DEVELOPING AND ENHANCING COMPETENCIES OF WORKFORCE TO SUPPORT EMERGING DIGITAL TECHNOLOGIES FOR GRID OF THE FUTURE

Grid Solution Expertise
Grid Division
Tenaga Nasional Berhad

Reimagining TNB & Grid of the Future

Reimagining TNB has identified Grid of The Futures as of the important catalysts for TNB future growth, which creates the demand for high quality technical experts that are exceptionally competent to provide solutions to the future Grid challenges

International recognition of expertise

Local & international entrepreneurship thinking & business savviness

Mastering existing capabilities & designing future technologies in digital environment

Post VUP to Support Reimagining TNB

Post VUP implementation requires Grid Division to align its directions and strategies to support aspirations of Reimagining TNB

- New operational structures
- New business model
- New technical challenges

Traditional Grid

Unlocking values of employees, customer and financial standings

Organisational structures are streamlined with more focus given in each area of expertise

Emphasis of improved efficiency, productivity and innovations

Interdependencies between the technical experts and the operation teams become more critical.

Reimagining TNB (Grid of the Future)

Challenges in Power Utility (Traditional Grid)

Complex Power System

- Integration of Distributed & Renewable Generation
- Pressure for high quality & reliable power supply
- Fast restoration of supply
- Reduce planned and unplanned outages.
- Handling of Grid congestion

Aging Infrastructure

- Exposure to high risk of failure due to aging of equipment.
- Equipment's diagnostic and condition monitoring since no proper record and background history.
- Underrated equipment due to system upgrading and network complexity which may expose to possible failure.

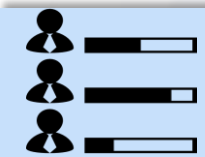
New Technology & Modernization

- Compact & hybrid design for less footprint & maintenance.
- New configuration of substation design for less space utilization.
- Environmental compliance & sustainability requirements

New Regulations & Business Model

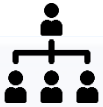
- Increased customer, market and regulation roles
- New rules & regulations by regulatory bodies
- New business model in power industry
- Technical & Economic Justifications for New Projects & Grid Enhancement Projects

Emerging technologies in grid modernization & digitalization to support the above challenges has shifted the power utility from traditional environment to new digital environment



Gaps in level of expertise, knowledge, and experience for workforce to meet the above challenges in this new digital environment

Digital Transformation in Power Industry



Digital revolution in power industry with introduction of smart/intelligence grid, renewable energy, distributed generation & new digital technologies

Traditional Grid

GRID MODERNIZATION & DIGITALIZATION

Demand new capabilities for Grid system as this trigger new business, challenges & regulatory framework.

Most power utilities facing digital transformation to be fully digital grid as long term strategic objective to improve grid efficiency, availability & reliability

In digital environment, data collection & exchange are growing exponentially, creating opportunities w.r.t wide application in data analytics for control and automation, asset planning, monitoring & diagnostics in the Grid

This transformation shifting the profile and skill requirements for the future grid workforce

Modern/Digital Grid (Grid of the Future)

The Traditional Grid Workforce

Skill Sets For The Traditional Grid Workforce

Core-Technical Skill Sets

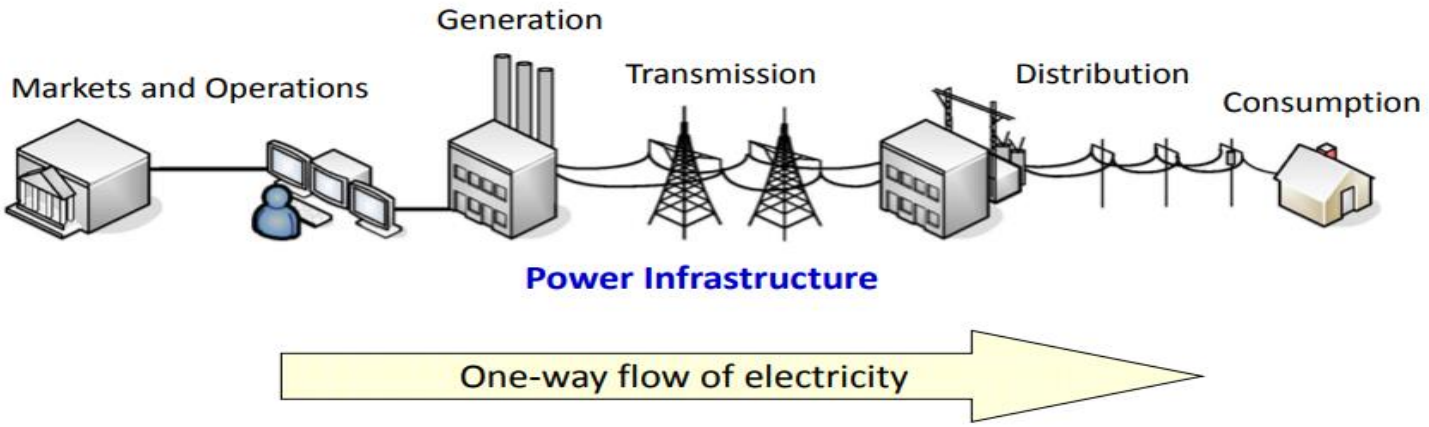
Electric Machinery
Energy Conversion & Development
Power Development & Generation
Energy Management Systems
Motor Drives & Controls
High Voltage AC/DC & FACTS
Power Electronic Applications
Power Quality & Measurement
Power System Relaying & Protection
Power System Stability & Control
Power System Transients
Power System Instrumentation
Power System Operations
Power System Planning
High Voltage Engineering

