Competitive Edge of NRENs and Financial Sustainability
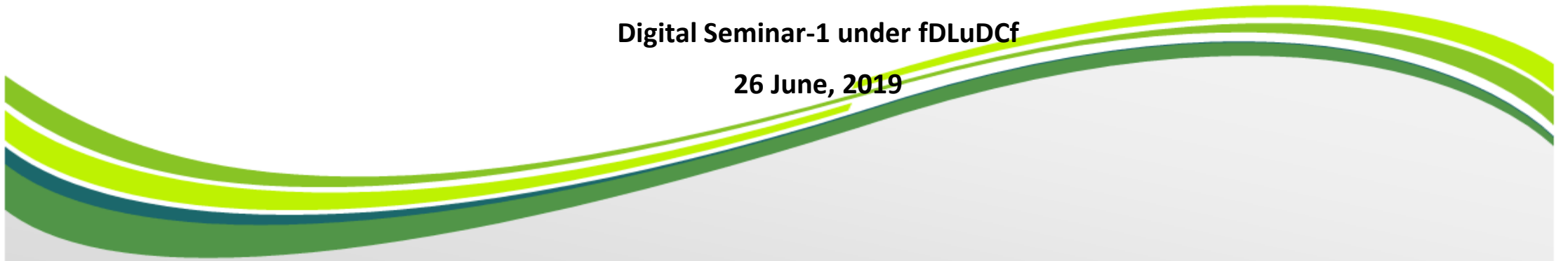
Presented by

Mohammad Tawrit

Chief Executive Officer, BdREN

Digital Seminar-1 under fDLuDCf

26 June, 2019

NREN SUSTAINABILITY?

Competitive Edge + Financing Support = NREN Sustainability

PART-I
COMPETITIVE EDGE OF NREN

COMPETITIVE EDGE: DELIVERY OF PRODUCTS AND SERVICES

- First and Foremost
  - To make its clients feel that it is providing something additional, not provided by other service providers
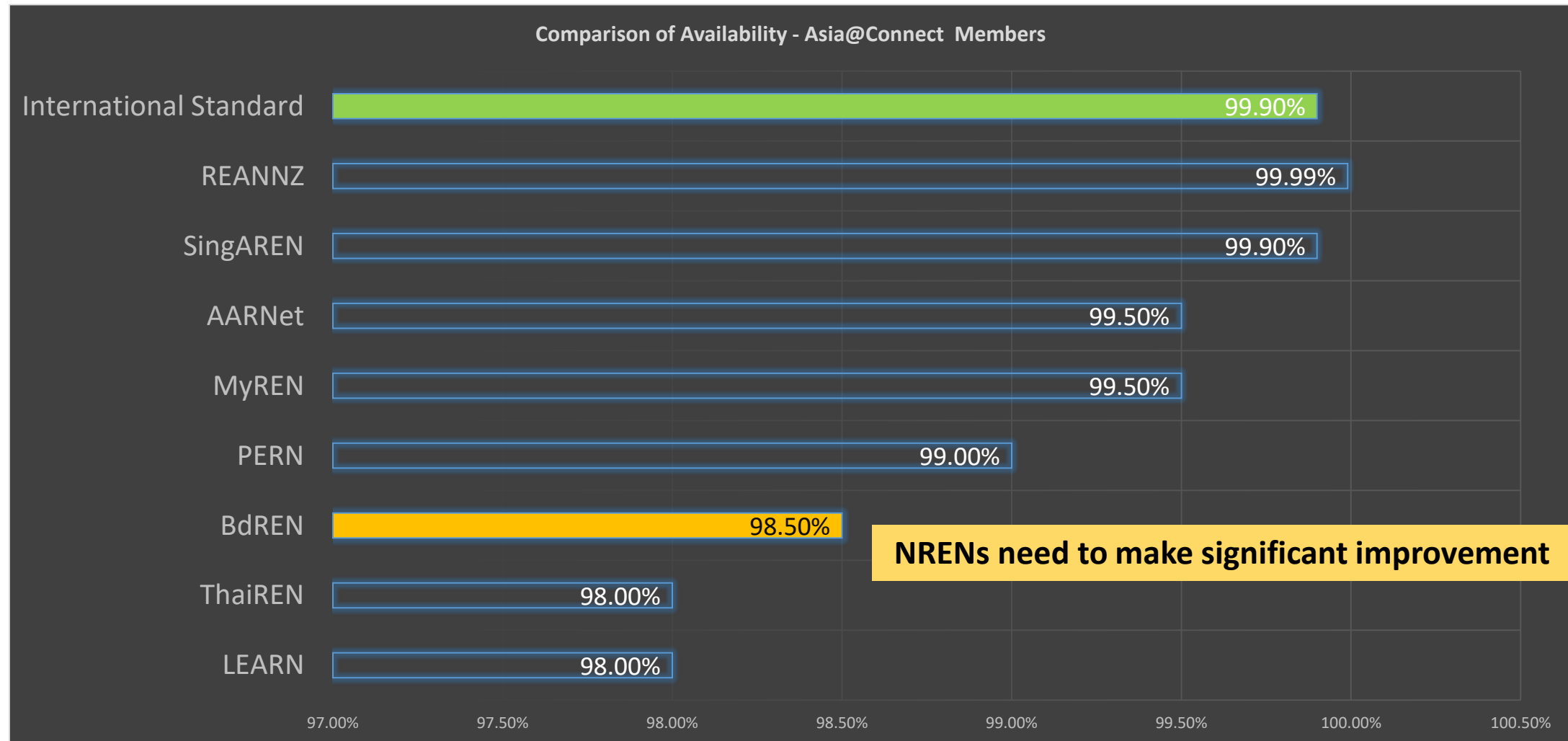
Rendering Services with highest quality

- Quality to be determined by:
  - Availability of the Network
  - Performance of the Network

Rendering Advanced and Innovative Services

- Services which is beyond the scope of the ISPs/Traditional Service Providers
  - EduRoam/Identity Federation
  - Computing/Virtualization Services

BdREN

COMPARISON OF AVAILABILITY – ASI@CONNECT MEMBERS

Comparison of Availability - Asia@Connect Members

NREN	Availability
International Standard	99.90%
REANNZ	99.99%
SingAREN	99.90%
AARNet	99.50%
MyREN	99.50%
PERN	99.00%
BdREN	98.50%
ThaiREN	98.00%
LEARN	98.00%

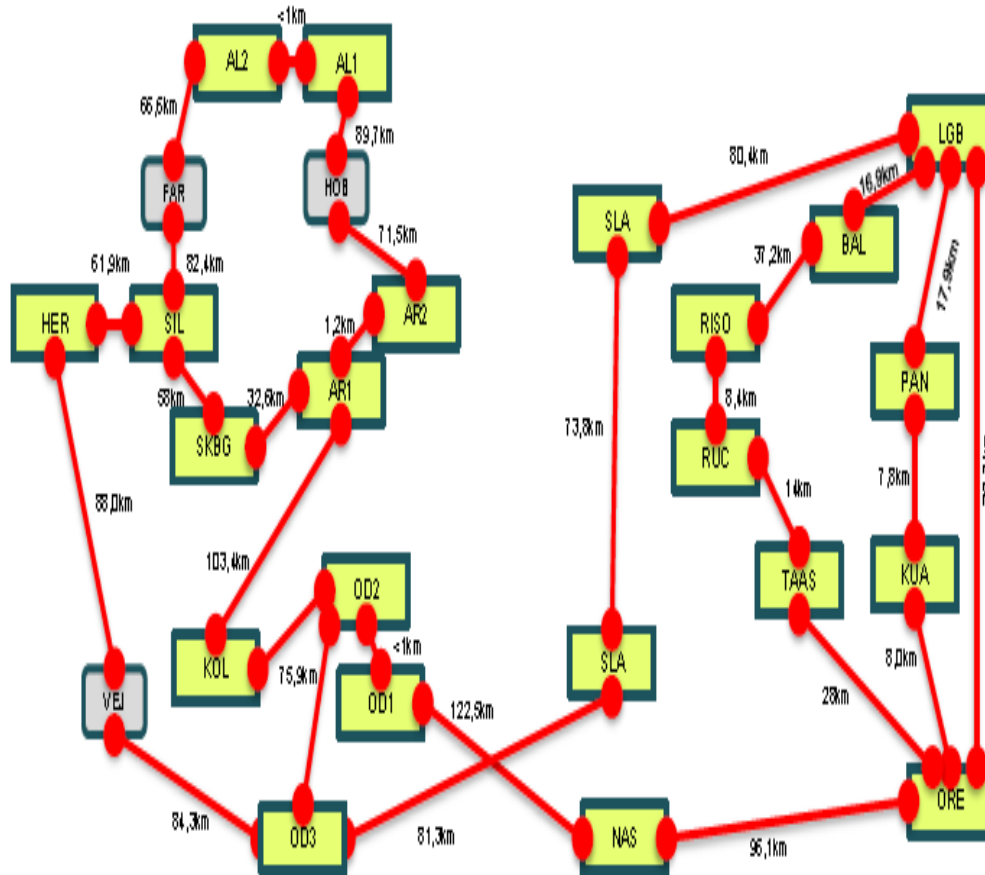**NRENs need to make significant improvement**

HIGH AVAILABILITY

> **High Availability: Backbone**

> **High Availability: Upstream**

> **High Availability: Last-mile**
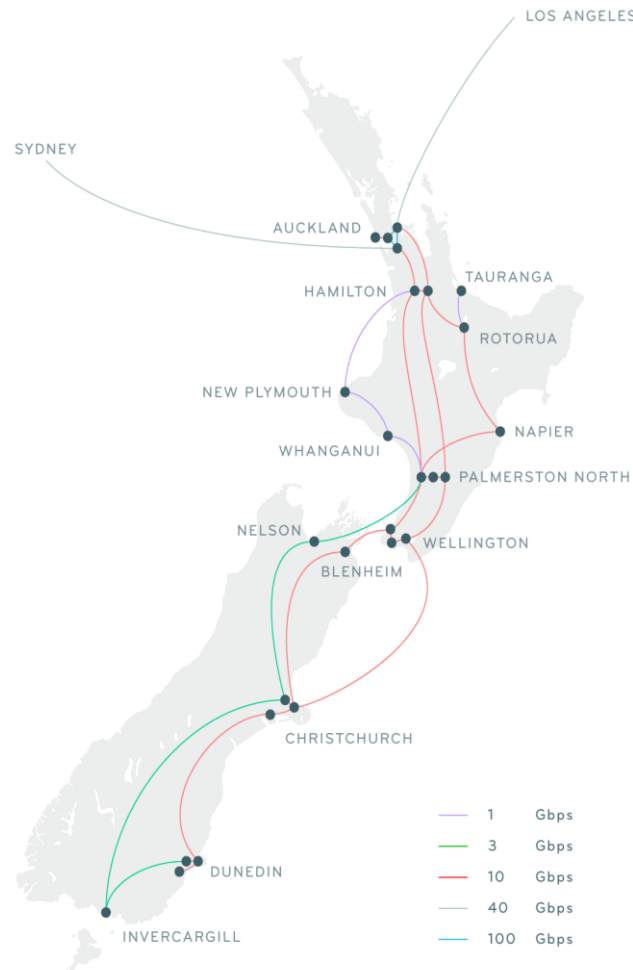
HIGH AVAILABILITY: DEIC AND OARNET

