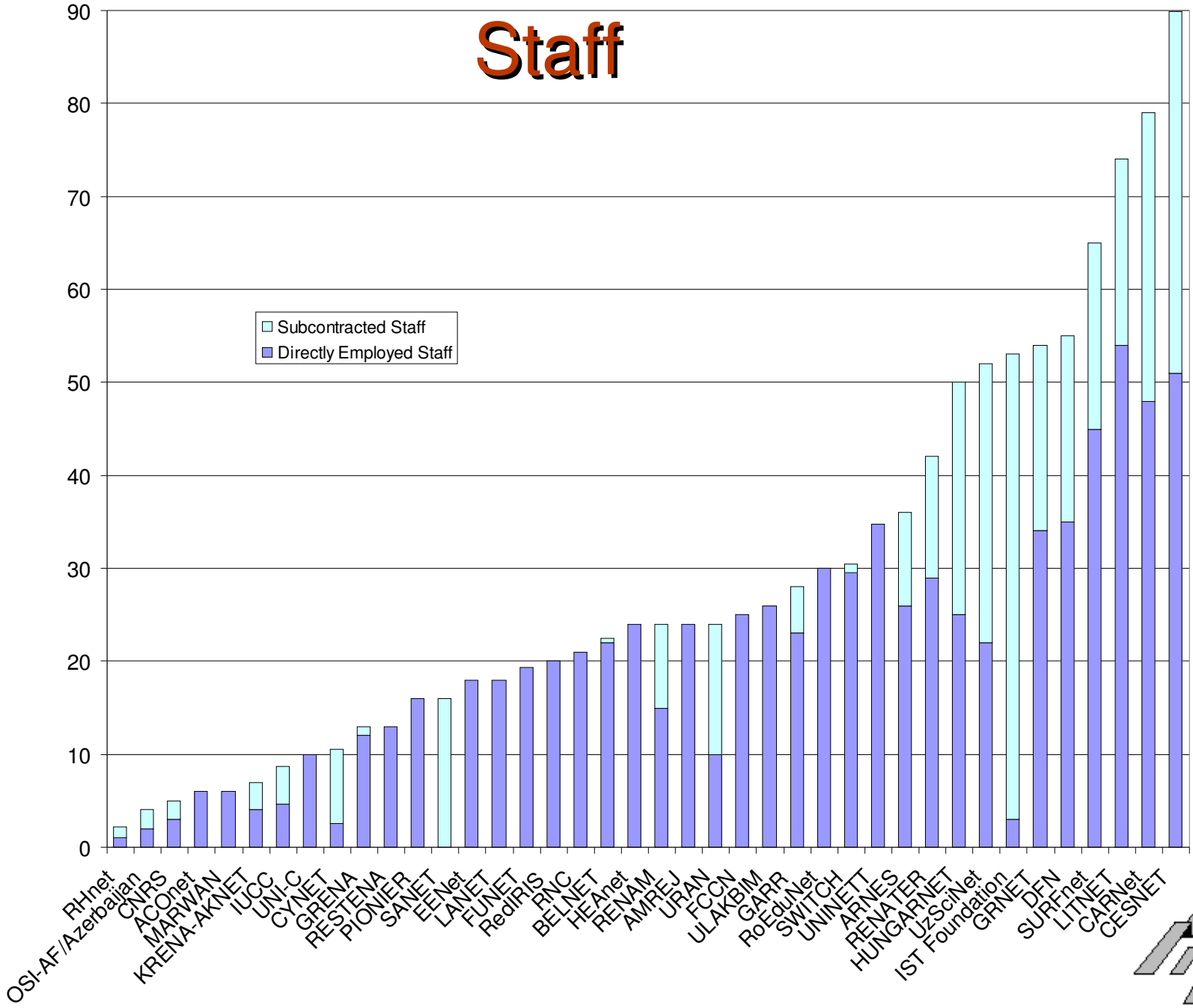
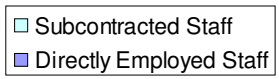
NREN's are members/partners in

- TERENA (www.terena.nl)
- DANTE (www.dante.org)
Shareholder/Member of the GEANT Consortium
- CEENet (www.ceenet.org)
- EC projects (e.g. SEEREN, EUMEDCONNECT)
- RIPE (www.ripe.net)
- IETF (www.ietf.org)
- ICANN (www.icann.org)
- CENTR (www.centri.org)