+

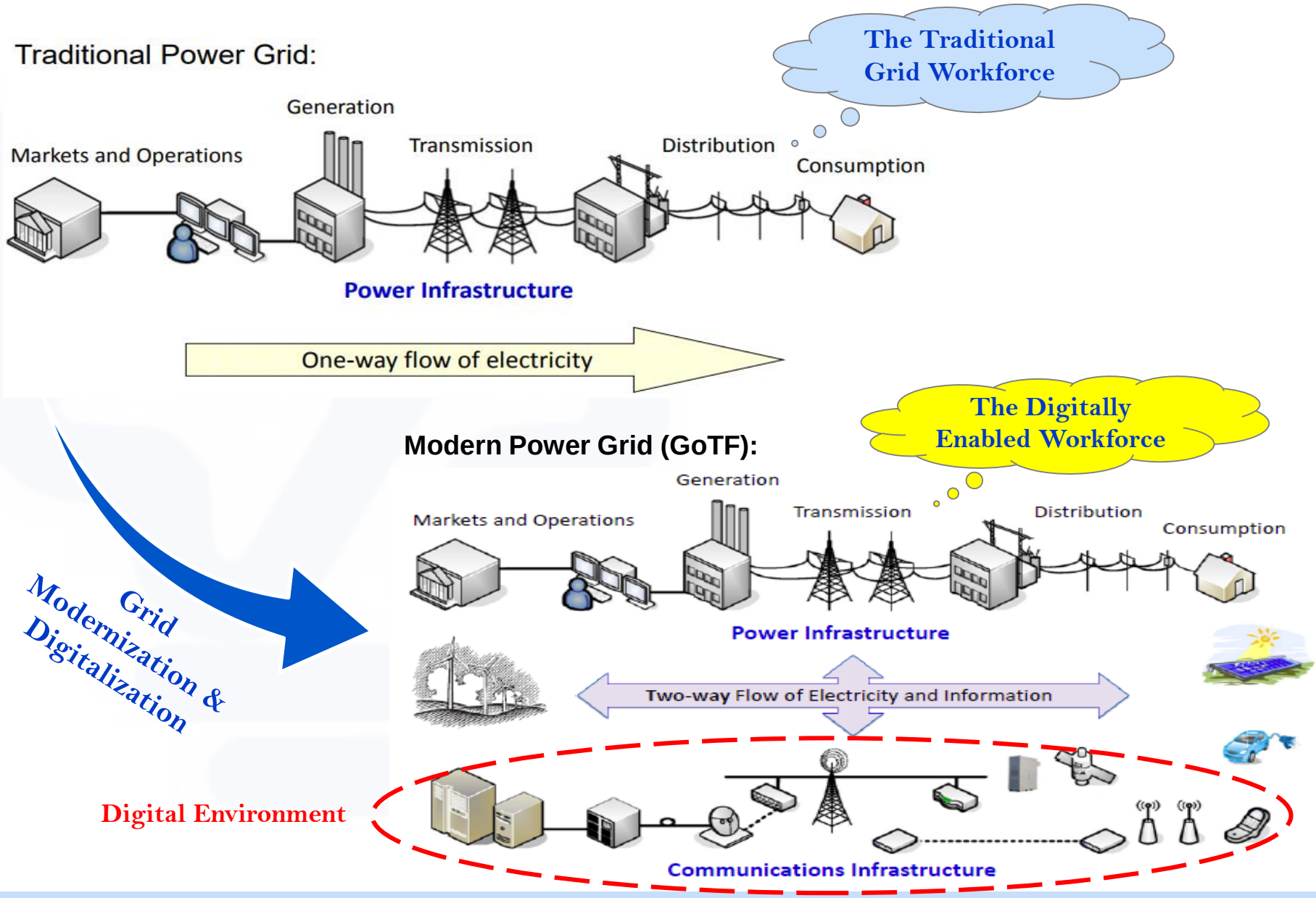
Project
Management
Leadership
Problem Solving
Team Building
Communication
Contract Laws

Leadership & Soft Skill Sets

Traditional Power Grid:



Grid Modernization and Digitalization



The Digitally Enabled Workforce

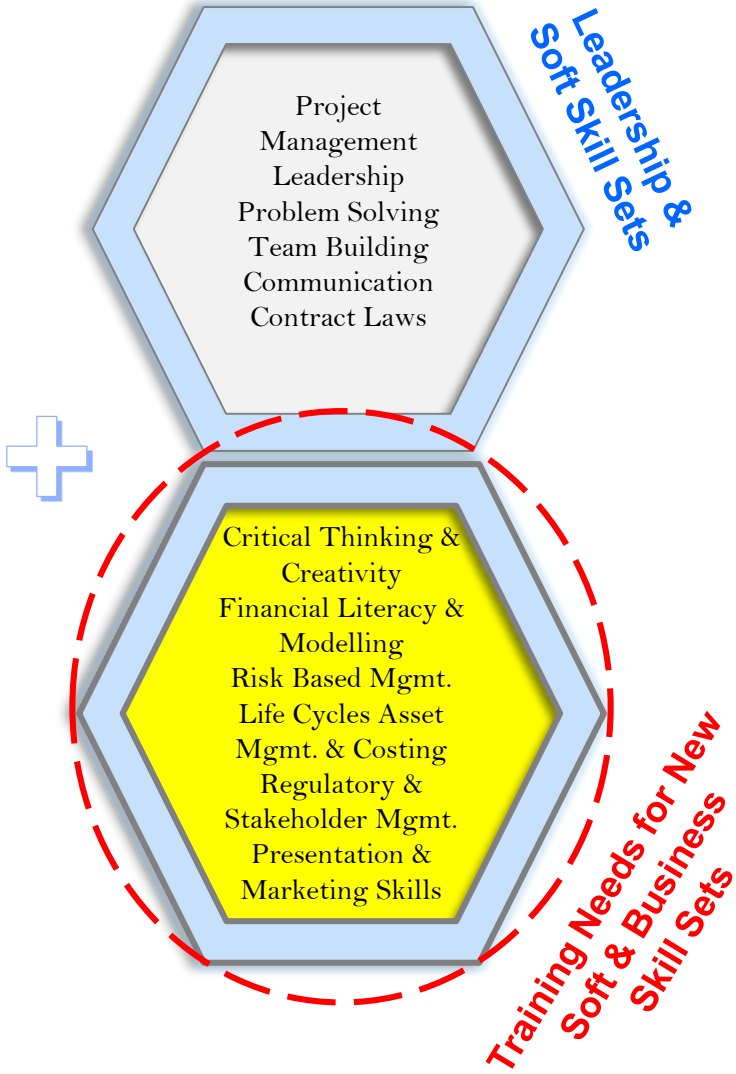
Skill Sets For The Digitally Enabled Workforce