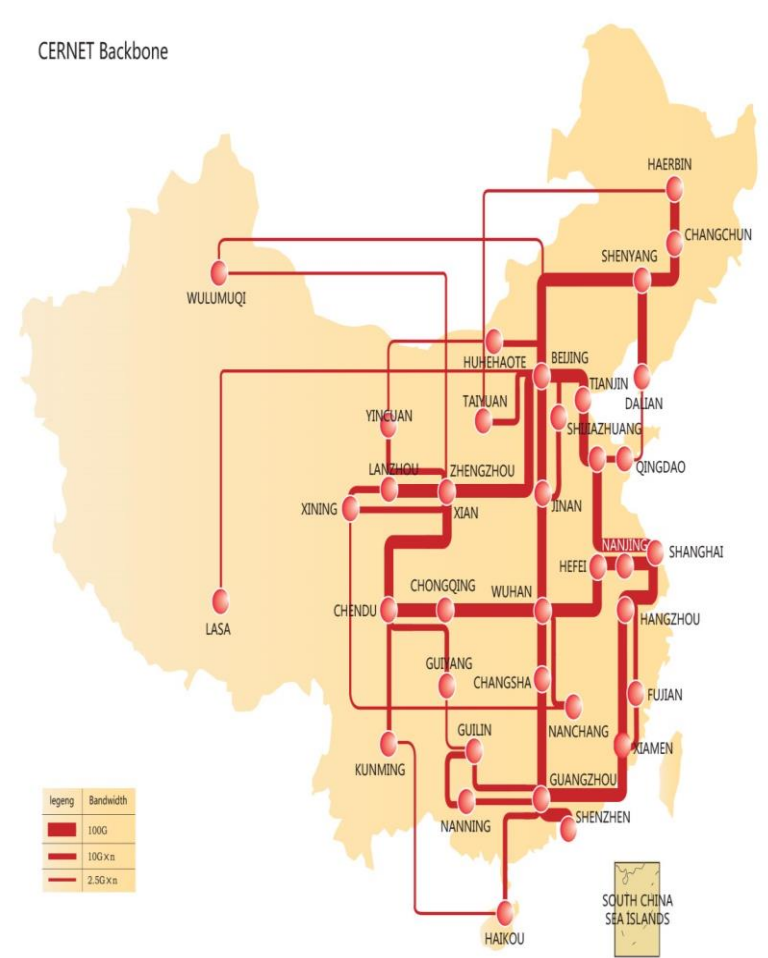DeIC: High Availability

OARNet: High Availability

HIGH AVAILABILITY: TRANSMISSION REANNZ, AARNET AND CERNET

REANNZ: High Availability

AARNet: High Availability

CERNET: High Availability
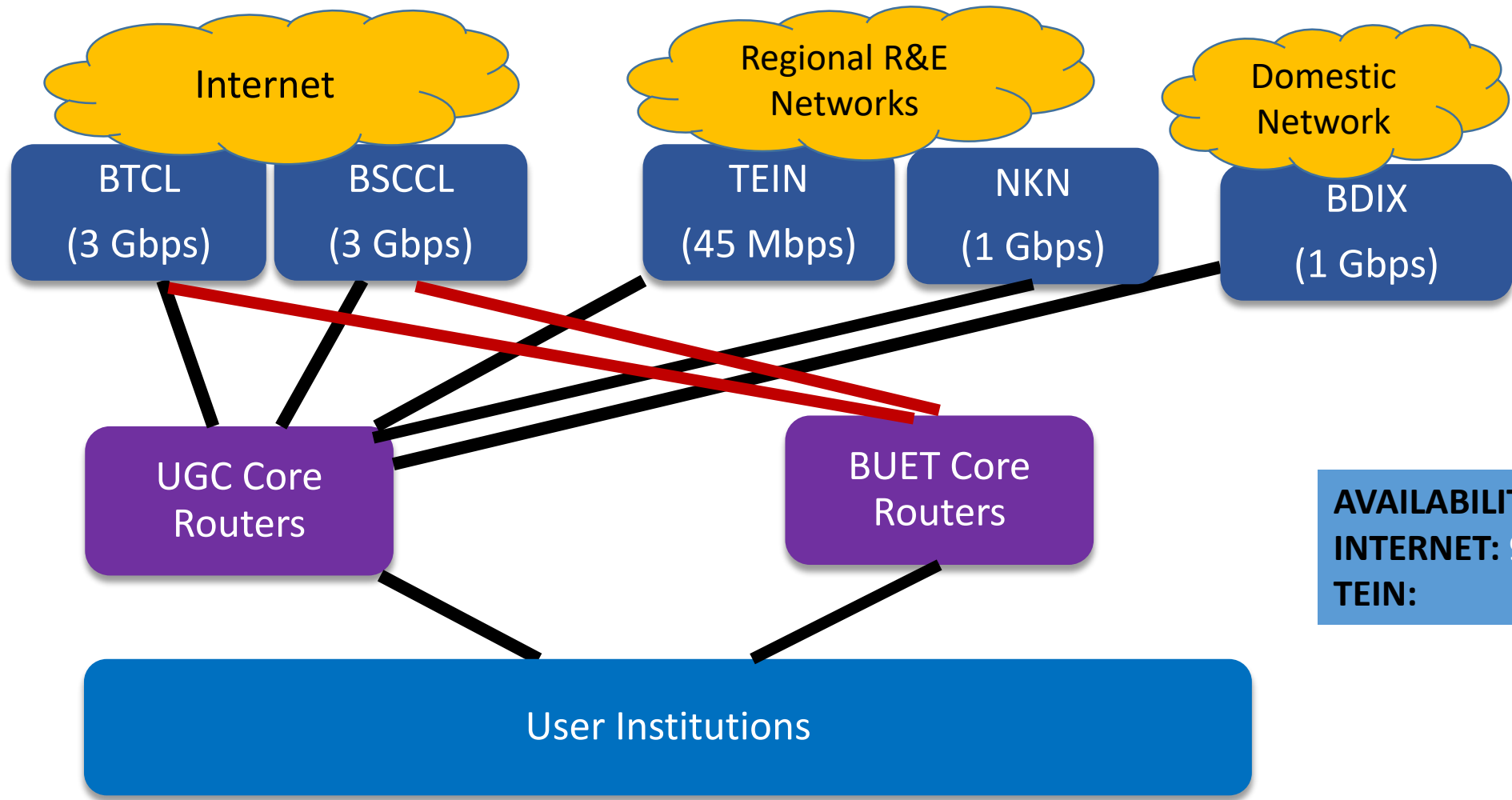
TRANSMISSION BACKBONE [BdREN]

Spur

Spur

Spur

Spur

Spur

Spur

Rangpur

Mymensingh

Sylhet

Rajshahi

Dhaka

Khulna

Barishal

Chattogram

79
109
62
77
43
43
78
118
85
42
60
23
41
90
65
97
15
73
27
44
10
13
16
10
102
9
56
62
68
62
69
68
53
30
66
75
130
56
90

15 14 13 12 10 11 9 16 24 25 17 23 22 18 19 20 21 8 7 6 5 4 3 2 1 26 27 28 29 30 31 32 33 34 35

AVAILABILITY:
CENTER: 99.7%
PERIPHERY: 98.0%

BdREN DC   BdREN PoP   BdREN PoP   BdREN PoP   BdREN PoP

DWDM Transmission No...
1 BU, Barishal
2 KUET, Khulna
3 BSMRSTU, Gopalganj
4 JUST, Jashore
5 PGCB-SS, Madaripur
6 PGCB-SS, Faridpur

10 PGCB-SS, Natore
11 RU, Rajshahi
12 PGCB-SS, Shirajganj

16 MBSTU, Tangail
17 PGCB-SS, Kabirpur
18 JU, Savar

22 NSU, Bashundhara
23 PGCB-SS, Tongi
24 BTCL Office, Mawna

28 SUST, Sylhet
29 CoU, Cumilla
30 PGCB-SS, Feni

34 PGCB-SS, Dohazari
35 PGCB-SS, Cox's Bazar

TOO MANY SPURS DON'T RESEMBLE HIGH-AVAILABILITY

NETWORK QUALITY: PERFORMANCE OF THE NETWORK
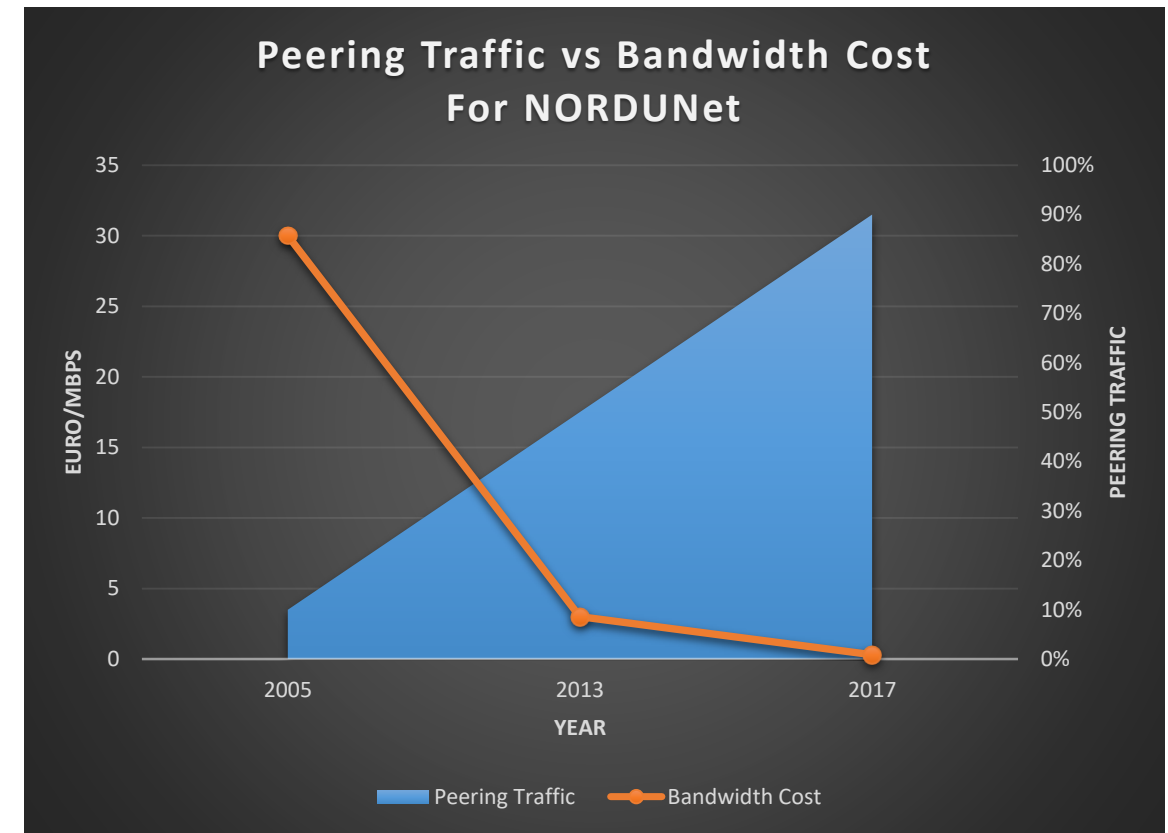
- ## Reduction of Delay/Jitter/Packet Loss
  - ### Establish Local Caching with Google, Microsoft, Facebook Cache Servers
  - ### BdREN's Present Status: Peering with IIGs, TEIN, NKN and BdIX
- ## Planned:
  - ### Immediate Peering with Google
  - ### Take Microsoft, Facebook and Akamai Cache Services through NKN

Cost of Peering vs IP-Transit

IP-Transit — Peering
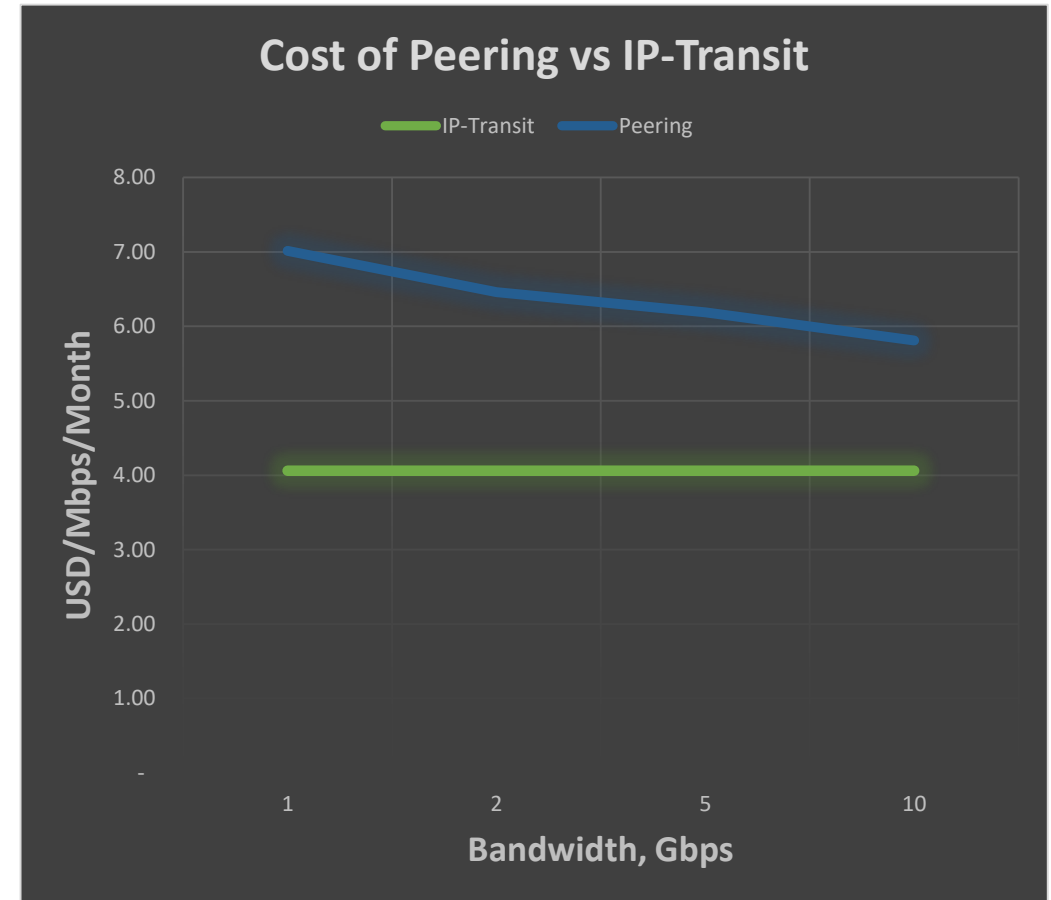
Peering statistics in Nordic countries