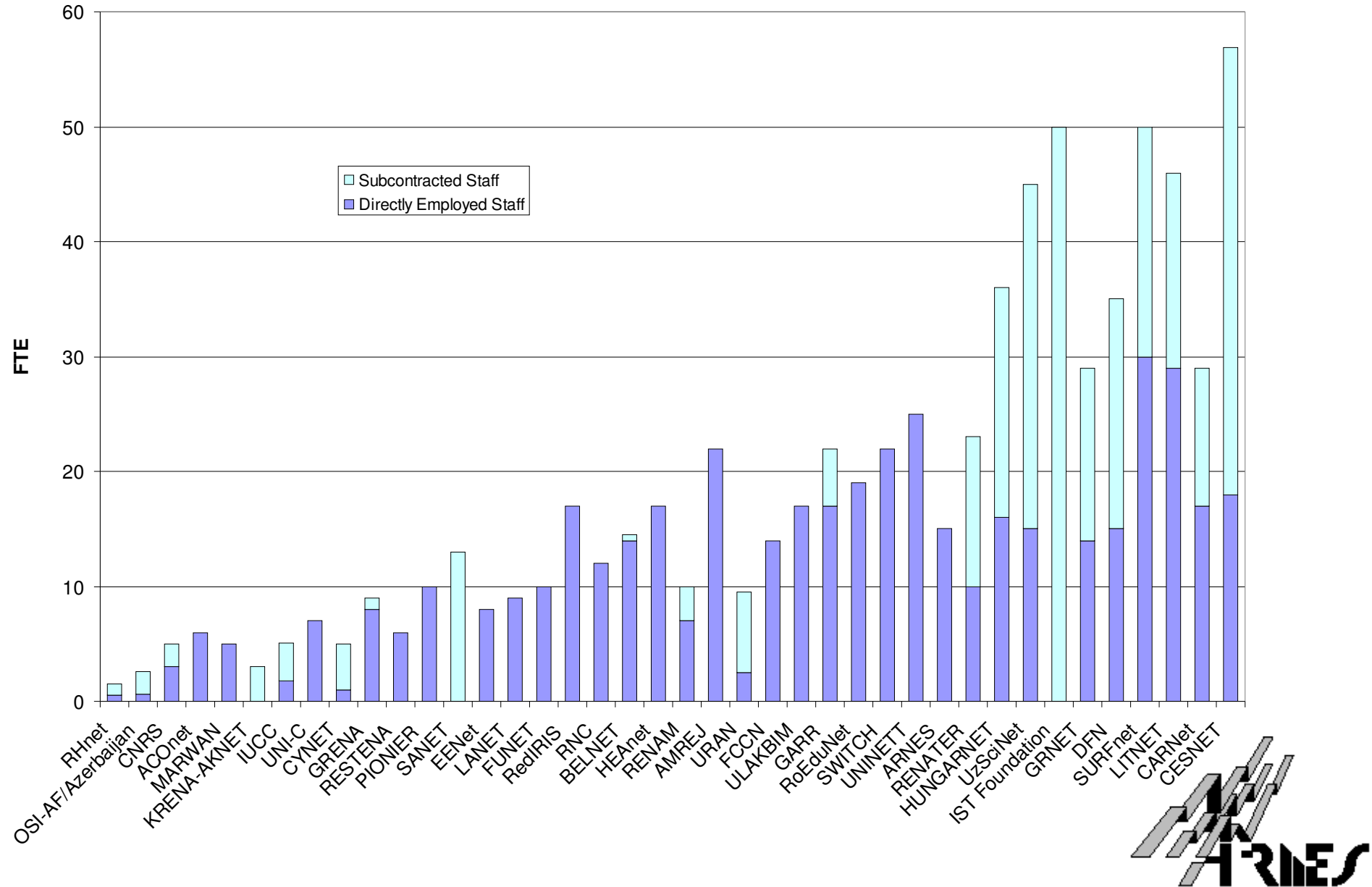


Staff

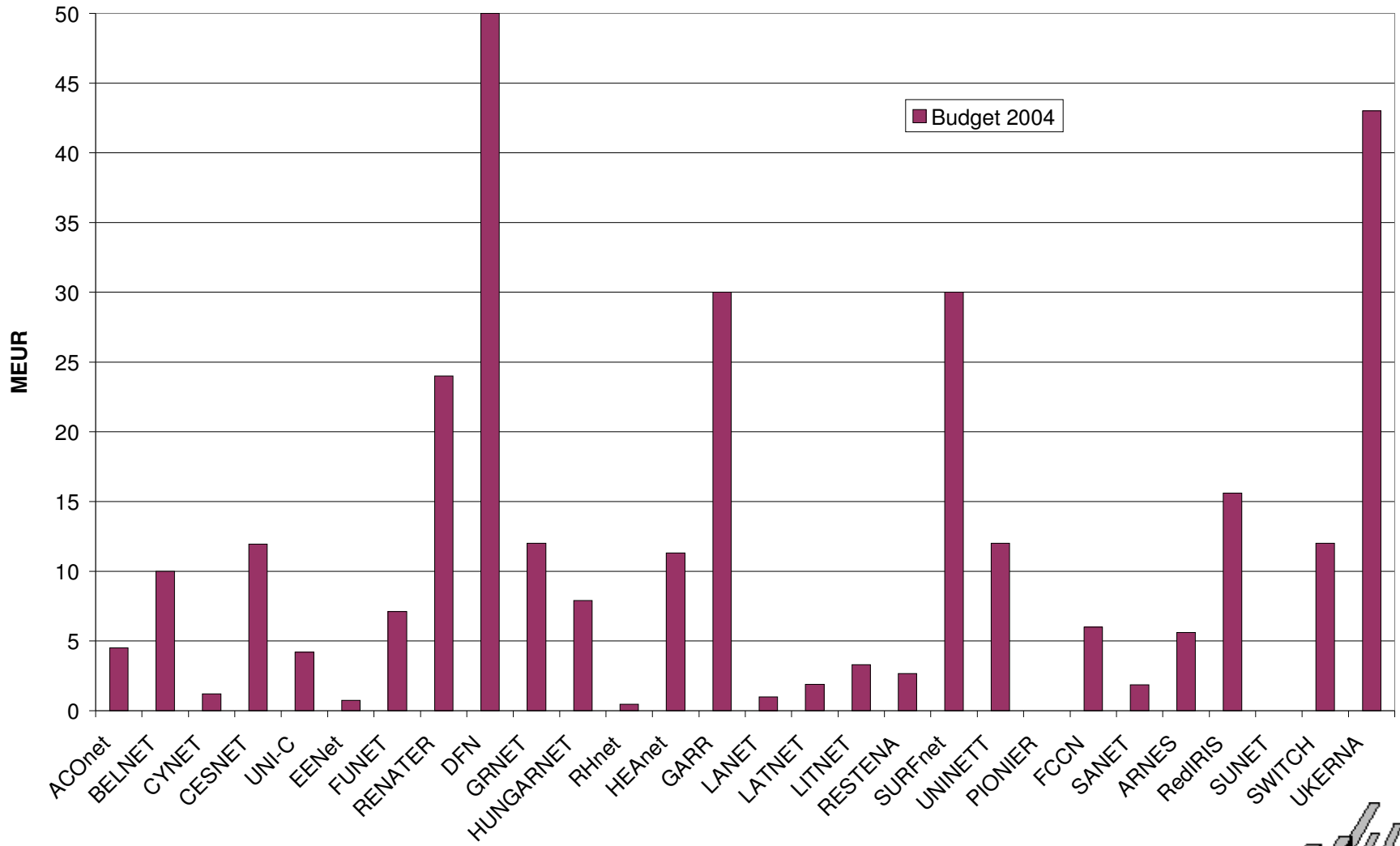
FTE

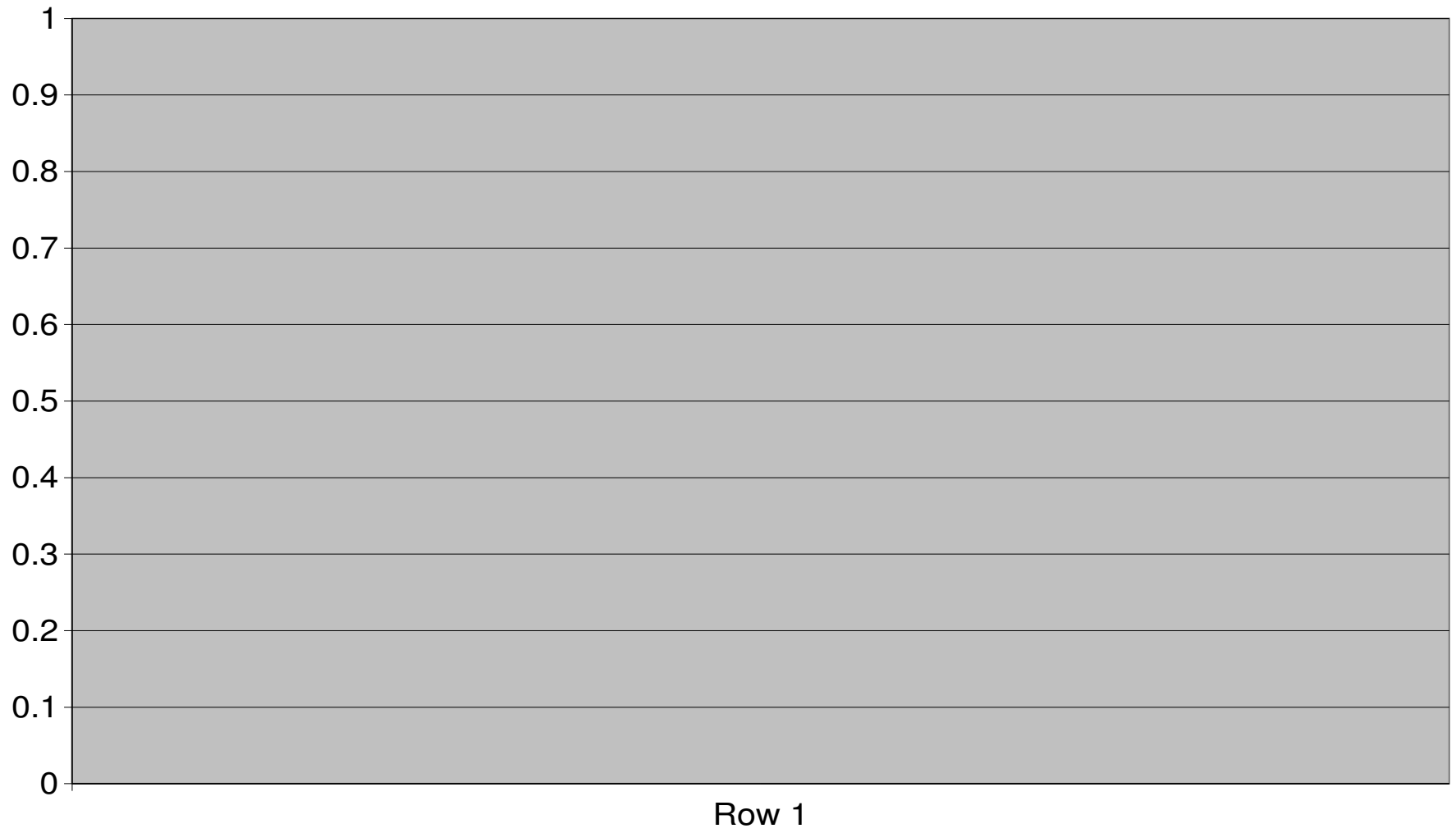


Technical staff



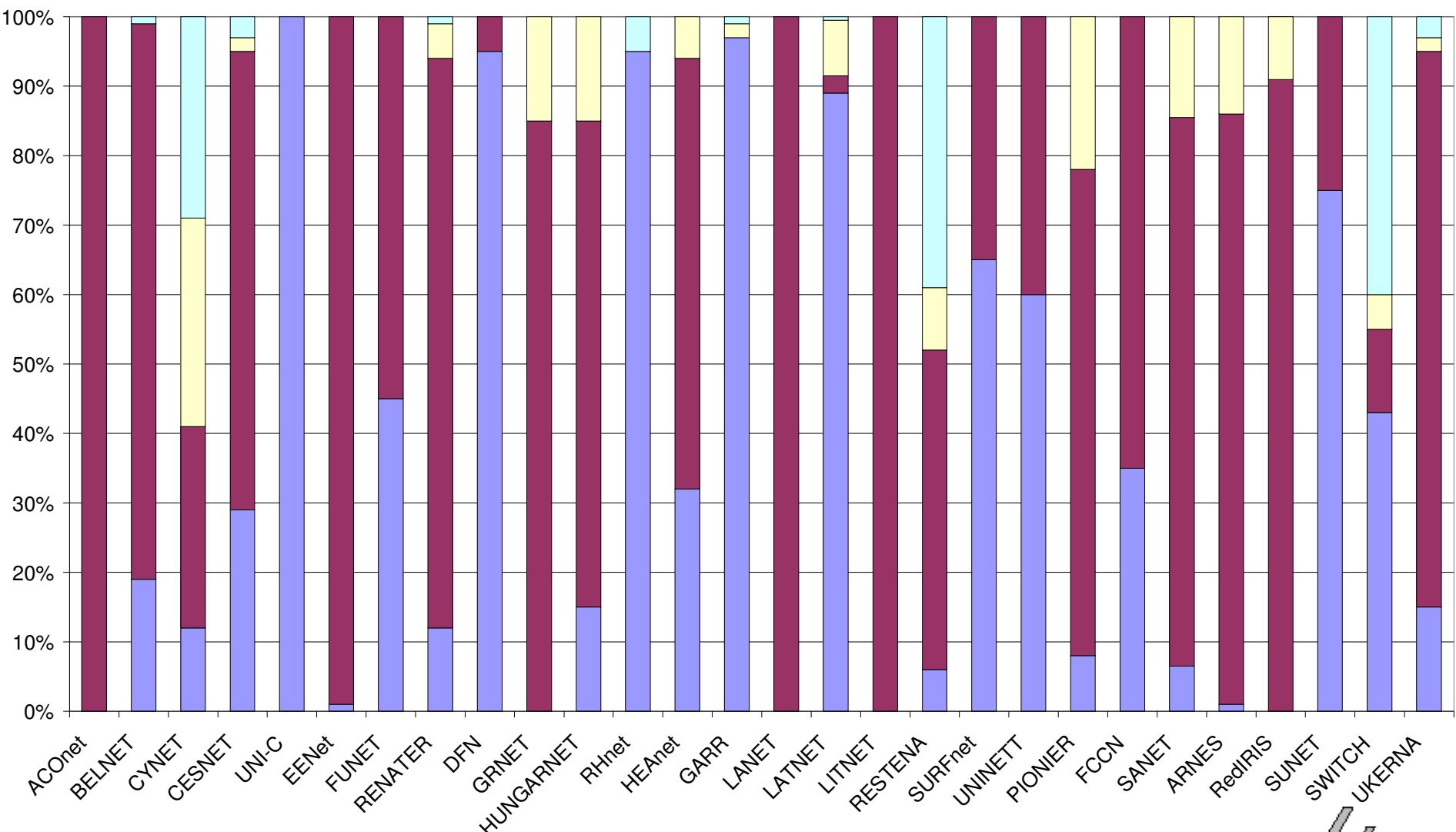
Total budget in 2004



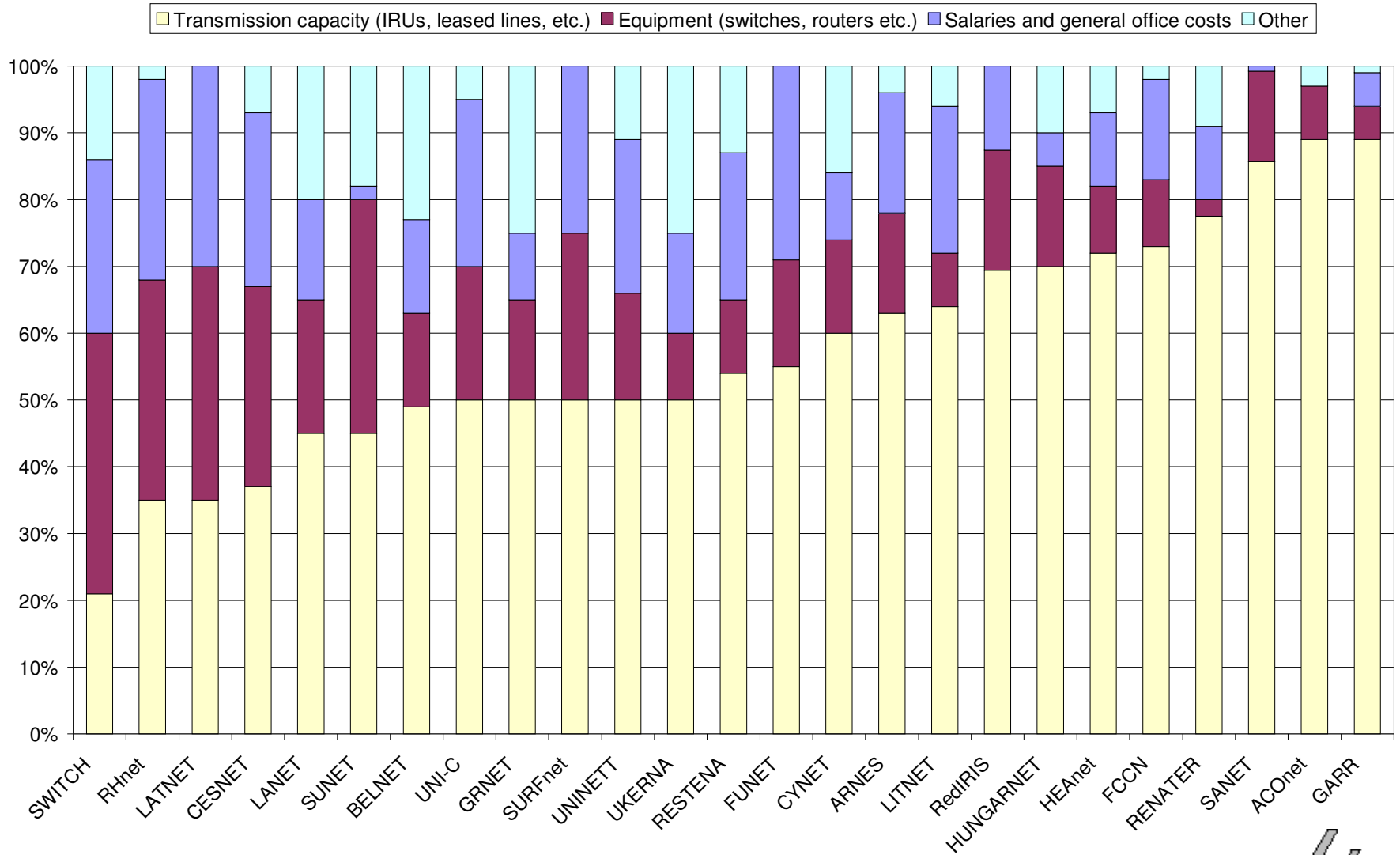


Income sources

■ Users/Clients
 ■ "National government and public bodies"
 ■ EU
 ■ Other sources



Expenditure categories



What are the direct benefits of NREN's

- They offer a communication system designed to meet the special demands of research and education.
 - High capacity between research and education institutions in the developed world
 - High quality of service necessary for real time applications
- They are engaged in testing new technologies and development of new applications in distributed learning, teaching and research.
- Looking back
 - NREN's were first to introduce Internet
 - NREN's were the first domain registers
 - NREN's were the first IX managers



What are the indirect benefits of NREN's

- NREN's are stimulating competition in telecommunication infrastructure provision (especially in high capacity...)
- Educating the young population - users
- Educating young engineers



Digital divide

- EC document: Science, Technology and Innovation in EU+ 2002:
“Candidate countries possess a huge potential capacity to produce scientific and technological knowledge.
Their integration in the European Research Area opens new dimensions and opportunities in Europe”
- The researchers all over the ERA would like to do the similar work
- There is a big gap in the state of networking infrastructure for R&E between more and less developed European countries.



Networking is relatively more expensive in less developed European countries

- GDP per capita in new EU countries is 25 to 70 % of the EU average
- Telecommunication infrastructure is missing
- Prices for leasing infrastructure are high because
 - telecommunication market is often not yet liberalized
 - telecommunication market is too small for real competition
- Most of less developed countries are small – this brings additional problems.