Electric Machinery
Energy Conversion & Development
Power Development & Generation
Energy Management Systems
Motor Drives & Controls
High Voltage AC/DC & FACTS
Power Electronic Applications
Power Quality & Measurement
Power System Relaying & Protection
Power System Stability & Control
Power System Transients
Power System Instrumentation
Power System Operations
Power System Planning
High Voltage Engineering

Core -Technical Skills

Renewable Energy & New Technology Integration
Energy Storage Systems
Real time Digital Systems
Operational Technology/IT
Software Development
Data Analytics & Modelling
Data Communication & Mining
Data Security & Cyber Crime
Digital & Intelligence Networks
Smart Grid & IEC61850
Online Condition Monitoring
Asset Health Management
Condition & Predictive Maint.
Sensor Technologies
Digital Signal Processing

Training Needs for New Digital Skill Sets & Knowledge



Critical Areas For The Digitally Enabled Workforce

Data Specialist

Possess analytical skills required to process, extract value from, visualize and communicate with data

Sensor Tech Specialists

Play roles to review sensor design & characteristics, its reliability & performance to produce data

The Digitally Enabled Workforce

Software & application Programmers

Possess skill sets in designing, testing, maintaining & developing application software/expert system tailored to Grid's requirements

Critical Skill Sets

Database System Admin. & Cyber Security Specialists

Play roles to plan, develop, maintain, manage Grid's database systems, operating system & security policies with cyber security specialist to protect Grid infra from cyber-attacks/cyber crimes.

Other Critical Areas in Digital Environment

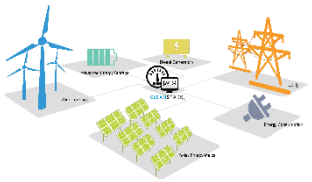
Focus on specific complementary disciplinary areas to diversify and improve knowledge and competency which are critical for digital environment.

Intelligence/Smart Grid and Network of the Future

Data analytics and algorithm

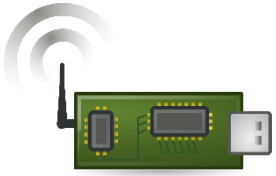
Distributed Generation & Integration Technologies

PV and Energy Conversion



Asset Monitoring & Diagnostics

Power Electronic & Application



Sensor Development & Technology

Cyber Security

IoT & Cloud Technology

Optimized Training Packaging – 6Ds Approach

Discuss & Diagnose

Identify actual training needs through syndication and discussion and diagnose every part of topics with trainee/participants

Design & Develop

Design the course outline and develop training syllabus to cover all topics as discussed/diagnosed

Deliver & Demonstrate

Appoint the right trainer with his/her specialization matches with the topics/syllabus and capable to deliver & demonstrate the training needs

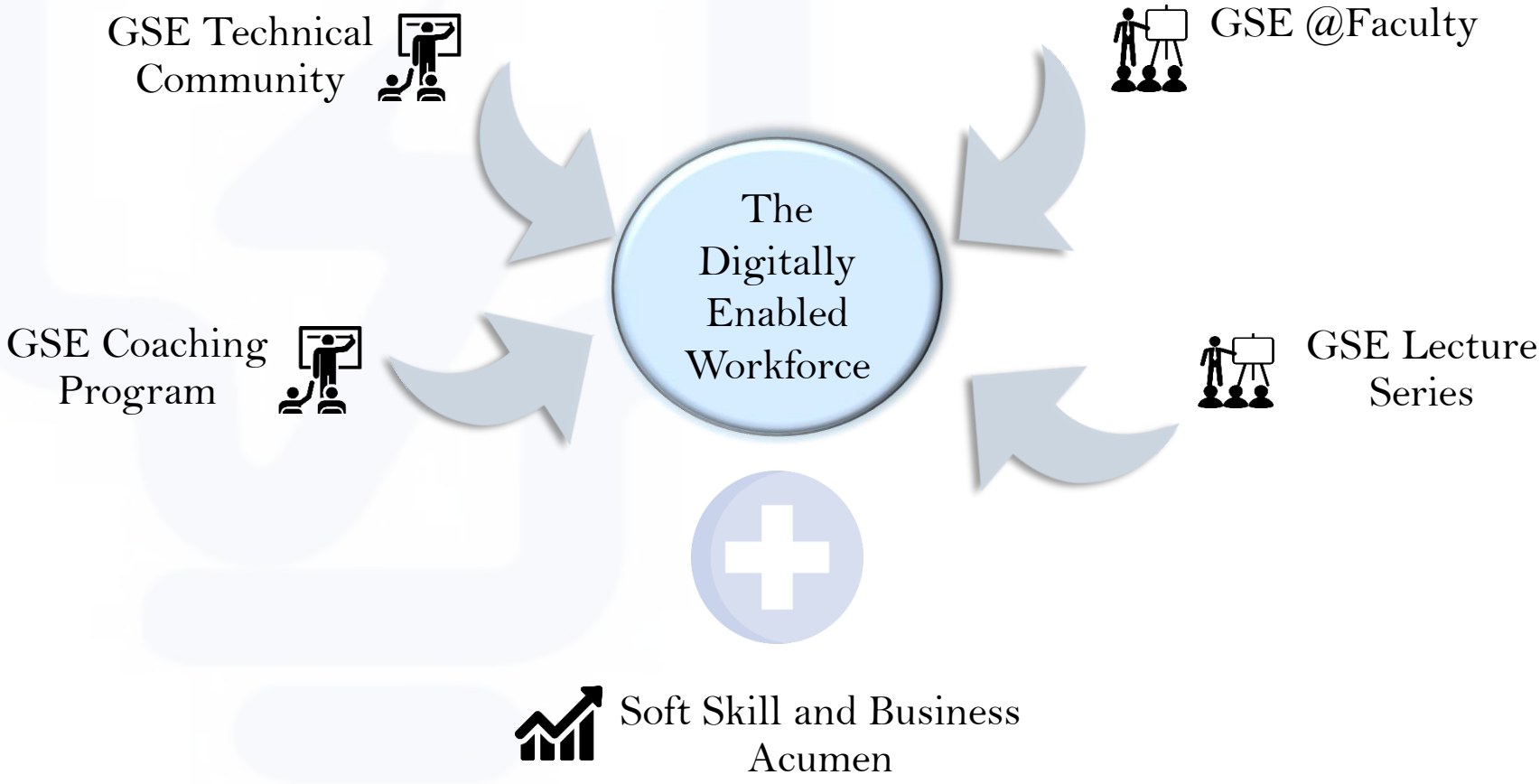
Training Package Syllabus/Topics Offered