Peering in NORDIC Countries

Peering Traffic vs Bandwidth Cost For NORDUNet
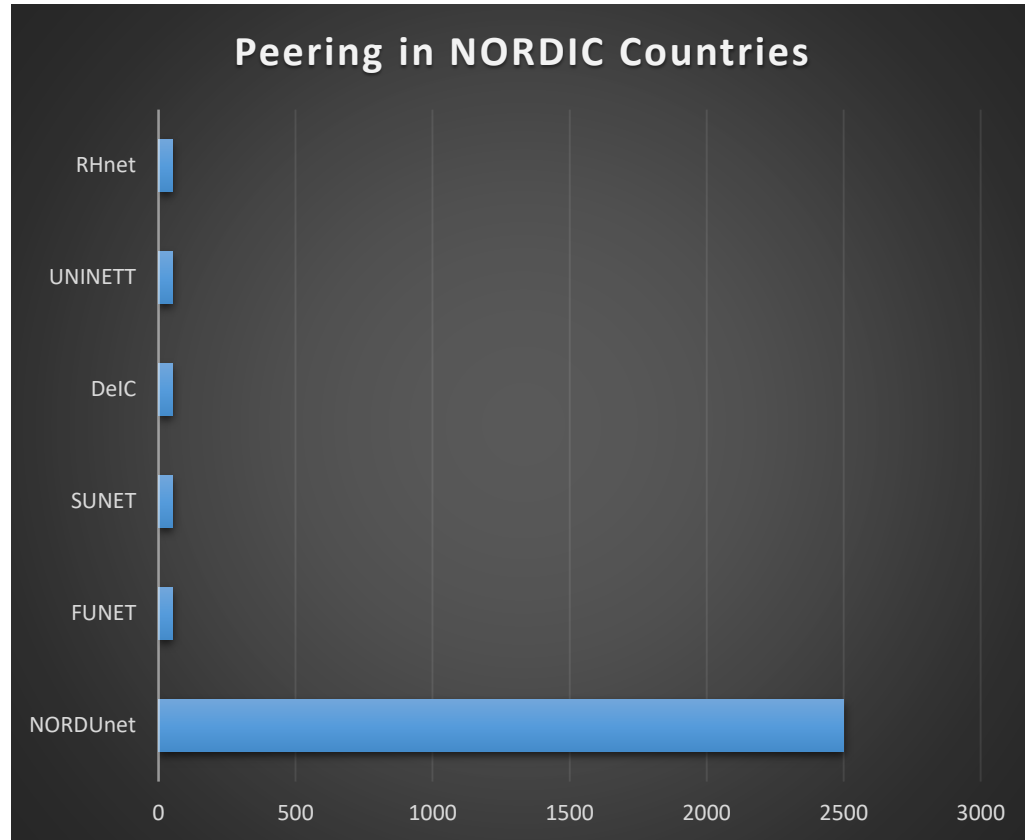
TEIN should come forward with Peering with high volume traffic sources

RENDERING ADVANCED SERVICES

Computing Services through Virtualization

Storage and Backup Service
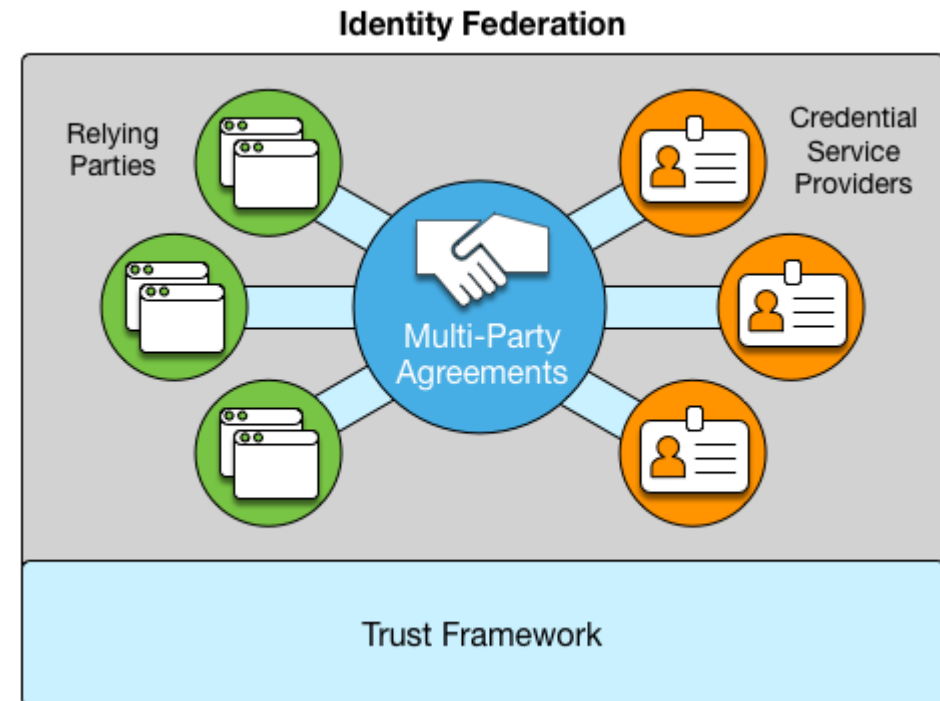
Hosting Service

Virtual Conferencing/Meeting

RENDERING INNOVATIVE SERVICES

- ## EduRoam Services
  - Already Implemented in 16 among 22 NRENs surveyed under Asi@Connect
  - Already Implemented in BdREN

- ## Identity Federation Services
  - Only implemented in a few NRENs surveyed under Asi@Connect
  - Activities are underway to pinpoint the need and implement it accordingly

COMPARISON OF DELIVERY OF BASIC SERVICES

GÉANT

Name of NRENs	Network Services							Security Services				Identity		Hosting/Collocation Services								Other Services						Service Index
	IP Connectivity	IPv6	Virtual Circuit/VPN	Multicast	NTP Service	Optical Wavelength	24x7 Monitoring	CERT/CSIRT	DDoS Mitigation	Vulnerability Scanning	Anti-Spam Solution	EduRoam	InterFederation	DNS Hosting	Cloud Storage	File Sender	IaaS	SaaS	Web Hosting	Email Server Hosting	Collocation	Consultancy/Training	Video Conferencing	Domain Name Register	IP Address Allocation	Virtual Learning Education	Web/Desktop Conference	
DeIC																												17
HEAnet																												23
FUNET																												19
SUNET																												21
GRNet																												14
UNINETT																												21
SurfNet																												22
ACOnet																												14
GARR																												20
JANET																												16
DFN																												18
EEnet																												15
HUNGARNET																												23
BASNET																												17
IUCC																												16

Source: GEANT compendium database

Competitive Edge of NRENs and Financial Sustainability

BdREN

COMPARISON OF DELIVERY BASIC SERVICES

Name of NRENs	Network Services							Security Services				Identity		Hosting/Collocation Services								Other Services						Service Index
	IP Connectivity	IPv6	Virtual Circuit/VPN	Multicast	NTP Service	Optical Wavelength	24x7 Monitoring	CERT/CSIRT	DDoS Mitigation	Vulnerability Scanning	Anti-Spam Solution	EduRoam	InterFederation	DNS Hosting	Cloud Storage	Filesender	IaaS	SaaS	Web Hosting	Email Server Hosting	Collocation	Consultancy/Training	Videoconferencing	Domain Name Register	IP Address Allocation	Virtual Learning	Web/desktop conference	
BdREN	✓	✓	✓			✓	✓					✓		✓	✓		✓		✓	✓	✓	✓	✓	✓			✓	16
LEARN	✓	✓		✓	✓		✓				✓	✓		✓					✓	✓		✓	✓	✓	✓		✓	15
ERNET	✓	✓	✓										✓						✓	✓		✓						07
REANNZ	✓	✓					✓					✓										✓	✓		✓			07
AARnet	✓	✓	✓			✓	✓									✓						✓	✓			✓	✓	12
NREN	✓	✓			✓		✓					✓		✓	✓		✓	✓	✓			✓	✓	✓		✓	✓	14
MyREN	✓						✓					✓				✓					✓							07
NKN	✓	✓	✓	✓			✓							✓	✓		✓	✓	✓	✓		✓	✓		✓			16
ErdemNET	✓													✓	✓				✓	✓		✓		✓				06
PERN	✓	✓	✓	✓			✓					✓		✓	✓			✓	✓	✓		✓	✓	✓	✓	✓		17
PREGINET	✓	✓	✓	✓			✓					✓		✓					✓			✓	✓	✓				12
ThaiREN	✓	✓	✓		✓		✓					✓		✓	✓		✓		✓			✓	✓	✓	✓	✓		18
VinaREN	✓	✓		✓			✓								✓							✓						07
SingAREN	✓	✓		✓								✓	✓		✓	✓						✓						10
INHERENT	✓	✓	✓	✓			✓																✓					7
CERNET	✓	✓	✓	✓	✓		✓	✓	✓	✓									✓			✓	✓	✓				17
HARNET	✓	✓		✓	✓		✓		✓			✓	✓						✓			✓	✓	✓	✓		✓	13

Competitive Edge of NRENs and Financial Sustainability

COMPARISON OF BASIC SERVICES: GEANT vs ASI@CONNECT

GEANT: 18.6 vs Asi@Connect: 11.8

Number of Basic Services -GEANT

DeIC: 17, HEAnet: 23, FUNET: 19, SUNET: 17, GRNet: 14, UNINETT: 18, SurfNet: 22, ACOnet: 14, GARR: 20, JANET: 16, DFN: 18, EEnet: 15, HUNGARNET: 23, BASNET: 17, IUCC: 16

Total Score — Average

Number of Basic Services - Asi@Connect

BdREN: 16, LEARN: 15, ERNET: 7, REANNZ: 7, AARnet: 12, NREN: 14, MyREN: 7, NKN: 16, ErdemNET: 6, PERN: 17, PREGINET: 12, ThaiREN: 18, VinaREN: 7, SingAREN: 10, INHERENT: 7, CERNET: 17, HARNET: 13

Total Score — Average

Competitive Edge of NRENs and Financial Sustainability

TAKE-OUT FROM THIS PART: ESTABLISH COMPETITIVE EDGE

BANDWIDTH SERVICES

BEYOND BANDWIDTH SERVICES

Recommendation for Asi@Connect

❏ Allow Commodity Internet Traffic

❏ Peering with:

Google   Microsoft   [Facebook]   Akamai

01. BdREN-TEIN-MB-POP - Traffic- Se0/3/0

	Current	Average	Maximum
■ Inbound	15.12 M	5.77 M	35.80 M

Total In: 4.77 TB

	Current	Average	Maximum
■ Outbound	354.26 k	648.99 k	6.34 M

Total Out: 536.9 GB
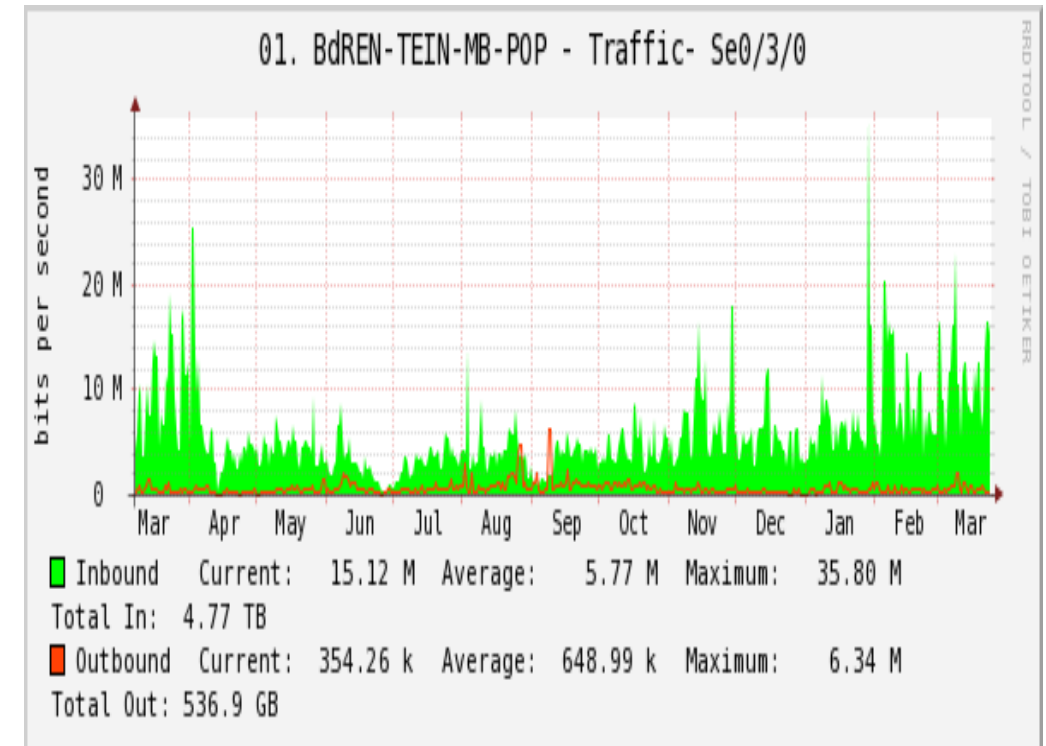
PART-II
FINANCIAL SUSTAINBILITY

EXISTING CHARGING MODEL - BdREN

- Traffic Model: Slot based
  - Basic Services on Fixed Subscriptions up to a certain limit
  - Limit Cross will shift the Category to a higher level

- Subscription based charging for Large Clients (Public Universities)

- Usage/Package based charging for few clients (Private Universities, Medical Colleges and Research institutes)

PRESENT CHARGING MODEL – PUBLIC UNIVERSITY

Package A:	Package B:	Package C:
1 Gbps Bandwidth	600 Mbps Bandwidth	400 Mbps Bandwidth
Unlimited Intranet	Unlimited Intranet	Unlimited Intranet
VM - Core: 144 CM/year	VM - Core: 96 CM/year	VM - Core: 72 CM/year
VM - RAM: 288 GB-M/year	VM - RAM: 192 GB-M/year	VM - RAM: 144 GB-M/year
VM - Storage: 188 TB-M/year	VM - Storage: 120 TB-M/year	VM - Storage: 96 TB-M/year
Video Conferencing Facility	Video Conferencing Facility	Video Conferencing Facility
Mail Server Hosing	Mail Server Hosing	Mail Server Hosing
Web Server Hosting	Web Server Hosting	Web Server Hosting
DNS Hosting	DNS Hosting	DNS Hosting

