1. What are the risks and opportunities in relation to the development of micro grids and what issues do these raise for the connections framework in NI?

Voltage problems in rural areas, particularly if local export exceeds demand. Behind the meter generation and local storage of more than 16A/phase could be facilitated by smart metering and communication from G99 relays that indicates frequency and duration of export curtailed due to voltage issues. Such info could be used to adjust transformer fixed tapping to facilitate more export while ensuring voltage does not fall too low at high demand.

If heavy demand customers on rural lines became microgrids then net max demand may be reduced, mitigating undervoltage risk.

Replacement of long runs of open wire overhead cable with a more capacitive conductor such as ABC or waveform underground cable could support full load voltage. It would also permit upgrading of TT earth systems to TN-C-S.

2. Do you agree with our guiding principles?
YES- Reliable TN earthing (required by ESQCR for new connections, normally offered by GB DNOs and universal in ESB) should be standard in a connection offer, and not at a premium cost to TT.

Cost of upgrading DNO LV wiring that historically provided only TT earthing should rightly be socialised.

Cost of required consumer wiring upgrades to support TN-C-S such as 10mm2 bonding (if existing thinner) on a 35mm2 supply incomer, should be funded by an interest free loan, spreading the cost over say 2 years as a monthly extra to their electricity bill.

3. Do you agree with our proposed scope in relation to this connection review?
this includes:
• Are there other issues which you consider we should take into account. If so, please explain why

EARTHING OF DOMESTIC DWELLINGS
ESB has made TN-C-S the normal earthing system for supplies throughout the RoI.
That means they have invested in former TT-only networks (commonplace in rural areas and where LV supplies are overhead). All GB DNOs, except National Grid, are offering FREE provision of TN-C-S (sometimes TN-S if network so configured) earthing terminals to domestic and small business customers that hitherto had only TT earthing.

Esqcr has a shortcoming in that the DNO is only obligated to provide an earth terminal to NEW connections.

This allows DNOs to absolve themselves of responsibility for providing and maintaining a safe and reliable earth on TT systems.
Customers may be oblivious to danger associated with substandard antiquated installations.

If not electrically knowledgeable, installation users/owners may see direct costs for improvements e.g. charges for a PME terminal, replacement quote for a VOELCB, as a burden yielding little benefit- particularly if there is limited or no experience of internal faults or tripping.

VOELCB devices have been deprecated since 1981, in favour of RCDs, however they continued to be installed in NI through the 1980s. Many are still in service- exposing users of such installations to risk of lethal shock in the event of failure to detect fault current through parallel paths.

Furthermore, if RCDs are installed, they are the primary defence (in a TT system) against internal earth faults, unless Ze<1 ohm. RCDs are much less reliable than fuses/MCBs at clearing fault current. RCD Failure to trip could cause

-Earthed metalwork in the installation to rise to supply potential on an uncleared fault, in a manner akin to broken PEN conductor on PME.

-Fire to break out due to heating of an uncleared fault (Ze is too high to trigger fused or MCB on TT)

In Australia, this was a problem deemed so serious that DNOs (as in RoI) began a programme of converting TT earthed circuits to TN-C-S capable circuits.

NIEN should be equipped with allowances to

Identify All LV circuits only supporting TT earthing.
Convert such circuits to support TN-C-S earthing of fixed buildings, notwithstanding maintaining TT or TN-S supplies to sub circuits e.g. to caravans, marina supplies and fuel filling pumps, where TN-C-S is prohibited by ESQCR.

To minimise risks associated with diverted neutral current,

NI Water should be facilitated (funded) and directed to convert any and all metallic water service pipes (incoming to buildings) to plastic. Same goes for gas network supply pipes.

That will also eradicate improper practice of reliance on a metallic pipe as an earth electrode, deprecated in 1966.

Conductive conduit and or long horizontal runs of bare conductor could be employed by the DNO to provide a low-Ze supplementary earth connection to PME at the origin.

If local supplementary electrode Ra<<10, that would mitigate voltage rise and limit diverted neutral current in an installation, in case of an external broken neutral.

• Are there any connection areas we should remove from the scope of our review? If so, please explain why
NO

4. Do you consider the current ‘partially deep’ connection boundary in NI appropriate? Please explain your rationale further and provide evidence.
NO

5. Do you consider a shallow connection boundary to be appropriate in the NI context? Please explain your rationale further and provide evidence.
If so, which of the following connection types should have a shallow connection boundary;
• Demand only
DEFINITELY YES

• Generation only
Up to a limit as per GB
• Demand and Generation
DEFINITELY YES to support microgrids.
• An alternate connection type (for example Domestic/Non-Domestic connections)
Please explain your rationale further.
Where
TN-C-S is banned by ESQCR,
TN-S should be offered by separate earth where supply cable is not SNE. Separate earth should be dedicated in case of fuel filling station.

For caravan parks, I see scope for the amendment of ESQCR to permit TN-C-S connections to caravans subject to

1. A double PEN conductor, with continuity monitoring, from supply to site.

2. Earth grids or loops under each pitch- to limit potential rise in case of a fault.

In RoI/ESB I can see no equivalent prohibition to ESQCR on TN-C-S use at marinas/caravans/filling stations.

6. Do you consider a shallow-ish boundary to be appropriate in the NI context?
Only for large generation connections.

7. Do you believe that moving to a more shallow connection boundary in NI will deliver NI renewable targets that otherwise would not be met? Please provide evidence to demonstrate your answer.
Yes, it will reduce upfront costs to renewable generators.

8. Please provide evidence on the potential impacts on energy affordability in NI if reinforcement costs where socialised further? What would the impact on energy affordability be in NI if household bills where to increase per annum by;
• 1-3%
• 4-7%
• 7-10%
• > 10%
Unknown

9. Can NIE Networks differentiate between RP6 allowances, RP7 business plan connection requests and how these differentiate and have been factored into the analysis that has been done on potential reinforcement connection costs analysis NIE Networks have completed?
No comment

10.Do you think that a developer led or plan led is the best approach for the future development of connections in NI?
Please explain your answer.
Plan led

11.Do you think the current 3-month timeframe for SONI and NIE Networks to

issue a connection offer is appropriate? Please explain your answer.
No comment

12.If our legislation facilitated it, should obtaining planning permission be a pre-requisite in order to receive a grid connection? Please explain your answer.
Yes- planning permission prerequisite would prevent connection hoarding.

13.If our legislation facilitated it, do respondents consider any other issues associated with the current queue process? Or that a different approach to managing the connection queue, would result in quicker connections? If so, what would that be? Are there any lessons to be learned from other jurisdictions?
GB DNOs
ESB

14.Do you have any other information relevant to the subject matter of this Call for Evidence that you think we should consider?
No

15.Please list any connection issues you have raised in order of priority. Please explain your reasoning behind your priority.

TT only earthing (where DNO takes no responsibility for earthing)- often presented to fixed buildings in rural areas. Particularly when meter box is on an outbuilding e.g. shed/garage attached to house.

BS7671 (18th edition) has no prohibition on a TN-C-S origin at an outbuilding, provided there is SNE after the cutout and bonding of metallic services between the two buildings. A low impedance earth electrode should be provided by DNO if necessary to reduce prospective voltages in case of open PEN conductor. This could take the form of a conductive supply duct or a length of bare copper run alongside the supply duct.