Matching Training Package with Training Needs on :-

- Basic/Fundamentals
- Syllabus Contents/Topics
- Case Studies/Experiences

GSE Competency & Learning Journey

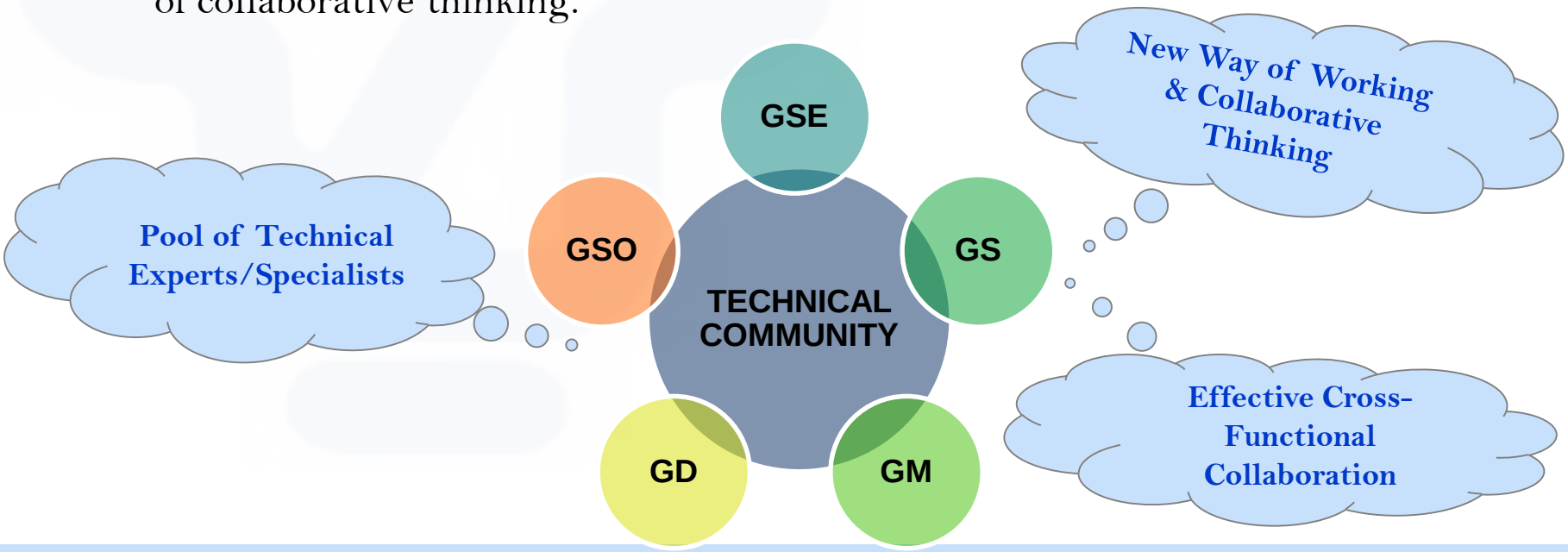
GSE to support and produce the digitally enabled workforce by establishment a pool of highly competent technical specialists through a comprehensive development program and learning journey