Monthly Charge	USD 4,705	USD 3,529	USD 2,353
No of University	4	9	21

BdREN

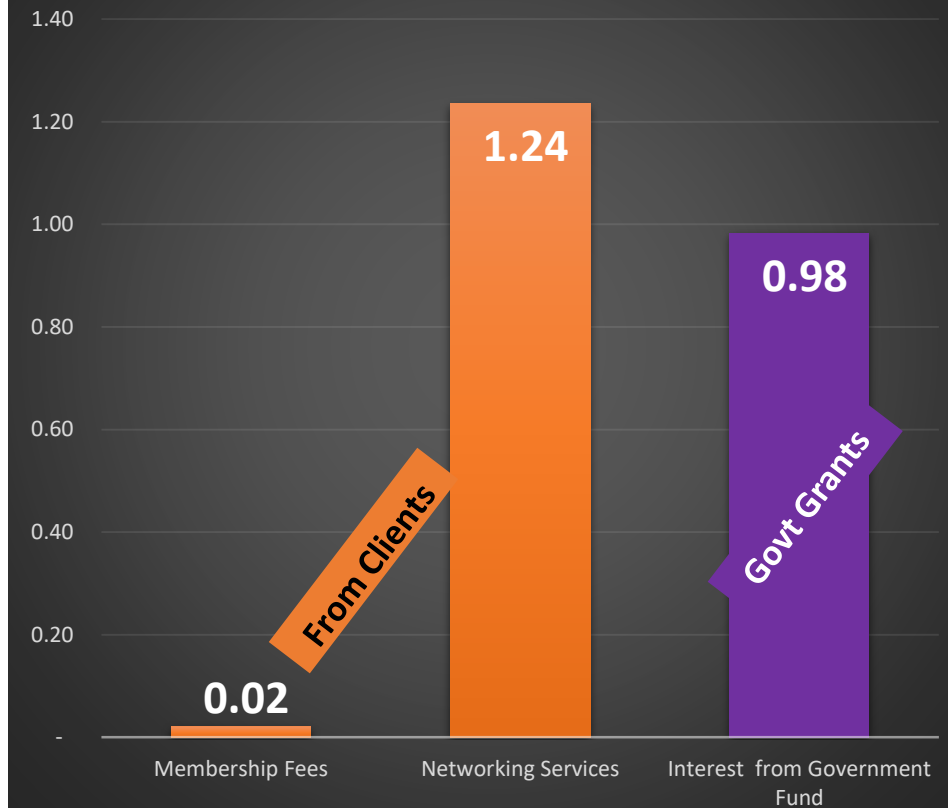# FINANCIAL SUSTAINABILITY - BdREN

SOURCES OF REVENUE

- Membership Fees (Flat)
- Network Service Revenue
- Interest derived from Endowment Fund allocated by Government
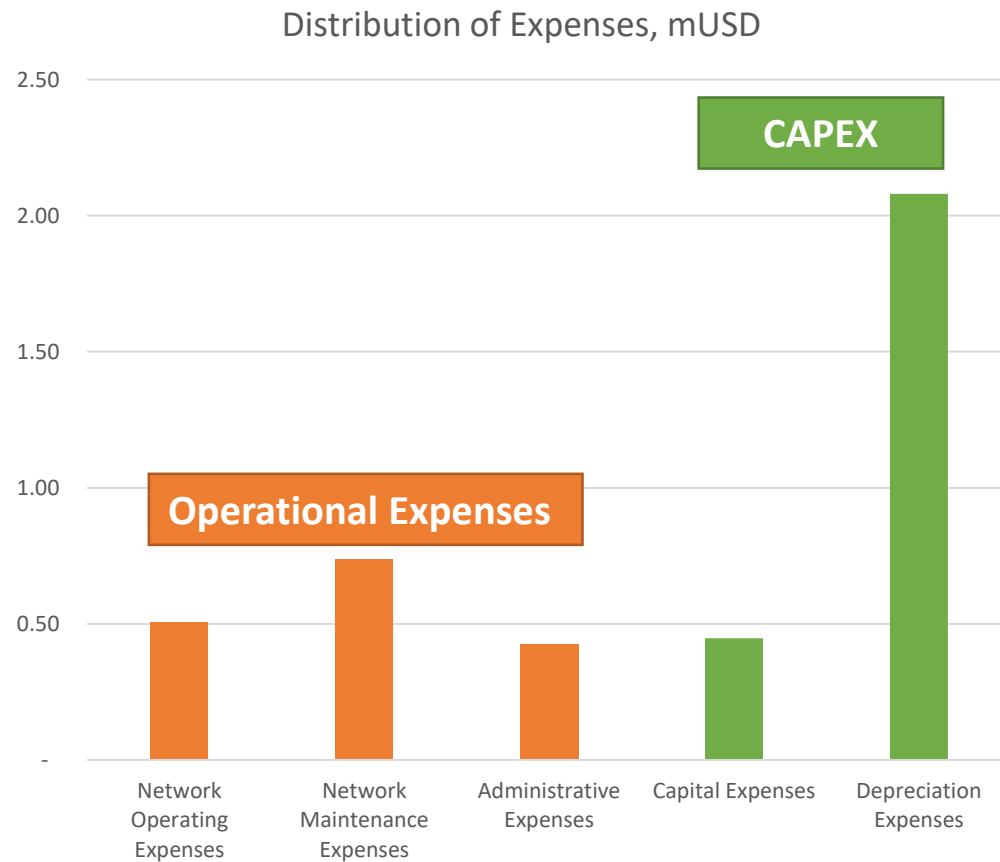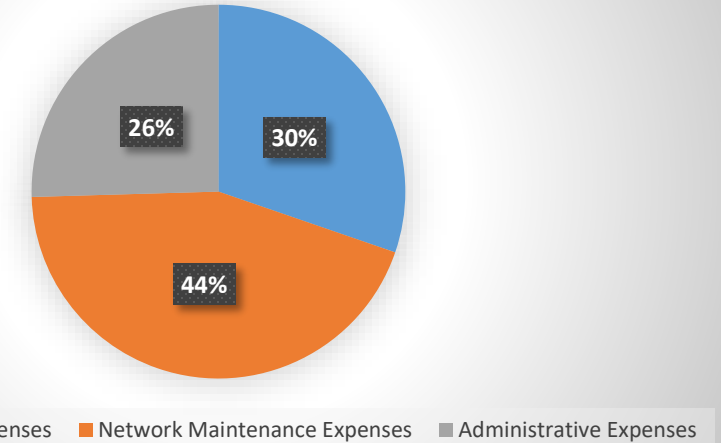
Revenue Distribution - BdREN

Revenue from Government 44%

Revenue from Clients 56%
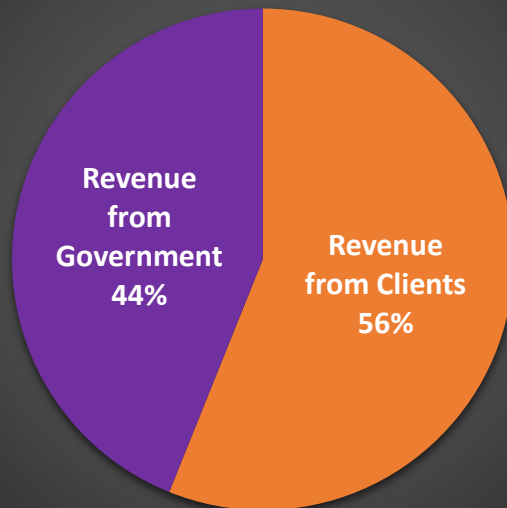
Distribution of Annual Revenues, mUSD

From Clients

Govt Grants

0.02 — Membership Fees

1.24 — Networking Services

0.98 — Interest from Government Fund

FINANCIAL SUSTAINABILITY – BᴅREN

ANNUAL EXPENSES

Distribution of Expenses, mUSD

CAPEX

Operational Expenses

Distribution of Operational Expenses

- Network Operating Expenses: 30%
- Network Maintenance Expenses: 44%
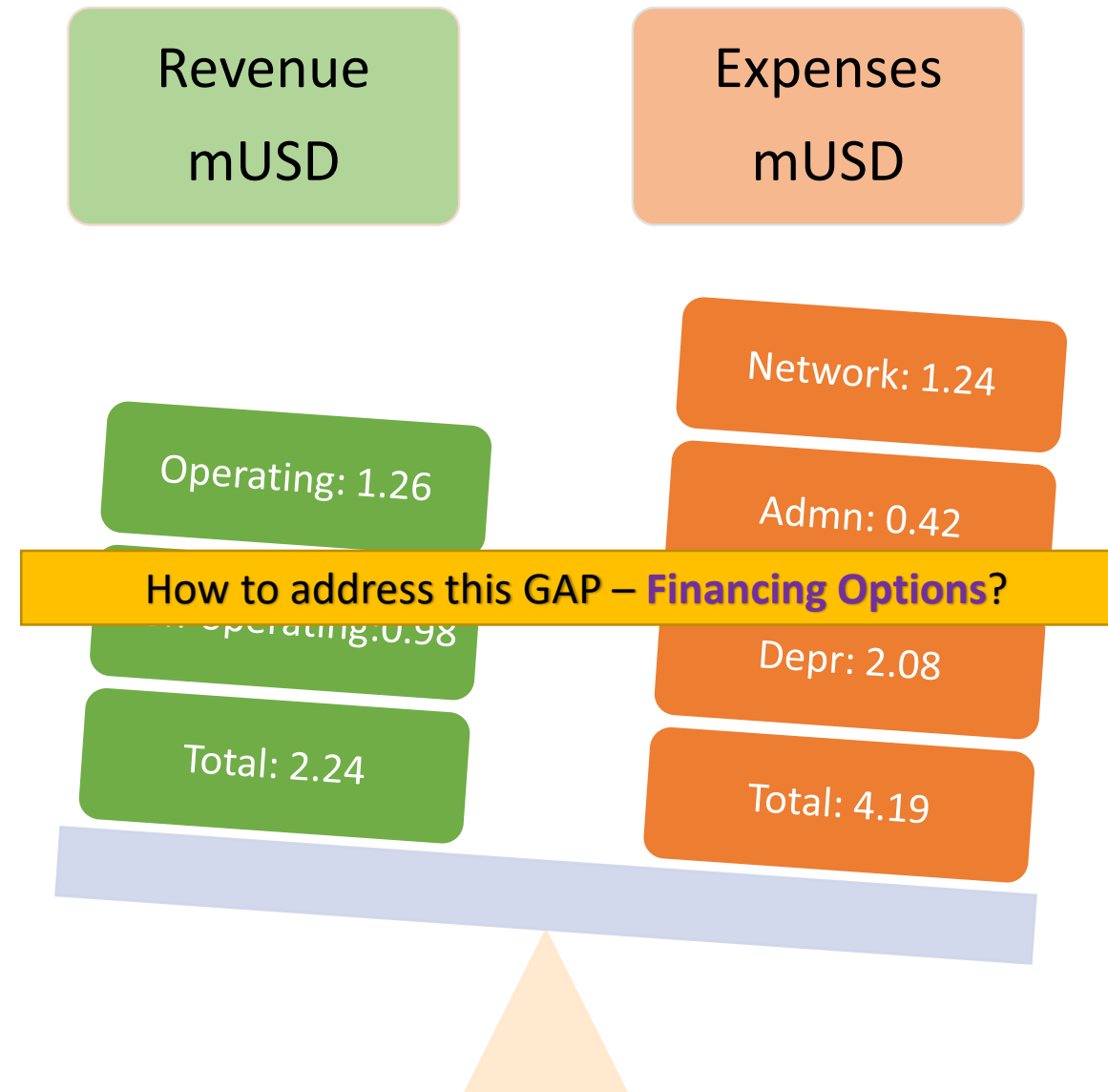- Administrative Expenses: 26%

- Operational Expenses
  - Network Operational Expenses
  - Network Maintenance Expenses
  - Administrative Expenses

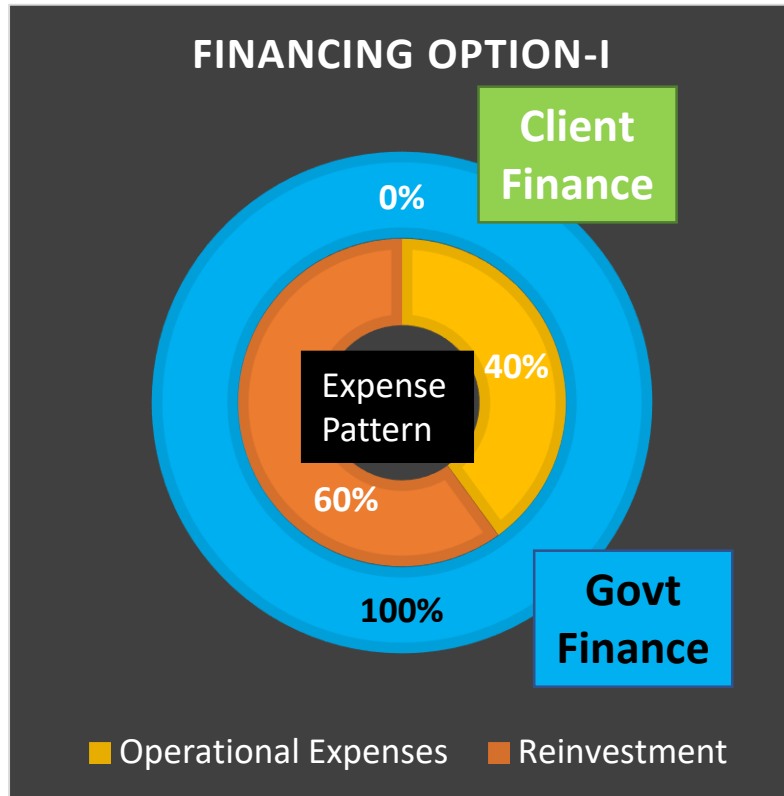# COMPARISON: REVENUE VS EXPENSES - BdREN

Annual OPEX
USD: 1.67m

Operational Expenses covered
by Annual Revenue earnings

Annual Revenue
USD: 2.24m

COMPARISON: REVENUE VS EXPENSES - BdREN

Revenue

mUSD

Expenses

mUSD

Network: 1.24

Operating: 1.26

Admn: 0.42

How to address this GAP – **Financing Options**?