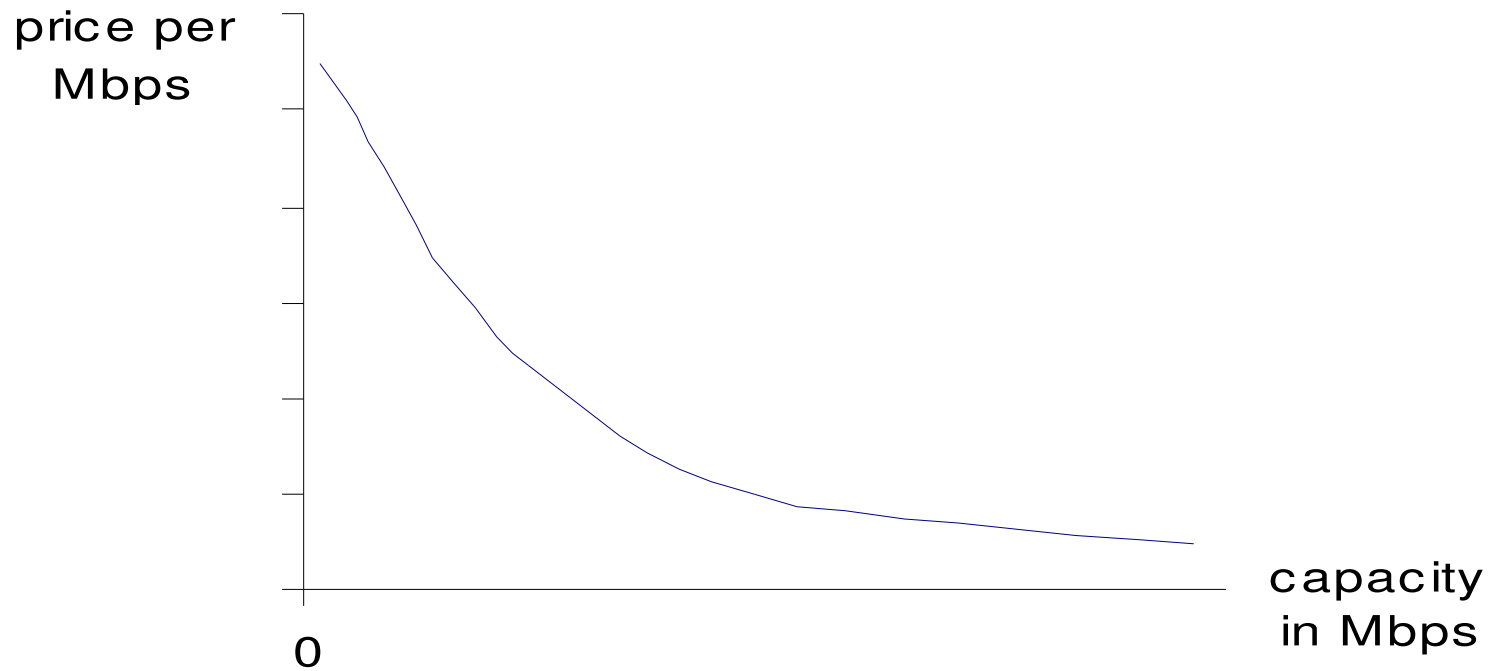
Running an NREN in a small country is relatively more expensive

In a small country it is more expensive (calculated per user) to provide the same level of service.

- Relatively more international capacity is needed
- Low capacity circuits are relatively more expensive
- Circuits so the same capacity are often more expensive
- The NREN needs the same effort to introduce a new service



Price for leased lines is not a linear function of capacity



Circuits of the same capacity are more expensive

For less developed countries

- Telecommunication market is often not yet liberalized or it is liberalized on the paper but not in the practice.

If the country is also small:

- In many cases there is only one operator
- There is less demand for high capacity circuits
- Telecommunication regulator is not effective as he has not enough staff (but the problems are the same as in bigger countries)



What can be done in small and less developed countries for the realization of “equal opportunities” in ERA ?

- NREN should **enlarge its user community** (connecting schools and libraries)
 - NREN can double its user community with 30 % additional funds
- NREN should **get more money from the government**
- The government should stimulate real **competition in telecommunication infrastructure** sector
- Advice and support from other NRENs
- More financial support from the EC