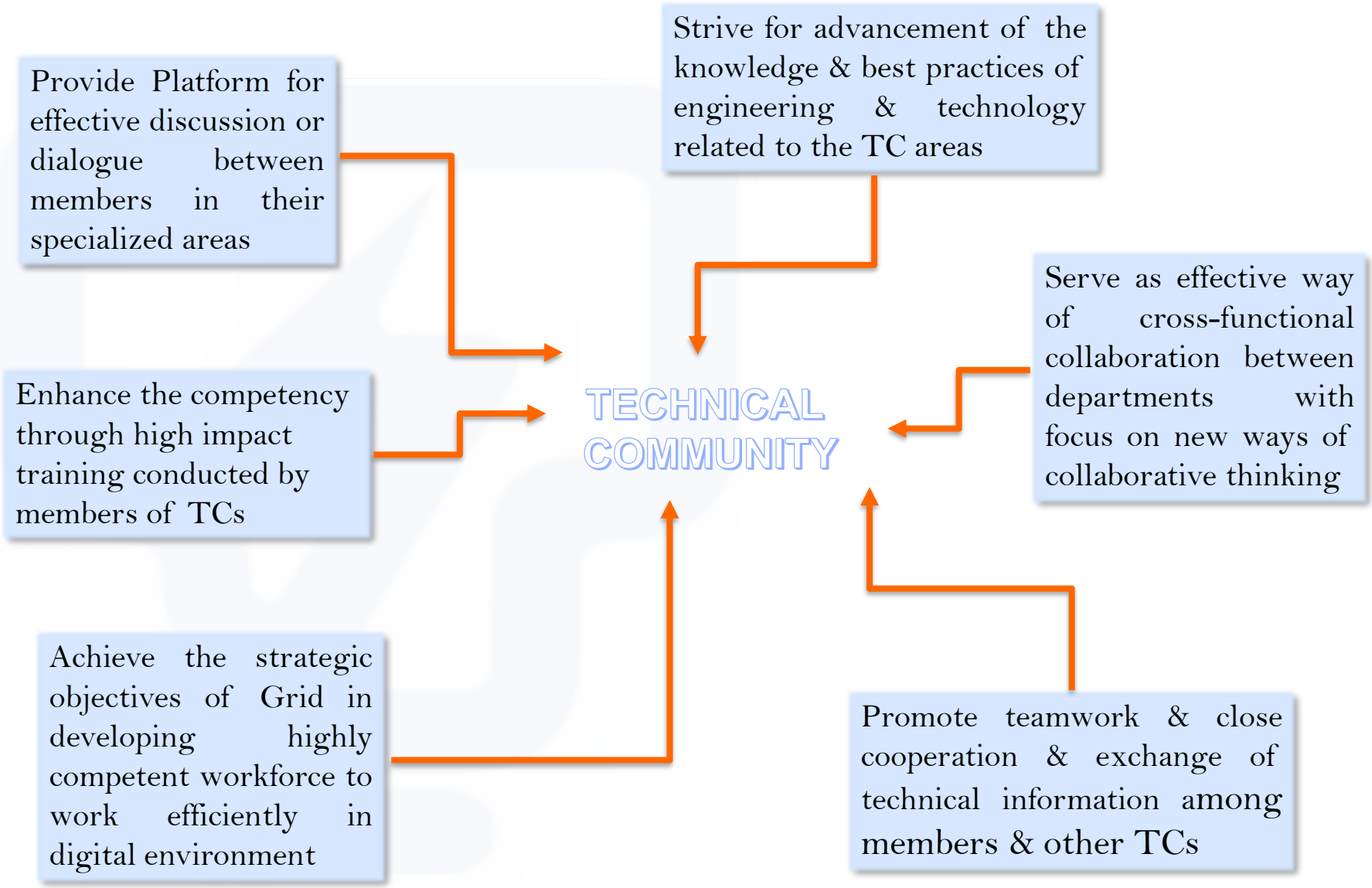
GSE Technical Community

- A platform where a pool of technical experts/specialists in various fields of expertise (design, engineering, operation and maintenance) within the Grid Division to undertake activities related to the grid system.

- The main objective of this Technical Community (TC) is to increase cross-functional collaboration between the departments within the Grid and encourage knowledge and skills sharing beyond the traditional boundaries in the Grid where the focus is on the people's new way of working and way of collaborative thinking.

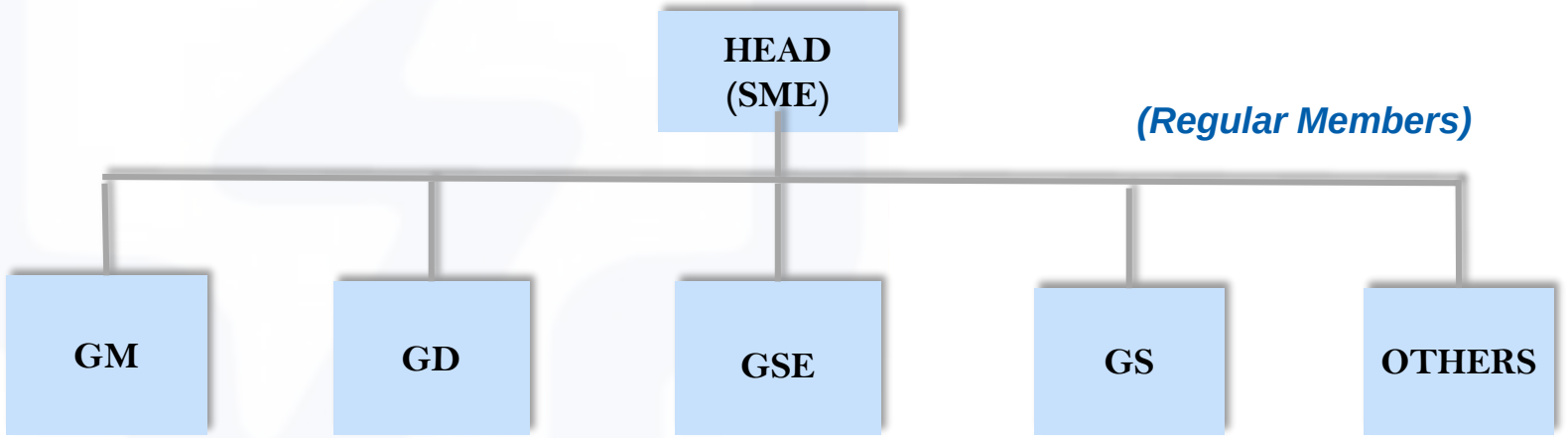


Objectives


Provide Platform for effective discussion or dialogue between members in their specialized areas
Strive for advancement of the knowledge & best practices of engineering & technology related to the TC areas
Enhance the competency through high impact training conducted by members of TCs
TECHNICAL COMMUNITY
Serve as effective way of cross-functional collaboration between departments with focus on new ways of collaborative thinking
Achieve the strategic objectives of Grid in developing highly competent workforce to work efficiently in digital environment
Promote teamwork & close cooperation & exchange of technical information among members & other TCs

4-3 TC Structure & Composition of Members

Technical Community (TC) is a pool of experts formed in GSE to perform duties and responsibilities under scope of activities that related to specific products or area of expertise and constituted of experts mainly from GD and GM



- All members in Technical Community (TC) are governed by Terms of Reference as approved by Grid Technical Working Committee.
- TC is also a platform for succession plan or talent pool in specific area of expertise.

GSE Coaching Program

- GSE Coaching Program is designed to produce in-house technical experts and specialists who are ready for Grid of the Future Challenges.

- This is a tailored and structured competency development program where a coach is appointed and responsible to conduct a comprehensive coaching program to all members of TCs with the objective to build and upskill the competency of the members and certify them as specialist in their field of expertise.

- The key factor that drives this program is to identify technical gaps through assessing their skills, strength, and weaknesses and identify critical areas where development needed to reduce the gaps.

- By having a match pair of Coach/TC, it is expected that the coach at the end of the program would certify the members to reach the level of specialist.

Future Coach in GSE or Grid Division

SMEs/Technical Experts today are the coach of tomorrow. The coaching program will drive the growth of current expertise and groom the subordinates to be future coach

Roles and Responsibilities of TC Coach

TC Coach

- Review and identify gaps in members skills, knowledge competencies
- Develop program activities and scoping to reduce gap and meet target competency
- Supervising and guiding members in special project to meet its target & complete on time
- Conduct assessment on progress & achievement of members to qualify for certification
- Provide advice & guidance on activities particularly in analysis of technical problems
- Sharing resources & provide database access for knowledge sharing on tech. literature/reports & learning tools
- Conduct discussions via teleconference or social media to accomplish knowledge transfer
- Facilitate access for SME to involve proactively in international societies/bodies (CIGRE or IEEE, etc.)