Operating: 0.98

Depr: 2.08

Total: 2.24

Total: 4.19

FINANCING OPTIONS

FINANCING OPTION-I

Client Finance — 0%

Expense Pattern

40%

60%

100%

Govt Finance

Operational Expenses | Reinvestment

Fully Government Financing

FINANCING OPTION-II

Client Finance — 30%

Expense Pattern

40%

60%

70%

Govt Finance

Operational Expenses | Reinvestment

Hybrid Financing

FINANCING OPTION-III

Client Finance — 100%

Expense Pattern

40%

60%

0%

Govt Finance

Operational Expenses | Reinvestment

Fully Client Financing

Competitive Edge of NRENs and Financial Sustainability

BdREN

FUNDING MODEL IN GEANT PARTNER COUNTRIES

Legend: Client instructions | Government and public bodies | Other sources | The EU

Government Financing | Hybrid Financing | Client Financing

Y-axis: Percentage of total income

X-axis countries: Azerbaijan, Bulgaria, Spain, Greece, Lithuania, Montenegro, Romania, Serbia, Slovenia, Turkey, Croatia, France, Portugal, Estonia, Slovakia, Ireland, Latvia, Luxembourg, Macedonia, United Kingdom, Czech Rep., Belgium, Hungary, Georgia, Norway, Finland, Cyprus, Netherlands, Belarus, Moldova, Sweden, Ukraine, Israel, Italy, Switzerland, Germany, Austria, Denmark, Iceland

Source: GEANT Compendium, 2015

FUNDING MODEL ASIA, AFRICA, SOUTH & NORTH AMERICA

Government Financing

Hybrid Financing

Client Financing

Legend:
- Other sources
- EU
- National governments and public sources
- Users / clients

% of total income

Countries (x-axis): Lebanon, Brazil, Bosnia/Herzegovina, Canada, Algeria, New Zealand, Morocco, Russian Federation, Sudan, Australia, Hong Kong, Kyrgyzstan, USA
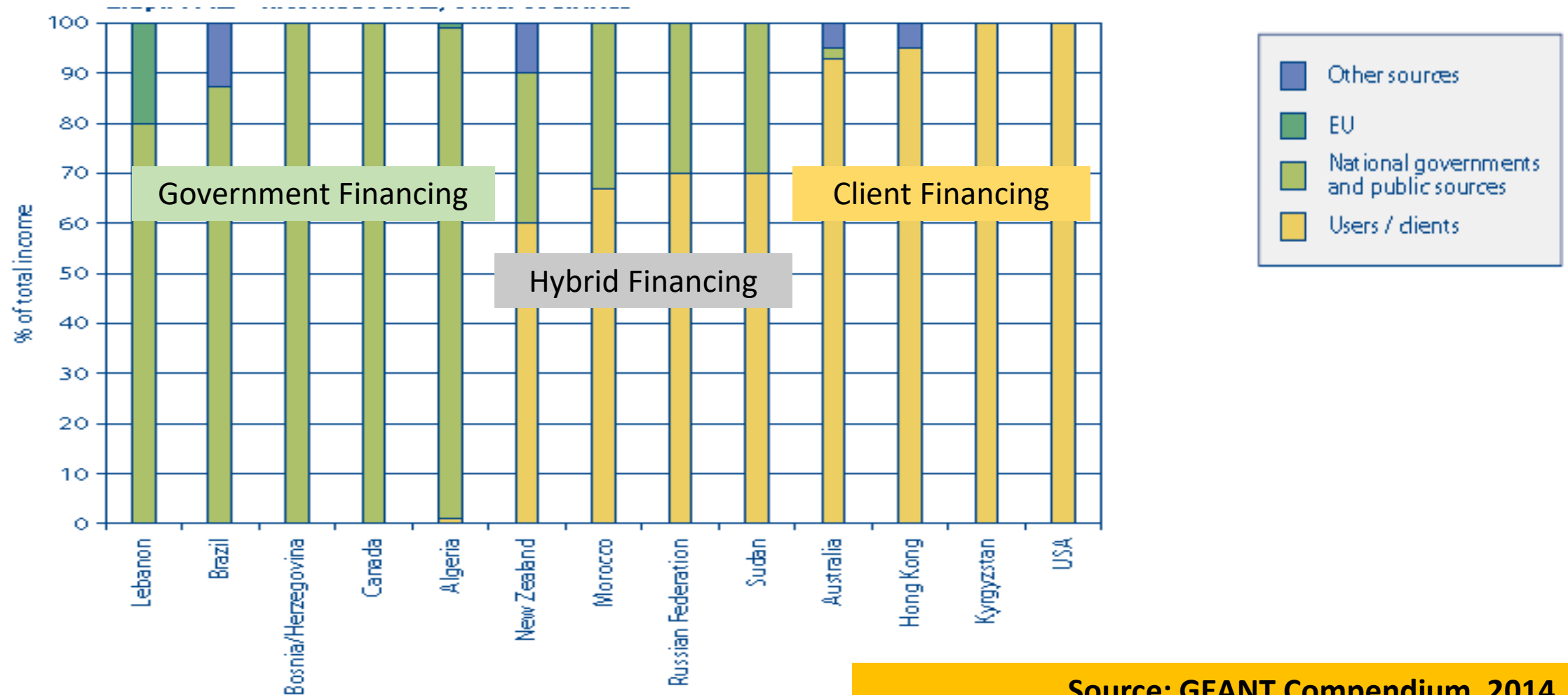
Source: GEANT Compendium, 2014

BdREN

FUNDING MODEL: NRENS UNDER ASI@CONNECT
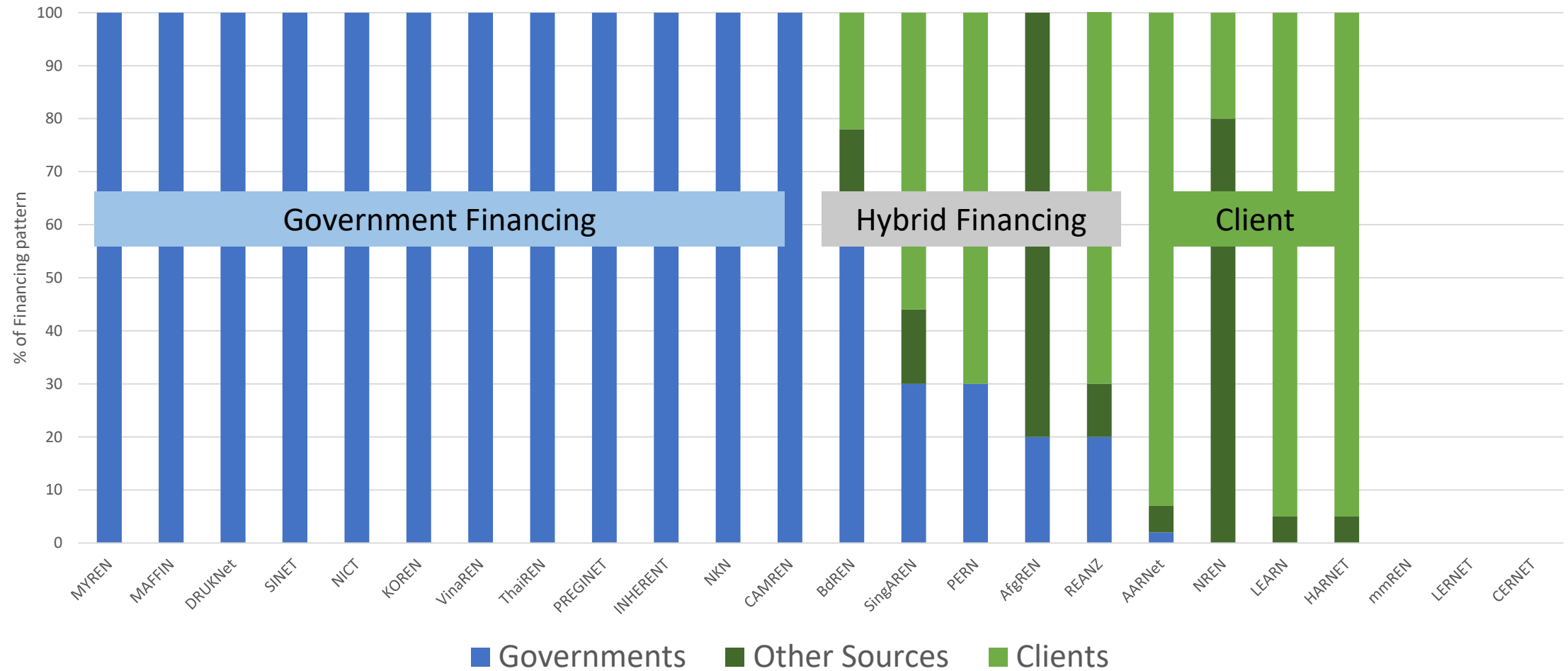
Source: Asi@Connect Compendium, 2018

FINANCING MODEL, NORTH AND LATIN AMERICA

- Established in 1993, CANARIE is a non-profit corporation, with the majority of its **funding provided by the Government of Canada**. https://www.canarie.ca/about-us/

- All this is possible thanks to resources received from its **funding agencies, namely the Ministries of Science, Technology, Innovation and Communications, Education, Health and Culture**, signed in its Management Agreement and corporate governance, composed of these ministries, representing the State, and by universities, scientific societies, users and associates, representing civil society. https://www.rnp.br/institucional/fazemos/

FUNDING MODELS IN NORDUNET

- Financing in NORDUnet
  - 83% Client Contribution
  - 15% EC Fund/Grants

REVENUE DISTRIBUTION

	Network Services	NOC Services	Project Services
Total EC Refund	Clients Contributions		
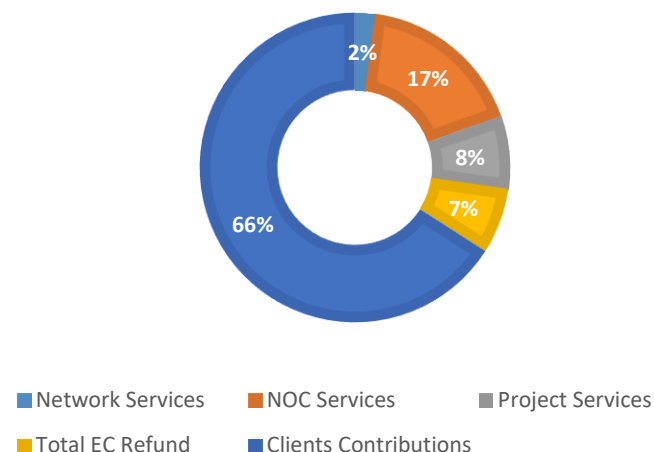
Network Services	Full Year EUR
Total Network Services	392 000
NOC Services	
Total Noc Services	3 193 100
Project Services	
Total Project Services	1 398 880
TOTAL SERVICES	4 983 980
Refund EC	
Total EC Refund	1 248 000
NET SALES	6 231 980
TOTAL CONTRIBUTIONS	12 051 061
TOTAL INCOME	18 283 041

TOTAL SERVICES — 27%
Total EC Refund — 7%
TOTAL CONTRIBUTIONS — 66%

BdREN

FINANCING MODEL FOR UGANDA, AFRICA

Capital Expenditure
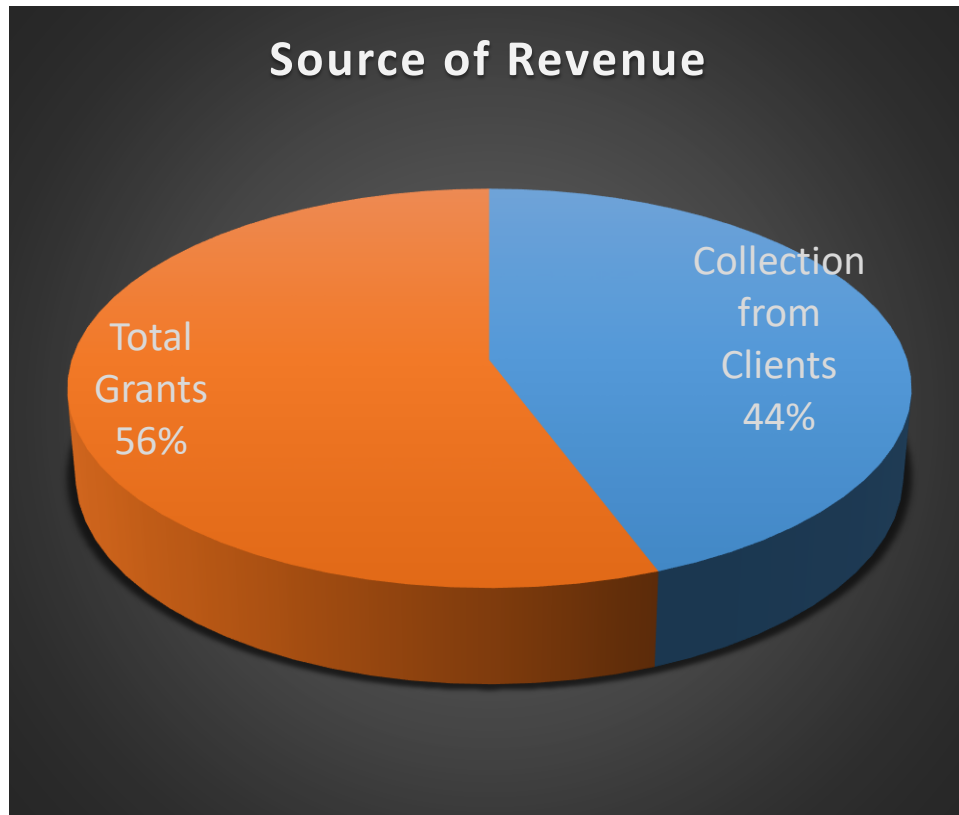
- Government and Development Partner Support