Steering Committee to oversee Program Implementation

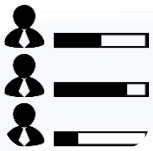
CPSC

- Chairman – Chief of GSE
- Head of Units from GSE/GD/GM (GTWC Members)
- Representative from HRBP (Grid)

Roles & Responsibility

- Ensure goals and objectives of the coaching program tie directly with the vision and mission of Grid Division
- Review planned activities/timelines for TC Coach/Members as development action plan
- Review scope/method/target of assessment process by coach
- Appointment of TC Coach & Members for the program
- Review assessment report by TC Coach on each TC Member and program deliverables
- Endorsement of budget requirement and program expenses

Coaching Program Milestone



Invitation Letter to TC Coach & Feedback

(**3 months**)

Appointment of TC Coach with ToR & Budget Approval

(**6 Months**)

Program Kick-Off

TC Coach/TC Members/Comm.

(**1 Month**)

Competency Review, Action Plan & Training Modules by TC Coach

(**3 Months**)

Face-to-Face & Long Distance Coaching, Supervision & Classroom Training

(**12 Months**)

Final Assessment on Each TC Member by TC Coach

(**1 Month**)

Presentation of Assessment Report by TC Coach

(**1 Month**)

Graduation of

TC Members

Program Duration = 18 Months
(Kick-off to Graduation)

GSE @ Faculty Program

- This is a technical collaborative program between GSE (from power industry) and local university (from academic fields) with the following objectives:-

Promoting university-industry collaboration in application based research, innovation and new technology development.

Establish platform for exchange and sharing of knowledge between university and power industry.

Establish a strong link between industry and academics that ensure the skills requirements of tomorrow's engineers are reflected in the university curriculum.

Provide opportunity to work in industrial and academic environment to broaden knowledge and experience.

Exposure to real needs of power utility industry and academic fields.

Promoting innovation through joint research and study

Scope of GSE @ Faculty Program

- The collaboration contribute mutual benefits for both parties and the scope extended to the following areas:-

Exchange of both personnel through :-
- Attachment of lecturers at GSE for knowledge exposure in engineering activities related to grid business and industry.
- Appointment of SME as visiting lecturer to give lectures to post-graduate students in power industry subjects/topics.

Joint technical collaboration/study on special topics to enhance grid reliability and anticipate the future needs of the modernization and digitalization.

Promote innovation and technological product development related to GSE business for potential commercialization of the product.

Facilitate SMEs in GSE to enroll for their Master or PhD at the university.

Scope of GSE @ Faculty Program

- Attachment of electrical engineering students for industrial training program.
- Joint supervision of student projects/thesis as co-supervisor in grid related topics.
- Organize joint technical conference/seminar/colloquium for internal and external participants including publication of paper/journal.
- Sharing of technical knowledge and experience from industry and academic in electrical power engineering.
- Conduct high impact training and knowledge development tailored to GSE needs.
- Organize social activities to bridge the gap and encourage informal interactions between personnel from both parties.

Memorandum of Understanding (MoU)

Grid Solution Expertise (GSE) TNB

College of Engineering, Local University

Period - 2 years

Technical Collaboration under
GSE@ Faculty Program can provide a strong link between TNB and University

GSE @ Lecture Series Program

- GSE Lecture Series is a platform for all SMEs and engineers in GSE to impart knowledge or share experience and exchange ideas. In-house experts (SMEs) with vast knowledge and experience in their specialized areas conduct this informal classroom session. Outside trainers/speakers are invited to give lecture on specific topics or areas under this program.

- The GSE Lecture Series is also extended to external classroom session where GSE's SME to give a public lecture to participants in their subject matter expert at any public institutions, IEMs, local/government bodies, GLCs, etc.

Key Topics for Lecture Series

- Review of Power System Analysis and Application
- Data analytics, networking & communication system
- Renewable generation technologies & integration
- Digital & Intelligence grid substations system technology
- New Emerging Technologies in HV Transmission
- Smart Grid Technology & IEC61850 Applications
- Design & Construction of HV Transmission system – Substation, Lines & Cables
- Condition Monitoring & Equipment Diagnostics
- Review of HV Engineering & Applications
- Case Studies on Fault Investigation & Root Cause Analysis

GSE Soft Skills & Business Acumen Program

- Focus on creativity, critical thinking, presentation skills, financial literacy and modelling including work ethic such as effective communication skills, attitudes and team collaboration, social and emotional skills that enable people to effectively navigate new environment and work well with others.

Leadership & Management

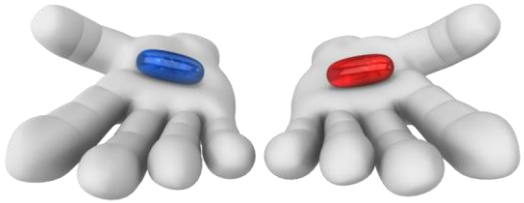
Team Building

Presentation

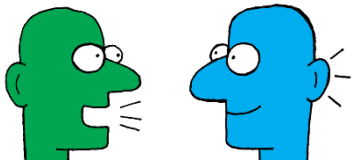
Strong Work Ethics

Negotiation

Interpersonal

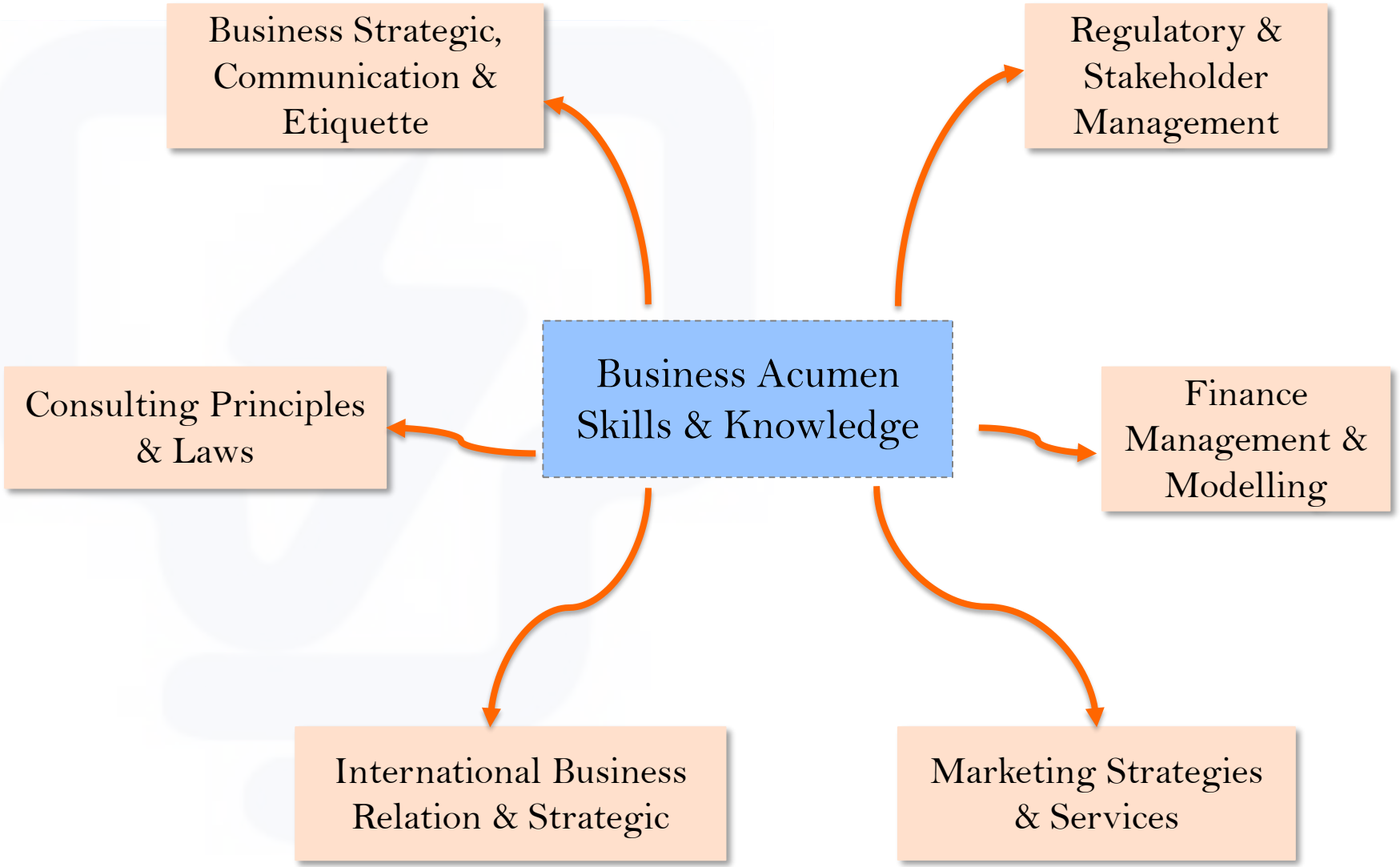


Decision Making & Problem Solving



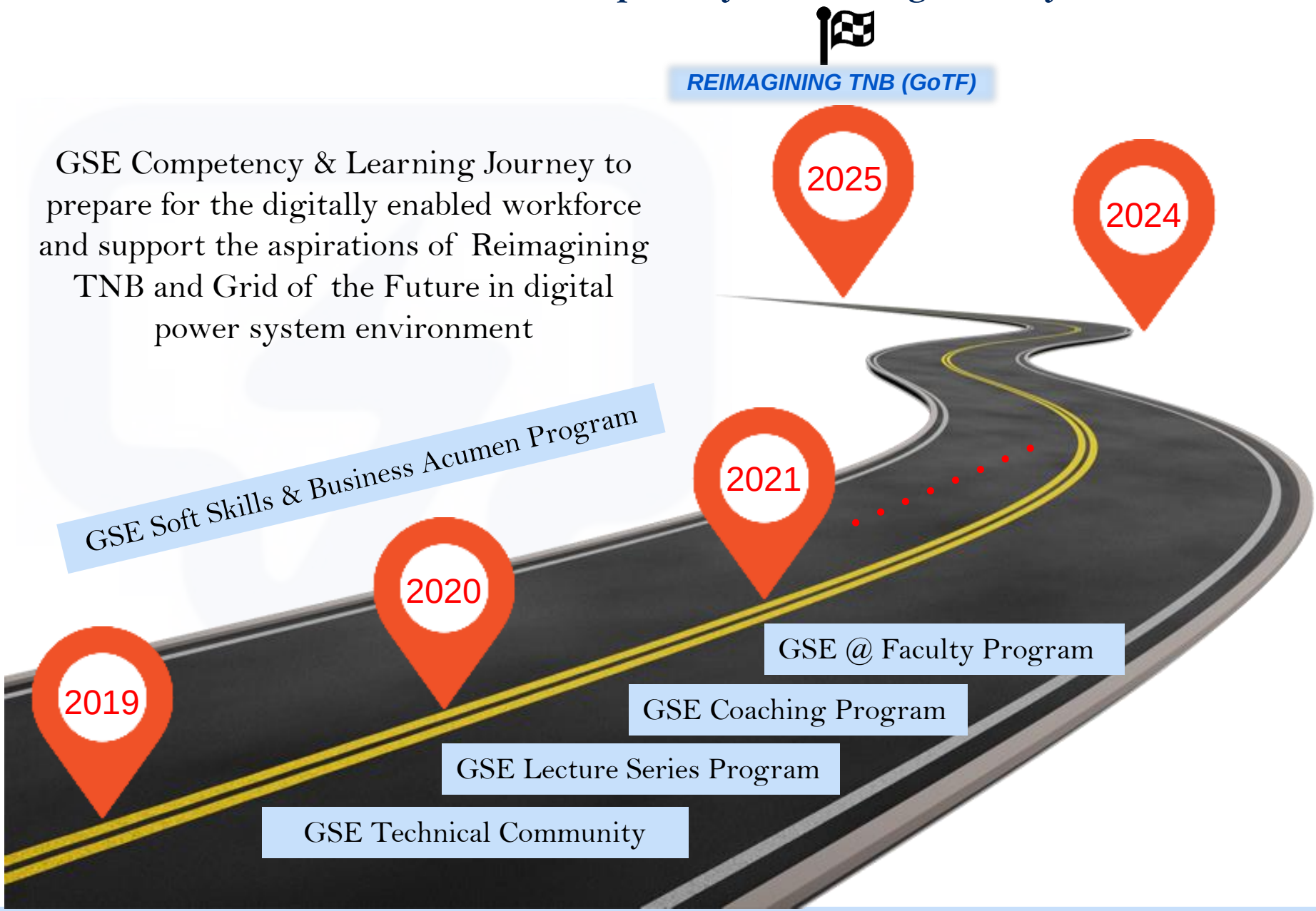
Communication

GSE Soft Skills & Business Acumen Program



Milestone For GSE Competency & Learning Journey

GSE Competency & Learning Journey to prepare for the digitally enabled workforce and support the aspirations of Reimagining TNB and Grid of the Future in digital power system environment