Operational Expenditure

- Membership subscriptions and Revenue accrued from products and services
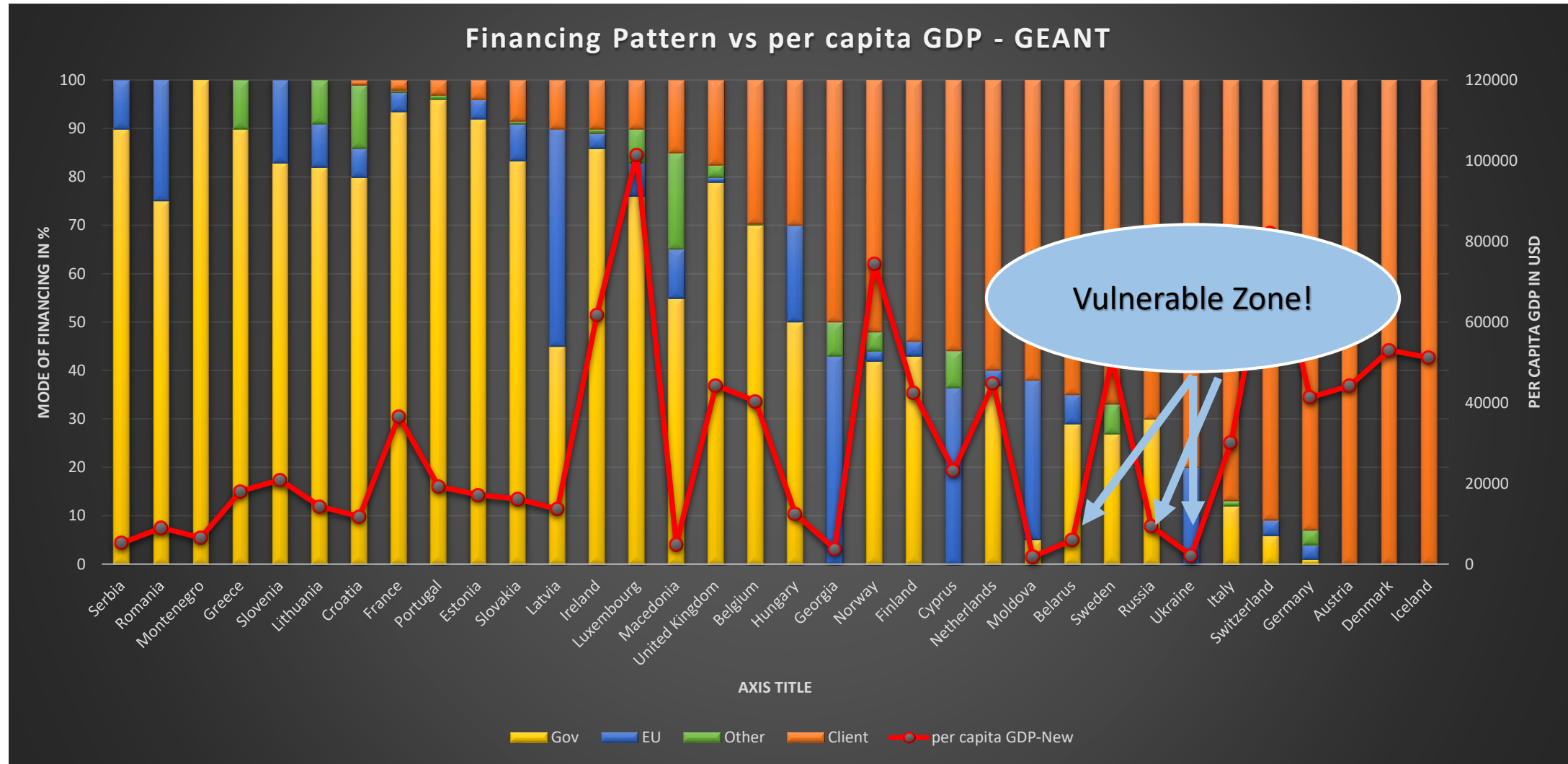
FINANCIAL MODEL IN OARNET

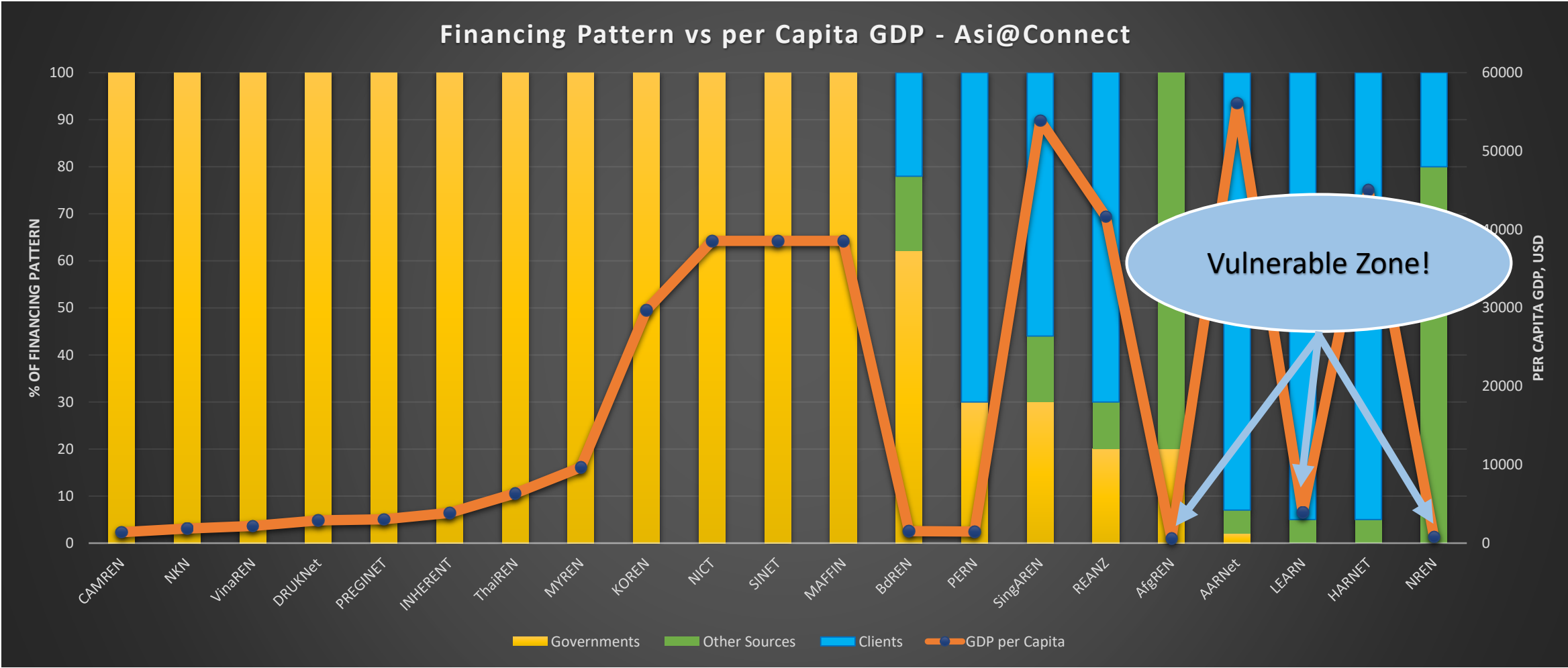## OARnet Operating Financials – FY16

Source of Revenue

Total Grants 56%

Collection from Clients 44%

Sources of Revenue	Budget	Actual	Variance
User Fees	5,874,705	7,170,358	1,295,653
Grant/Contracts	0	0	0
Other Funding	3,000	43,163	40,163
Regents Funding (Higher Ed Subsidy)	3,172,519	3,172,519	(0)
ODE Funding (K12)	712,148	712,148	0
BEMC Funding (PBS)	301,065	303,212	2,147
State of Ohio - OIT (OneNetwork)	3,200,000	3,200,000	0
Reserve Transfers In (Out)	0	(1,400,000)	(1,400,000)
Total Revenue	**13,263,437**	**13,201,400**	**(62,037)**

WHICH FINANCING OPTION SHOULD BE THE RIGHT OPTION?

DETERMINING FINANCING MODEL

Financing Pattern vs per capita GDP - GEANT

Vulnerable Zone!

DETERMINING FINANCING MODEL

Financing Pattern vs per Capita GDP - Asi@Connect

Vulnerable Zone!

Legend: Governments | Other Sources | Clients | GDP per Capita

Competitive Edge of NRENs and Financial Sustainability

PLANNED FUNDING MODEL[OPEX] - BDREN

Hybrid Financing

Financial Sustainability Plan [OPEX Management] - BdREN
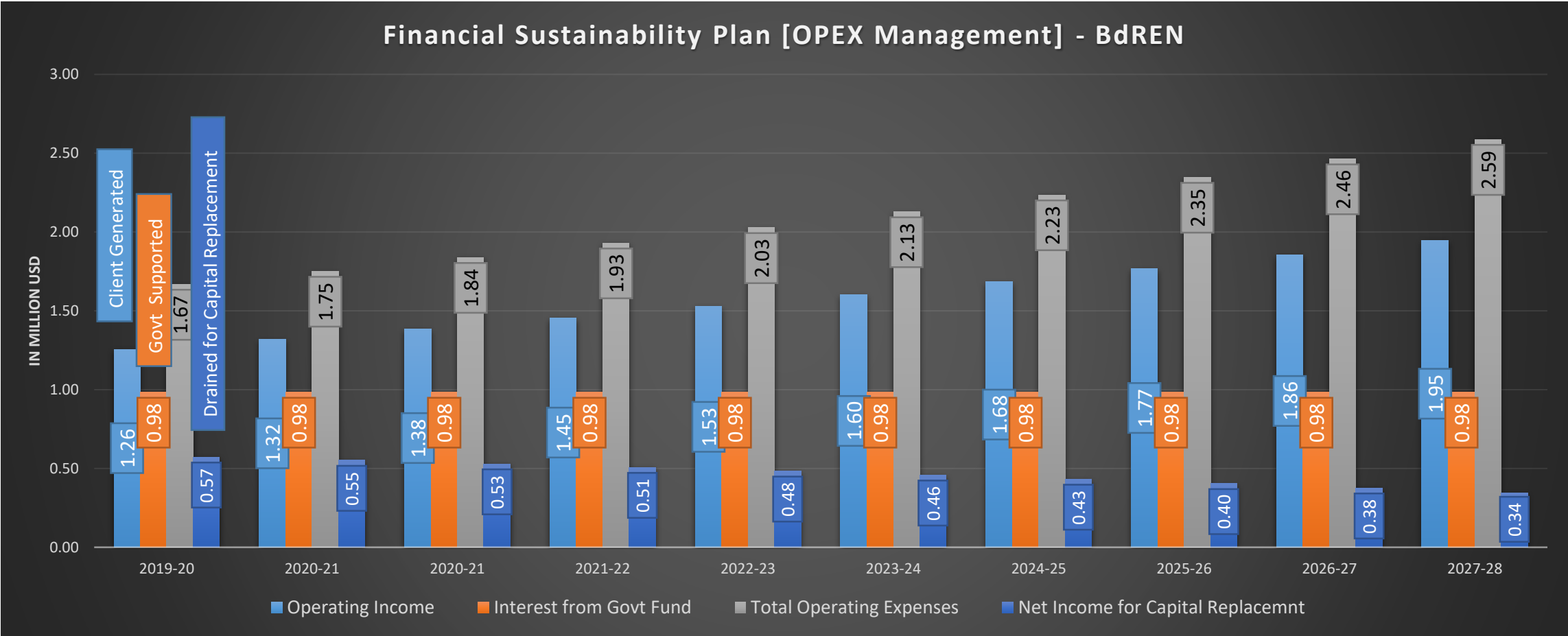
Balance drained for Capital Replacement

PLANNED FUNDING MODEL[CAPEX] - BDREN

**Government Financing**

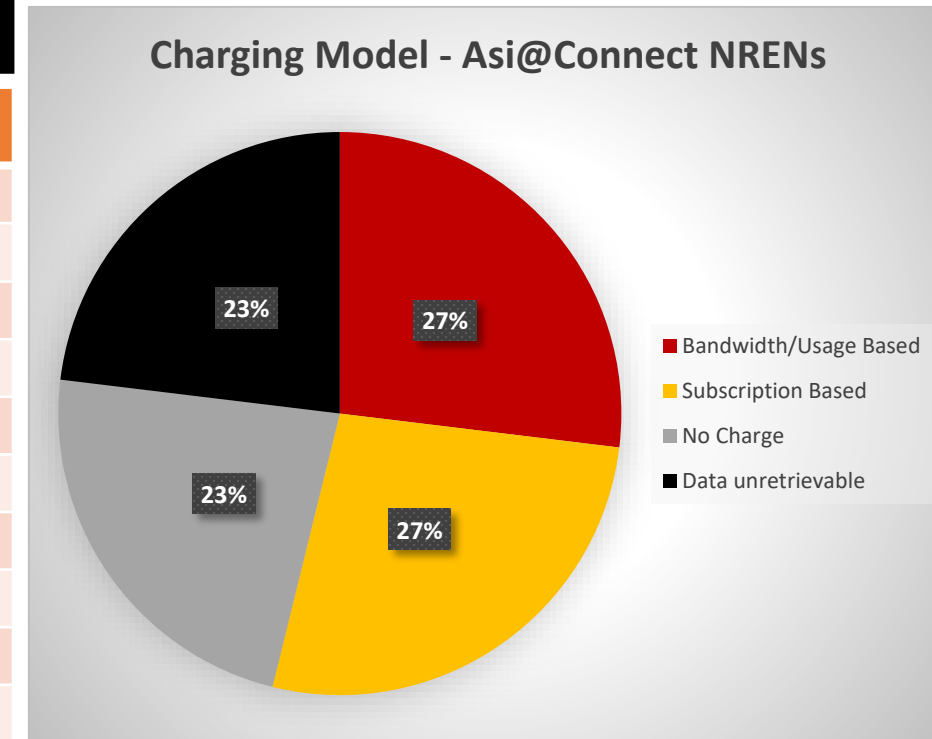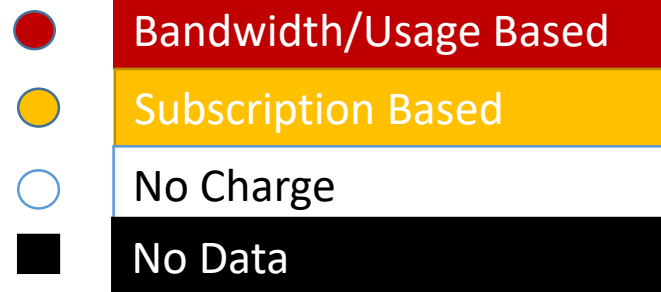Financial Sustainability Plan [CAPEX Management] - BdREN
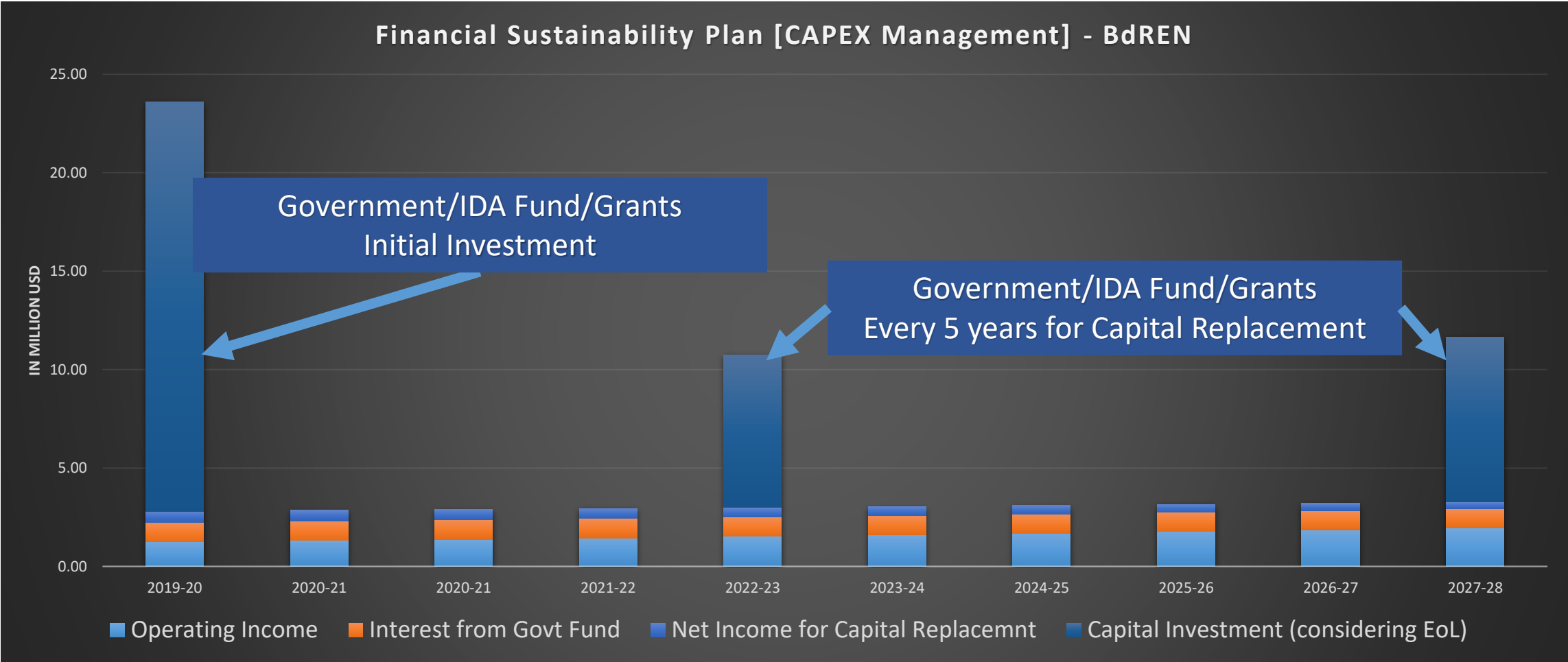
CLIENT CHARGING MODEL

- Bandwidth/Usage Based
  - The more bandwidth you use the more you pay
  - Contraction/Restrictive Model
  - Focus on Bandwidth

- Subscription/Package Based
  - The more you use the less you pay
  - Expansion/Unrestrictive Model
  - Focus on Services

- Free of Charge
  - Most cases Restrictive
  - Government Supported

Restrictive, Non-Restrictive Model and FoC

— Payment-Restrictive   — Payment-Non Restrictive   — Payment-FoC
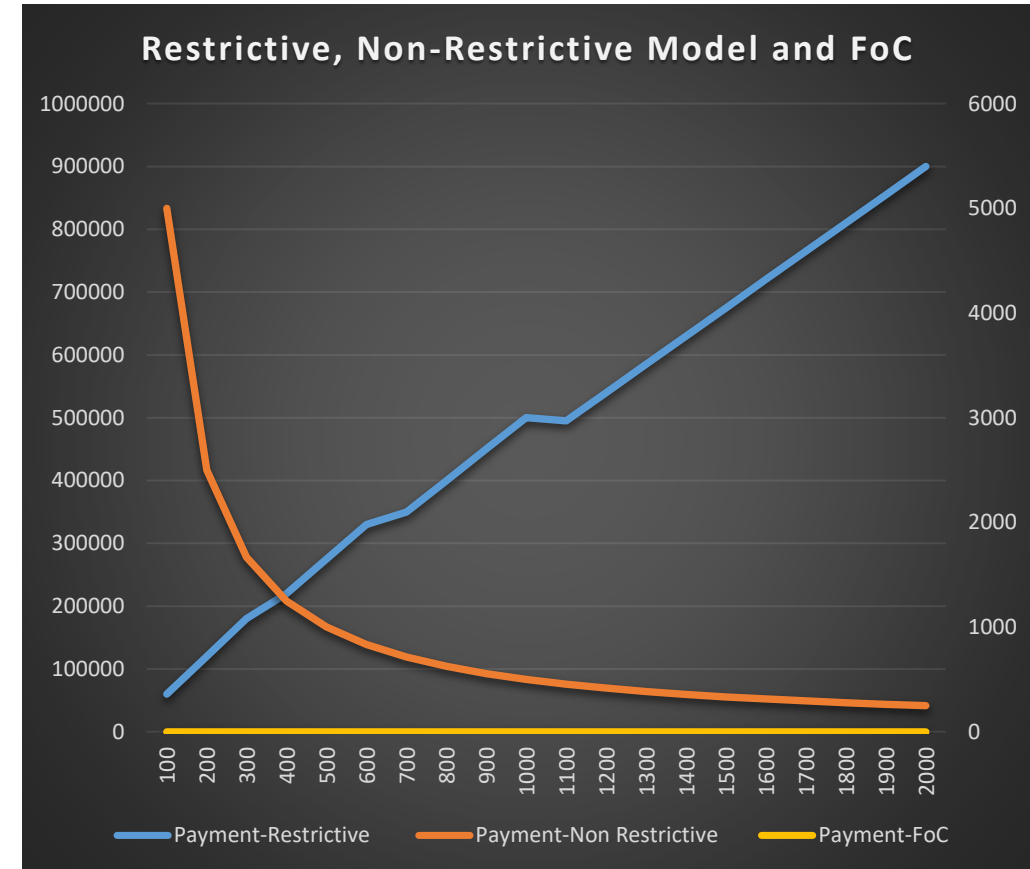
BdREN

CLIENT CHARGING MODEL – ASI@CONNECT

Beneficiary Countries

Name of NREN	Country	Charging Matrix
AfgREN	Afghanistan	⬛
BdREN	Bangladesh	🟡
DIT&T	Bhutan	🔴
ITC	Cambodia	⚪
NKN	India	⚪
INHERENT	Indonesia	⚪
LARNET	Laos	⬛
MyREN	Malaysia	🔴
ErdemNet	Mangolia	⬛
mmREN	Myanmar	⬛
NREN	Nepal	🟡
PERN	Pakistan	🔴
ASTI/PREGINET	Phillipines	⚪
LEARN	Srilanka	🔴
ThaiREN	Thailand	⚪
VinaREN	Vietnam	🟡

Non-Beneficiary Countries

Name of NREN	Country	Charging Matrix
AARNet	Australia	🔴
CERNET	China	🟡
CSTNET	China	⬛
HARNET	Hongkong	🔴
NICT	Japan	⚪
NII	Japan	🔴
MAFFIN	Japan	⬛
NIA/KREONET	South Korea	🔴
REANNZ	New Zealand	🟡
SINGAREN	Singapore	🔴 🟡

🔴	Bandwidth/Usage Based
🟡	Subscription Based
⚪	No Charge
⬛	No Data

Charging Model - Asi@Connect NRENs

- 🔴 Bandwidth/Usage Based — 27%
- 🟡 Subscription Based — 27%
- ⬜ No Charge — 23%
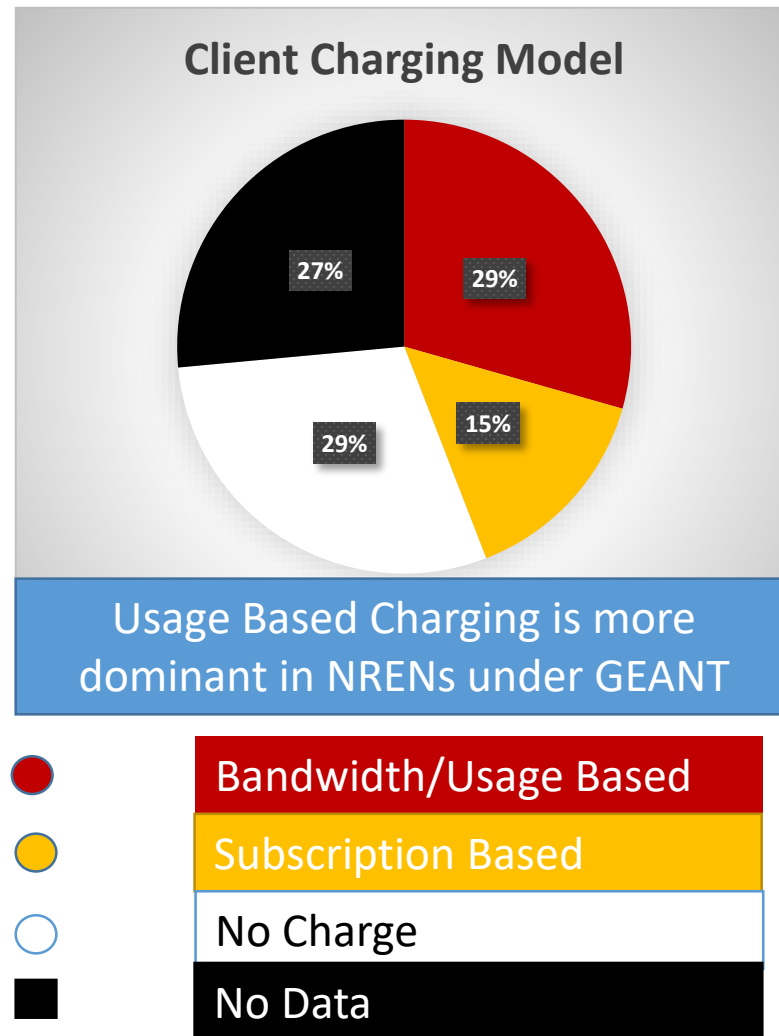- ⬛ Data unretrievable — 23%

Usage based charging and Subscription based Charging are equally dominant under Asi@Connect

BdREN

CLIENT CHARGING MODEL – GEANT PARTNER COUNTRIES

Name of NREN	Country	Charging Matrix
ACOnet	Austria	🔴
BELNET	Belgium	🔴
RENATER	France	🔴
DFN	Germany	⬛
GRNET	Greece	⚪
HEAnet	Ireland	🟠
Italy	GARR	🔴
RESTENA	Luxembourg	🔴
Netherland	SurfNet	⬛
FCCN	Portugal	🟠
RedIRIS	Spain	⚪
SWITCH	Switzerland	🟠
JANET	United Kingdom	🟠
IST Foundation	Bulgaria	⬛
CYNET	Cyprus	🔴
CESNET	Czech Republic	🟠
EENet	Estonia	⚪

Name of NREN	Country	Charging Matrix
Hungary	HUNGARNET	⬛
LANET	Latvia	⬛
LITNET	Lithuania	⚪
PSNC	Poland	⬛
RoEduNet	Romania	⚪
SANET	Slovakia	🔴
ARNES	Slovenia	⚪
ULAKBIM	Turkey	⬛
Aznet	Azerbaijan	⬛
BASNET	Belarus	🔴
BIHARNET	Bosnia Harzigowina	⬛
CARNet	Croatia	⚪
Georgia	GRENA	🔴
IUCC	Israel	🔴
MARNet	Macedonia	⚪
MARWAN	Morocco	⚪
AMREJ	Serbia & Montenegro	⚪

Client Charging Model

27%	29%
29%	15%

Usage Based Charging is more dominant in NRENs under GEANT

- 🔴 **Bandwidth/Usage Based**
- 🟠 **Subscription Based**
- ⚪ No Charge
- ⬛ No Data

Source: https://www.terena.org/activities/compendium/2010/

Competitive Edge of NRENs and Financial Sustainability

BdREN

CLIENT CHARGING MODEL – NORDIC COUNTRIES

- All institutes pay 1.54% of their Gross Revenue
- No restriction on bandwidth

- 58% of Total Expenses paid by all Institution based o
- No restriction on bandwidth

- Membership Fees For Universities and Polytechnics
  Euro/person/month
- Most of the Services covered under Membership fee

- Universities and Colleges pay fixed Annual Service Fe
- Most of the Services covered under Membership fee
- libraries, museums, private research institutions, university hospital
  research communities, private upper secondary schools, etc. pay Annual
  Service Fees based on Administrative Capacity

- Flat Fees based on Number of Employees

Type of Charging Model - Nordic

Subscription Based, 100%

CHARGING MODEL – WHICH ONE TO FOLLOW?