Conclusion

- The transformation of the traditional network workforce to the digitally enabled workforce with new skill sets, roles and responsibilities is critical as the digital revolution is coming to the power industry, for example the intelligence/smart grid demand new capabilities for the workforce.

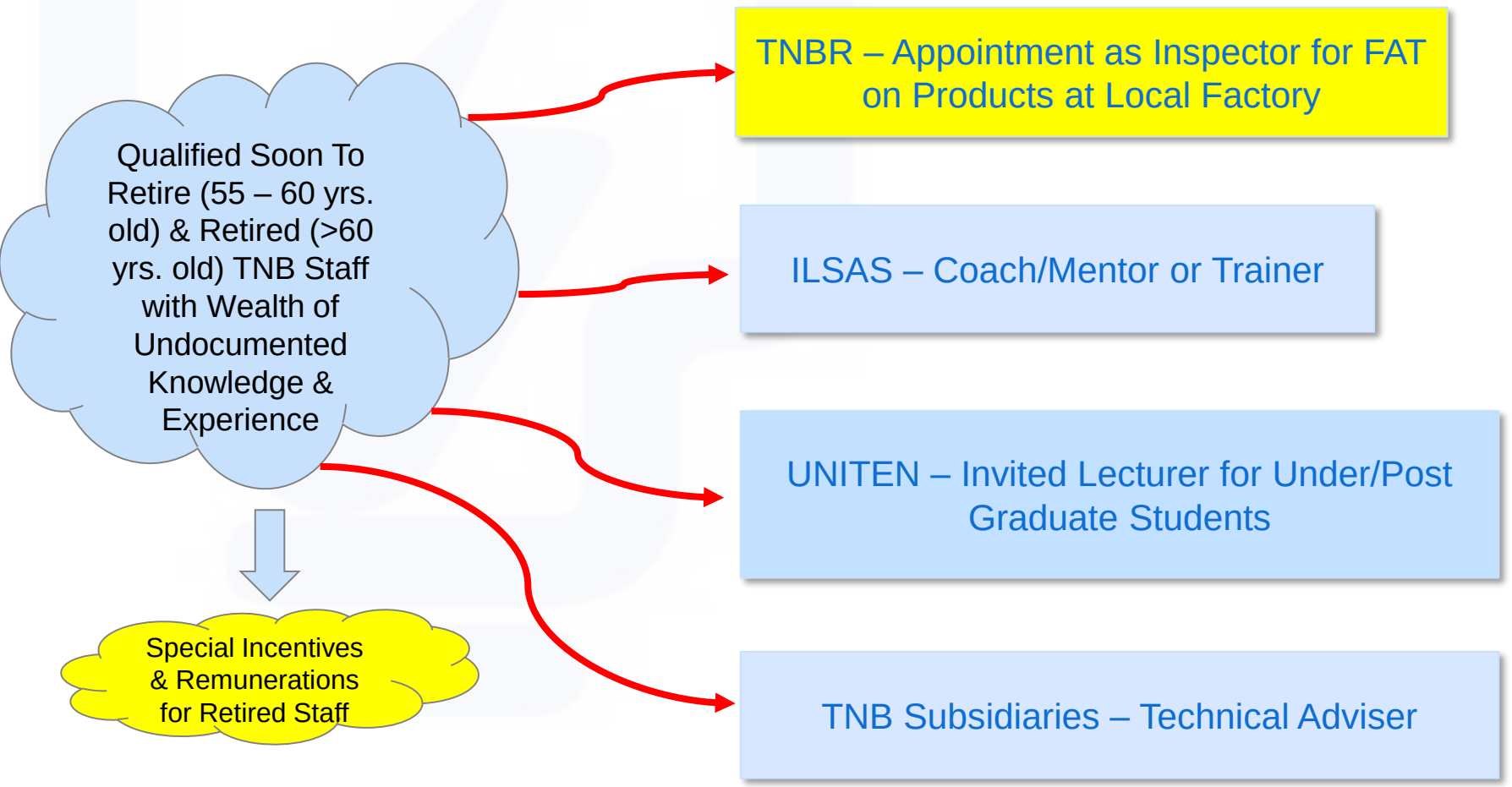
- The full commitments and supports from all parties (especially training service providers, local universities, etc.) in providing the right training needs to the power utility with the right approach (6Ds) is of paramount importance to succeed in this changing and challenging environment as driven by the digital convergence of energy, communication, data sensing and analytics, computing technologies, etc.

Conclusion

- The workforce of today and the future must not only better trained in digital technology, but they must also need to be taught new business and economic analysis skills to be able to perform and handle more business tasks as these tasks will get more complex with the new technological and regulatory changes in the power industry.

- The growing numbers of workers retiring (especially the baby boomer generation) who holds a wealth of knowledge and experiences (mainly in traditional grid) over the next few years may reach crisis level due to loss of highly competence and experienced workers to support and managing the grid system. This could drastically affect the efficiency and reliability of the grid system. Therefore, it is timely for TNB to look for effective knowledge management to identify and capture this 'undocumented knowledge and experiences' of staff nearing retirement so that it does not leave the organization at the rate of retiring people leaving the organization.

ESTABLSIH MORE PLATFORMS FOR SOON TO RETIRE AND RETIRED STAFF TO SHARE THEIR VALUABLE KNOWLEDGE & EXPERIENCE IN POWER INDUSTRY



THANK YOU