- Usage should not be fully restrictive
- Must be exclusive and differentiable from ISPs

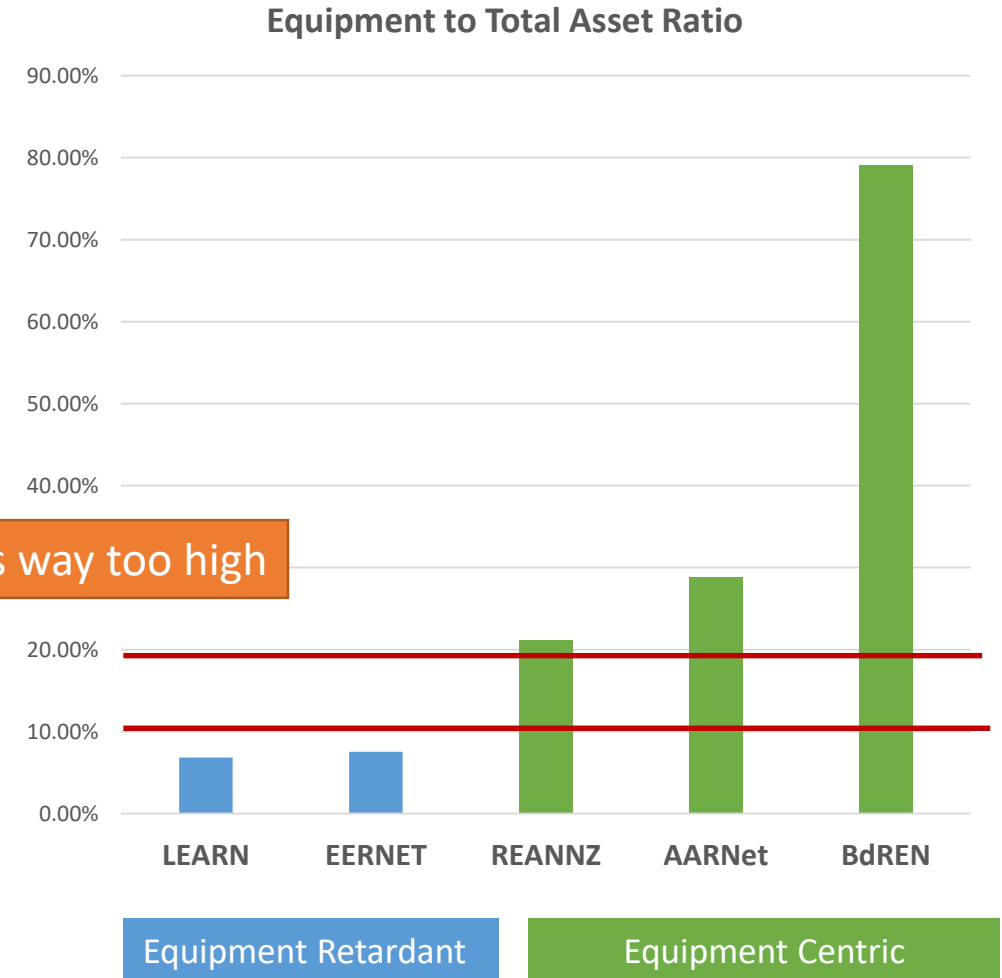# INVESTMENT OPTIONS: CASE STUDY WITH 5 NREN

INVESTMENT OPTIONS

Two types of NRENs
- Equipment Centric
- Equipment Retardant

- **Equipment Centric:** Equipment-Asset Ratio > 20%
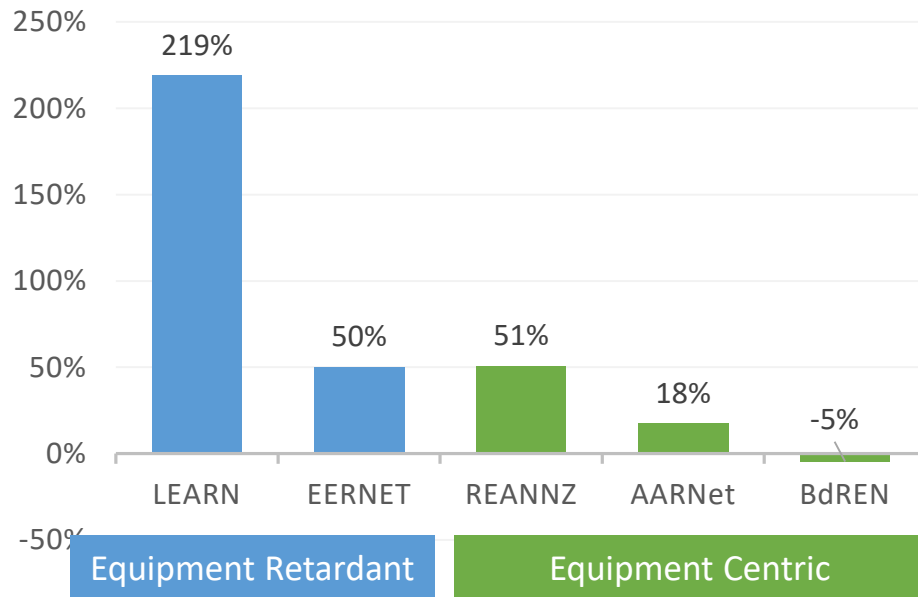- **Equipment Retardant:** Equipment-Asset Ratio < 10%

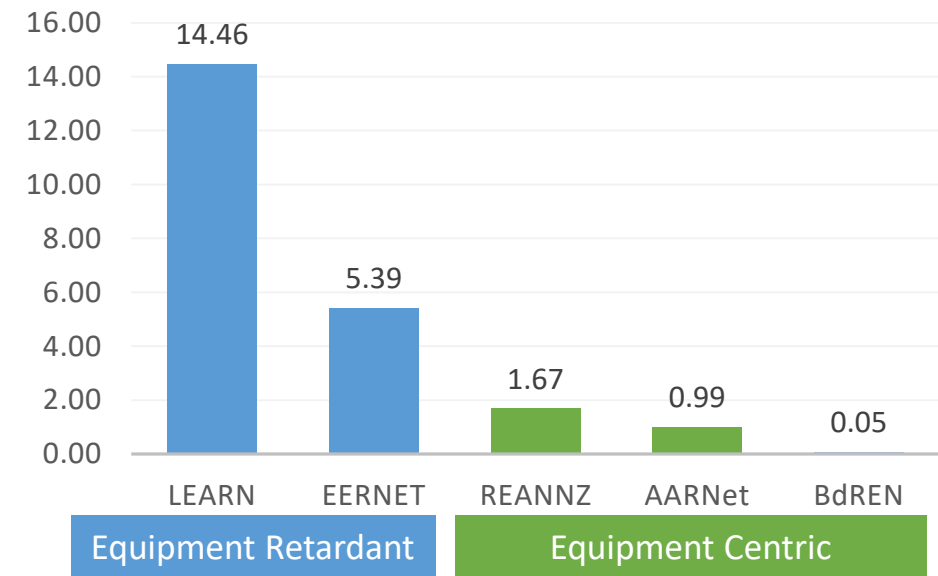BdREN's Equipment to Total Assets Ratio is way too high

Equipment to Total Asset Ratio

Equipment Retardant | Equipment Centric

INVESTMENT OPTIONS

Surplus to Equipment Cost Ratio

Annual Revenue to Equipment Cost Ratio

- BdREN's Surplus is Negative as Annual Revenue to Equipment Cost is too low
- For Equipment Retardant NRENs Surplus and Annual Revenue to Equipment Cost Ratio is higher
- For Equipment Centric NRENs Surplus to Equipment cost should be in and around 15% for sustainability

Competitive Edge of NRENs and Financial Sustainability

RECOMMENDED FUNDING MODEL – IN BRIEF

- GDP less than threshold: Hybrid Financing

- GDP Higher than threshold: Client/Hybrid Financing

- OPEX: Client Financing
  - To be recoverable from Clients.
- OPEX: Hybrid Financing
  - Government support might be needed in terms of Endowment Fund/Grants for countries residing with low per capita GDP

- CAPEX: Client Financing
  - To be recoverable from Clients
- CAPEX: Hybrid Financing
  - Government Financing/Loans from Development Agencies

RECOMMENDED CHARGING MODEL

Client Charging Model

Should be Flat/Subscription based with **no restriction** on Traffic or with **partial Restriction** with Subscription/Package based Charging
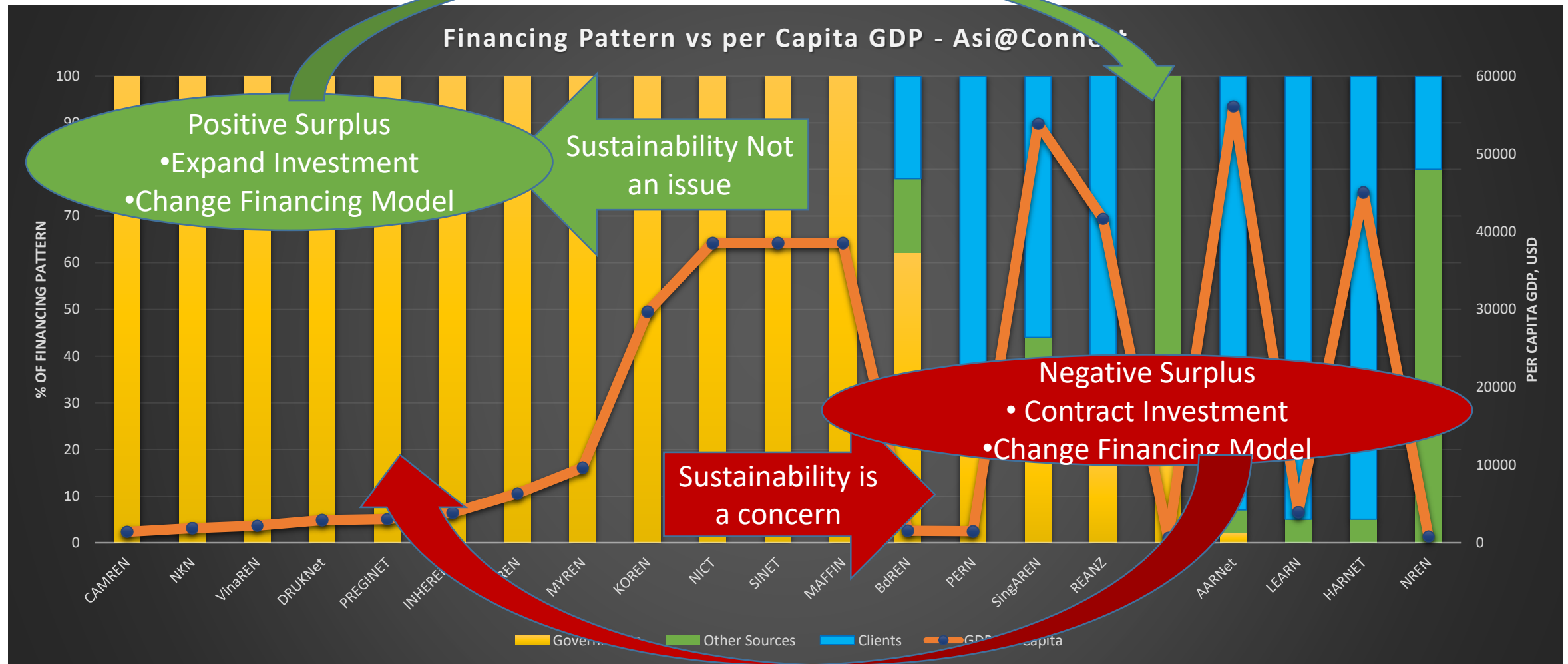
RECOMMENDED INVESTMENT MODEL

Investment Model (Client Financing)

- Investment on Equipment shall be made in a way so that surplus remains positive

Investment Model (Hybrid Financing)

- EBITDA should be positive
- Investment on Equipment shall be made in a way to cap depreciation cost
- Return on Equipment should be more than 10%

BdREN

DETERMINING FINANCING MODEL

Financing Pattern vs per Capita GDP - Asi@Connect

Positive Surplus
• Expand Investment
• Change Financing Model

Sustainability Not an issue

Negative Surplus
• Contract Investment
• Change Financing Model

Sustainability is a concern

Government   Other Sources   Clients   GDP per Capita

Competitive Edge of NRENs and Financial Sustainability

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Rajeewa Abeygunarathna

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